

**KNOWLEDGE AND PERCEPTION OF THE HEALTH IMPACT OF
PETROL STATIONS AMONG ADULTS RESIDING NEAR PETROL
STATIONS IN ATIBA LOCAL GOVERNMENT AREA,OYO
STATE,NIGERIA**

BY

Adekunle Gafar ADEBAYO

B.Sc. (Ed.), Biology (LASU)

MATRIC NO: 189027

**PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF PUBLIC
HEALTH IN HEALTH PROMOTION AND EDUCATION
DEPARTMENT OF HEALTH PROMOTION AND EDUCATION
FACULTY OF PUBLIC HEALTH
COLLEGE OF MEDICINE
UNIVERSITY OF IBADAN
IBADAN**

NOVEMBER, 2017

DEDICATION

To the glory of Allah, this work is dedicated to my noble Mother, Alhaja (Olori) Amudalat Adebayo for her unquantifiable and incomparable love. May Allah grant her long life with sound health and wealth to enjoy the fruit of her labour.

UNIVERSITY OF IBADAN LIBRARY

ABSTRACT

Petrol station (PS) establishment has become proliferated all over the country as a result of its economic value however, the facility predisposes people residing near it to several health risks as revealed by various literatures. These health risks include: fire outbreak, environmental pollution, traffic congestion, underground water contamination e.t.c. The gap in knowledge and perception of residents concerning the health impact associated with PS need to be identified hence this research work. This study therefore aimed at investigating knowledge and perception of the health impact of PS among adults residing near PS in Atiba Local Government Area, Oyo State, Nigeria. This could serve as useful baseline information to the regulatory bodies concerned with establishment and operation of PS.

This is a descriptive cross-sectional study design which adopted multi-stage sampling techniques to select 399 respondents who reside around the 57 functioning PS located within the study area. A pre-tested semi-structured questionnaire was used to collect data from respondents. The knowledge of respondents was assessed using 40-point knowledge scale while the scores were classified as; poor (0-12), fair (13-26) and good (27-40). A 10- point perception scale with the scores being categorized as favourable (≥ 5) and unfavourable (< 5) was used to determine perception of the respondents. Two structured observational checklists were used to assess level of compliance with government regulation on siting of PS and to identify safety practices that exist in PS. Data were analyzed using descriptive statistics and inferential statistics at $P = 0.05$.

Age of respondents was 36.6 ± 11.6 years and 50.8% were male. The knowledge scores of respondents was 17.2 ± 7.6 and 24%, 68% and 7.8% had poor, fair and good knowledge respectively. Perception scores of respondents was 5.11 ± 2.14 and majority (66.6%) of the respondents had favourable perception. There is a significant relationship between level of education and knowledge of the respondents ($P < 0.001$). Majority (73.4%) of the respondents who had fair knowledge had favourable perception. All, (100%) of the PS observed were owned by private owners. The plot size of the PS and the distance of PS to the nearest residential houses are 1.37 ± 0.67 and 20.2 ± 26.2 respectively. It was observed that, (57%) and (38.6%) of the PS had sand-box and fire extinguishers respectively. However, majority (81.7%) had 'switch off

your engine when refueling sign'. 78.9% of the PS had 'No smoking sign' and just (1.8%) of the PS had the environmental impact assessment report for the year (2015).

Conclusively, overall knowledge of the respondents was fair and many had favourable perception however, great gap exists in the knowledge and perception of siting PS close to residential area with some of the respondents reported that benefits of siting PS close to houses outweigh the disadvantages and that, siting PS close to residential houses cannot lead to any serious health problem. Also, most of the PS did not comply with Government regulations on establishing PS. The study therefore, suggests the need for well-designed public awareness and enlightenment on the health impact of PS, formulation and implementation of healthful policies and periodic inspection of PS to mitigate the menace associated with PS.

Keywords: Petrol station, health impact, adults, compliance, safety practices

Word count: 498

ACKNOWLEDGEMENT

To almighty Allah, the unsurpassed majesty and sustainer of Mankind are the glory and honor for making the completion of this course a realistic goal, my appreciation is endless. Aside, I must commend the unflinching effort and contribution of my wonderful supervisor, Dr. F.O Oshiname (Acting HOD) for adequate input of his professional and expertise experiences to ensure quality and success of this work. May God almighty reward him abundantly.

I am indebted to all my competent lecturers in the department; Prof O.O, Oladimeji; Prof A.J Ajuwon; Prof O.S Arulogun, Dr. O.E Oyewole, Dr. M.A Titiloye (My Mentor), Dr. I.O Dipeolu, Mrs A.I, Desmennu, Mrs M.M, Oluwasanu, Dr. (Mrs) Y.O John-Akinola who have equipped me from their wealth of knowledge and wisdom which has eventually aid the successful outcome this work. My profound gratitude goes to Mr John Imaledo (Great Motivator), Chief A.A Olubodun, Mr S.B. Bello, Mr W.O Quadri, Mr T.Oyeyemi, Miss O Olaniyi and all other non-academic staff members of my department for their contributions in one way or the other. I so much appreciate you all.

My special appreciation also goes to my darling wife (Alhaja, (Olori) S.D Adebayo), wonderful children, valuable siblings, esteemed friends and well-wishers for their moral and social support. Infact, they are just “too much”. I would also wish to pay a special tribute to Late Alhaji Hisa Adebayo, Late Mrs Sikirat Adebayo and Late Dr. V.A Ayansola for the care and love they showed to me, may their souls rest in perfect peace.

I sincerely acknowledge Mr Olanrewaju, F. Wale (Oyo State Ministry of Health), Dr Okhare Dapo and Mr Mumeen Adejuwon (Dept. of Environmental Health), Dr. M.A, Adebayo (Dept. of Community Medicine), Mr M.A Azeez (My boss), Mr Olawoyin Rasheed a.k.a proff. (EACOED,Lanlate Campus), CEO and staff of Better-de-come Investment and Miss Nafisat Abdulazeez (Olaoluwa) for their significant contributions to the success of this work. Also, I appreciate all my colleagues in MPH/HPE 2014 set for their social support and love been extended to me during the course of our study. May God Almighty Crown all our efforts and grant us unlimited success in all our endeavours. Reiteratedly, I say thank you all.

Adekunle Gafar ADEBAYO

CERTIFICATION

I certify that this project was carried out under my supervision, by **Adekunle Gafar ADEBAYO** in the department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.

SUPERVISOR

Dr. Frederick O. Oshiname

MPH (Ibadan), M.A (CWRU, Cleveland), PhD (Ibadan)

Senior Lecturer, Department of Health Promotion and Education,
Faculty of Public Health, College of Medicine,
University of Ibadan, Nigeria.

TABLE OF CONTENTS

TITLE PAGE	i
DEDICATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	v
CERTIFICATION	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF APPENDICES	xiii
LIST OF ACRONYMS	xiv
OPERATIONAL DEFINITION OF TERMS	xv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background of study	1
1.2 Statement of problem	3
1.3 Justification	4
1.4 Research question	5
1.5 Objective of study	5
CHAPTER TWO	6
LITERATURE REVIEW	6
2.1.1 Overview of the concept of petrol station	6
2.1.2 Historical Background of Petrol Station	9
2.2.1 Petrol Station Regulations in Nigeria	11
2.2.2 Physical planning standard before operating petrol station by DPR	12

2.2.3	Safety measure required of typical petrol	15
2.2.4	Hierarchy of hazard control	17
2.3.1	Health risks associated petrol station	18
2.3.2	Benzene and its mode of exposure	20
2.3.2	Toluene and its mode of exposure	22
2.3.4	Ethyl-benzene and its mode of exposure	24
2.3.5	Xylene and its mode of exposure	25
2.4	Recommendation for mitigating Health Risks of BTEX	27
2.5	Health Risk Associated with Petrol Station	28
2.6	Summary of literature review	33
2.7	Conceptual framework	36
2.7.1	Ecological Model	36
2.7.2	Health Belief Model	40
CHAPTER THREE:		43
METHODOLOGY		43
3.1	Study design and scope	43
3.2	Study area	43
3.3	Study population	44
3.4	Sample size	44
3.5	Sampling techniques	45
3.6	Study Variables	46
3.7	Inclusion and exclusion criteria	46
3.8	Instrument for data collection	46
3.9	Validity and Reliability of the instrument	47
3.10	Training of Research Assistants	48
3.11	Data collection procedure	48
3.12	Data management and analysis	49
3.13	Ethical consideration	50

CHAPTER FOUR:	52
RESULTS	52
4.1 Socio-demographic details	52
4.2.1 Knowledge of health impact of petrol stations siting in residential area	55
4.2.2 Association between respondents' knowledge and their socio-demographics characteristics	63
4.3. Respondents' perception of the Health impacts of petrol stations	71
4.3.1 Respondents' perception of petrol station	73
4.4 Observational assessment on the compliance with the government regulations on siting of petrol stations	76
 CHAPTER FIVE	 92
DISCUSSION, CONCLUSION AND RECOMMENDATION	92
5.1 Socio-demographic details	92
5.2 Awareness and Knowledge of the health impacts of petrol stations	93
5.3 Perception of the health impacts of petrol stations	95
5.4 Assessment on the compliance with the government regulation on siting of petrol stations	97
5.5 Assessment of safety practices that exist in petrol station	98
5.6 Implication for health promotion and education	99
5.7 Conclusions	101
5.8 Recommendations	102
 REFERENCES	 103

LIST OF TABLES

Table	Content	page
2.1	Review spatial requirement for development of petrol filling station in Oyo state	14
2.2	Reported concentration BTEX in the environment	19
2.3	Estimated daily intake of BTEX compound	20
4.1	Respondents' sex, religion, age, marital status and wards	53
4.2	Respondents level of education and occupation	54
4.3	Respondents' awareness of chemical substances in petrol	58
4.4	Respondents knowledge of the health condition that can be caused by noise generated in petrol station	59
4.5	Respondents knowledge of chemical components of petroleum products which are harmful or not harmful	60
4.6	Shows the respondents reported diseases that can be caused by drinking water that are contaminated by with petrol or petroleum products	61
4.7	Respondents' knowledge of the health conditions that can result from living close to a petrol station	62
4.8	Categorization of knowledge scores among respondents	65
4.9	Categorization of respondents' knowledge scores by sex	66
4.10	Categorization of respondents' knowledge scores by level of education	67
4.11	Categorization of respondents' knowledge scores by Age	68
4.12	Categorization of respondents' knowledge scores by Religion	69
4.13	Categorization of respondents' knowledge scores by Marital status	70
4.14	Respondents' perception on the health impact of petrol stations	72
4.15	Categorization of perception among respondents	74
4.16	Categorization of perception by level of knowledge	75
4.17	Distribution of petrol station by wards	79
4.18	Plot size of petrol station (in metres)	80
4.19	Petrol stations plot frontage width (in metres)	81
4.20	Petrol stations Frontage boundary setback to the road (in metres) (N =57)	81
4.21	Radius of Kerbline to Petrol Stations	82

4.22	Distance of PS to the nearest dwelling house (in metres)	83
4.23	Setback of pump to the center of the road (in metres)	85
4.24	Observational checklist on compliance with governmental regulation on siting of petrol station	86
4.25	Reported reason for non-availability of evidence of town planning services	87
4.26	Reported length of time it took the filling stations to get a town planning approval	88
4.27	Setback of the petrol station to the center of adjoining road (in metres)	89
4.28	Distance of petrol station to public facility	90
4.29	Availability of safety equipment for effective practices in Petrol station	91

LIST OF FIGURES

Figure	Content	page
2.1	Application of Ecological Model to the study	39
2.2	Application of HBM to the study	42
4.1	Ever heard that some chemicals present in petrol can cause disease	57

UNIVERSITY OF IBADAN LIBRARY

LIST OF APPENDICES

Appendix I	Questionnaire (English version)	108
Appendix II	Observational Checklist on compliance with government regulation on siting of petrol Station	116
Appendix III	Observational Checklist on Safety practices existing in petrol Stations	117
Appendix IV	Questionnaire (Yoruba Versions)	119
Appendix V	Scoring of Knowledge of the Health impacts of petrol stations	126
Appendix VI	Scoring of perception scale	130
Appendix VII	Existing and functioning petrol stations in Atiba Local Government Area, Oyo State, Nigeria	131
Appendix VIII	Informed consent form for respondents	134
Appendix IX	Picture of the researcher collecting data in the petrol station	136
Appendix X	Ethical approval	137

LIST OF ACRONYMS

Abbreviation

AGO	-	Automated Gasoline Oil
BTEX	-	Benzene, toluene, ethyl benzene and xylene
DPK	-	Dual Purpose Kerosene
DPR	-	Department of Petroleum Research
DOE	-	Department of the Environment
EKG	-	Electrocardiogram
FSD	-	Fire Service Department
GIS	-	Geographic Information System
HBM	-	Health Belief Model
HQ	-	Hazard Quotient
IPM	-	Independent Private Marketers
LGA	-	Local Government Area
LNG	-	Liquefied Natural Gas
NNPC	-	Nigeria National Petroleum Corporation
OPEC	-	Organization of Petroleum Exportation Countries
PMS	-	Premium Motor Spirit
PPB	-	Part Per billion
PPE	-	Personal Protective Equipment
PPMC	-	Pipelines and Products Marketing Company
PPPRA	-	Petroleum Product Pricing Regulatory Authority
PS	-	Petrol Station
WHO	-	World Health Organization

Operational Definition of Terms

Petrol Station:-This is a place where petroleum products are sold and other maintenance services are rendered.

Health Impact:-This is an important influence or effect on the state of complete physical, mental, social and emotional wellbeing not merely the absence of disease or infirmity.

Adults:-These are people of eighteen years and above who can decide on their own.

UNIVERSITY OF IBADAN LIBRARY

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Petrol Stations can be described as facilities where fuel and lubricants (such as Dual Purpose Kerosene (DPK), Premium Motor Spirit or Petrol (PMS), Automated Gasoline Oil or Diesel (AGO), Liquefied Natural Gas (LNG)) are sold to the end users (Afolabi, Olajide and Omotayo 2011). The American Heritage Dictionary of English Language (2011), defines it as a place where gasoline and oil are sold and a place where facilities are available for repairing or maintaining automobiles.

The name given to petrol station varies from one country to another around the world: it is known as garage in the United Kingdom (UK) and South Africa, Petrol station or petrol pump in English speaking commonwealth countries, fueling station, garage or gas bar in Canada, it is known as service station in Australia, gas station and petrol bunk in the USA and India respectively. In Nigeria and Japanese English, it is called filling station and Gas Station respectively. However, the ones which sell only electric energy in developed nations such as Canada and US are called charging stations (Mshelia, John and Emmanuel 2015).

Millions of automobiles on the Nigerian roads depend on petroleum products which are sold in Petrol station especially Petrol (PMS) and Diesel (AGO). Consequent upon this, petrol stations have proliferated greatly in various parts of the country (Festus, Dada, Iweka, Eyanfe, Osagie, Akinyam and Fan-Osuala, 2013: Ahmed, AbdulRahman, Koro, Ibrahim, Okoro and Agbo 2014). This, despite its relevance to economic growth in the country has come with various environmental challenges as well as exposure to various health risks. For instance, due to the inflammable nature

of all the petroleum products, there is a great risk of fire outbreak in every petrol station at any point in time especially if a source of ignition is present which is why Afolabi (2011) considered petrol stations as hazard prone facilities.

Moreover, constituents of petroleum products such as benzene, toluene, ethylbenzene and xylene (collectively referred to as BTEX) are reportedly harmful to human health. Benzene is a human carcinogen which causes cancer while toluene, xylene and ethylbenzene seriously affect the functioning of the human central nervous system (CNS) upon exposure (Sunadda, 2006). Exposure to benzene has both acute and chronic effects on human health. These effects include aplastic anaemia and cancer (WHO, 2010). Because petrol stations significantly contribute to ambient concentration of benzene and attract a lot of traffic, the health of people living in close proximity to such environments is endangered (Isabel, Marta, Enrique, Antonia and Jonathan, 2010; Sangotola, Fasanmade, Ayanrinade, Olatinwo and Olamide, 2015). Exposure to benzene according to Afolabi (2011) could result into dermatitis and haemological disorders and Fredric and Michael, (2010) reported the health consequences of exposure to BTEX to irritation of the eye, stomach and respiratory tract, brain and nervous system disorders, convulsions, headache, rapid heart rate, vomiting, coma and even death.

1.2 Statement of Problem

According to the World Health Organization (WHO) in 2004, more than 2.3million lives and properties worth more 4.5 billion dollars have been lost to fire outbreaks that can be traced to petroleum products mishandling. These properties include residential buildings, shops and automobiles of various kinds. Petrol stations, though important for day to day activities and movement from one place to another, are associated with series of environmental hazards. Sangotola et. al. (2015) highlighted these as road accident, fire outbreak, discharge of hazardous substances, and violence to staff, environmental pollution and traffic congestion. Thus, the health risks associated to a petrol station cannot be over-emphasized.

Apart from the above named problems and risks which are physical, petrol stations can also portend biological effects with devastating effects on the people who are nearby. These biological risks are reportedly caused by viruses and fungi when they proliferate uncontrollably as a result of fuel spillage (Ahmed et. al.,2014). The biological risks include cervical and spine injuries, mental stress, gastric and skin lesions etc. (Marta, Mara, Laurelize, Clarical, Lentic). It is however important to state here that oil spillage has being a major challenge in some parts of Nigeria. The Federal Government is battling with how to clean up Ogoni land which has been devastated and the water contaminated as a result of oil spillage which has increased the prevalence of cancer and other chronic diseases in the area.

Moreover, the BTEX constituents of petroleum products as explained earlier are either carcinogenic or suspect in the pathology of other chronic diseases, therefore, it can be inferred that increased concentration of these gases in the atmosphere due to unchecked proliferation of petrol stations is suspect in the epidemiological transition (which has led to the double burden of disease) experienced in Nigeria and other African countries. Siting petrol stations in residential areas therefore exposes

everybody around the station (not just the petrol attendants) to a risk of developing a chronic non-communicable disease such as cancer apart from the physical risks that could be developed from fire outbreaks, noise pollution around the station as well as inhalation of gas fumes which is also injurious to health.

Although, there are regulations and rules set up by the government to guide the establishment of petrol stations but compliance is very low and profit is the sole driver in siting petrol stations. The health risks it poses to the people around it is being neglected and not given the necessary attention by the government and the oil marketers, therefore, the people should be sensitized on the health impacts of these petrol stations. To this, the gap in knowledge and perception of residents need to be identified hence this research work.

1.3 Justification

This study will provide useful baseline information on the perceived health impacts of petrol stations among the community members. This information in the future can serve to fill the gap in knowledge and/or perception identified.

The findings from this study could be a useful material to the regulatory bodies that are in charge of petrol stations to ensure strict compliance with government policies and regulation on siting and safety activities in the petrol station to enhance environmental protection in order to promote healthy living of the residents and dwellers within and around the facilities.

Also, literature is scarce on the health impact of indiscriminate siting of petrol stations as perceived by community members, therefore, the findings from this study will contribute to the existing body of knowledge.

1.4 Research Questions

The following research questions were posed so as to accomplish the stated objectives

1. What is the level of knowledge of the health impact of petrol stations among adults residing near petrol station in Atiba Local Government Area, Oyo State?
2. What are the perceptions of the health impact of Petrol Stations among adults residing near petrol stations in Atiba Local Government Area, Oyo State?
3. To what extent are petrol stations in Atiba Local Government Area, Oyo State complied with government regulations regarding siting?
4. What are the safety-measures existing in petrol stations in Atiba Local Government Area, Oyo State?

1.5 Objectives of the Study

1.5.1 General Objective: - This study was designed to investigate knowledge and perception of the health impact of petrol stations among adults residing near petrol stations in Atiba Local Government Area, Oyo State, Nigeria.

1.5.2. Specific Objectives

The objectives of the study were to:

1. Assess the level of knowledge of the health impact of Petrol Stations among adults residing near petrol stations in Atiba Local Government Area, Oyo State.
- 2 Determine perceptions of the health impact of Petrol stations among adults residing near petrol stations in Atiba Local Government Area, Oyo State.
- 3 Assess level of compliance with government regulations concerning siting of Petrol stations in Atiba Local Government Area, Oyo State.
- 4 Identify safety practices existing in Petrol stations in Atiba Local Government Area, Oyo State.

CHAPTER TWO

LITERATURE REVIEW

2.1.1 Overview of the concept of petrol station

By the way of definition, Petrol Station could be seen as a facility where fuels and lubricants for automobiles which includes Premium Motor Spirit (PMS), Liquidified Natural Oil, Kerosene are sold, Ahmed et al, (2014). Petrol Station could be any petroleum facility, service station, public garage, highway filling station, petrol pump or fuel depot that sales fuel and lubricants for motor vehicles, Hanekom (2001); Genovese (2004); Spencer (2004). Mshelia et al, (2015), referred to Petrol Station as a structure or building where petroleum products are sold to motorists or for other Local Consumption.

According to the American heritage dictionary of English Language, (2011) filling Station is a place where gasoline and oil are sold and facilities are available for repairing or maintaining automobiles. This facilities (Petrol/filling/gas Stations or Petroleum outlet) was referred to as any land, building or equipment used for the sales or dispensing of petrol or oil for motor vehicles or incidental there to and includes the whole of the land, building or equipment whether or not the use as a petrol Station is a predominant use or is only a part there of. Muritala, (2015).

Ayodele (2011) also, made a contribution that, most filling Stations sell Petrol or diesel, some carry fuel such as liquefied Petroleum gas (LPG), natural gas, hydrogen biodiesel, Kerosene or butane while the rest add shops to their primary business. This facility could be addressed in various ways which largely depends on the race, continent and region over the world. For instance, in Canada, it is either garage, fueling Station, in Australia the structure is referred to as Service Station; in India it is

Petrol bunk; the facility is known as garage in both UK and South Africa; In Japanese English, it is gasoline; it is either Petrol Station or Petrol pump in some English speaking Common Wealth Countries while in Nigeria, the facility is addressed as filling Station, Mshelia etal, (2015).

In the USA, most of the infrastructure that dispenses gasoline and diesel fuel is located in Service Station. Service Station was described to be characterized by a three- ties structure which involves; producers, distributors and retailers. The Stations retail fuel and are always the only part of the supply chain with which consumers directly interact. Oil company owners and employees (Jobbers) distribute fuel to the service stations while three (3) jobbers serve as link between fuel refiners and retailers. The canopy which houses fueling infrastructure displays brandssuch as BP, shell, or Sunoco in the service Station. The branded canopy serves as an indicator of ownership relationship, branded fuel-supplier relationship and or marketing arrangement (Richard, 2012).

In Nigeria, Petroleum Industries are classified by sector or type of actors hence the actors consist of both private and public organizations. The Government Agencies and Functionaries such as: Nigeria National Petroleum Corporation Resources (NNPC), Petroleum Products Pricing Regulatory Authority (PPPRA) and the likes. While the private actors include: both indigenious and foreign actors. The indigenious actors consist of independent marketers while the foreign a Multinational Marketers such as Oando Nigeria Plc., African Petroleum Plc., Mobil Oil Nigeria plc., Conoil Plc. MRS Nigeria Plc., Total Nigeria Plc. e.t.c. Ehinomen and Adeleke (2012).

Based on sector, the petroleum industry in Nigeria Plc. e.t.c is divided into two main segments known as the upstream and the downstream sectors. The upstream sector is referred to as activities such as exploration, production and delivery to an export

terminal of crude oil or gas. While the downstream sectors are activities like loading of crude oil at the terminal and its user especially transportation, supply trading, refining, distribution and marketing of petroleum including activities of filling station (Murital, 2015).

Fuel retail outlets can be subdivided into three main categories such as Petrol Station, Garages and Service Station. Petrol Stations are establishments where sale of motor fuel is the main part of the business and few repair services are provided. Although, garages are establishment where the primary aim is to repair and rebuild motor vehicles. Sales of petrol may represent only a small proportion of the total turnover. While Service Stations are establishments that sell motor fuel and provide facilities for servicing vehicles and minor repair. Services such as forecourt convenience stores may also be provided. (DOE Profile, 1996)

Meanwhile, garages and petrol stations are widely distributed throughout the country. Sites range from the small urban and rural petrol stations, with just one or two petrol pumps, to large garages with a comprehensive workshop offering a complete repair and maintenance service. The large premises tend to be concentrated along the trunk road network and of the edges of built-up areas, along by-passes and at major road junctions.

Furthermore, most petrol stations are built in a similar manner, with most of the fuelling installation underground, pump machines in the forecourt and a point of service inside a building. Single or multiple fuel tanks are usually deployed underground. Local regulations and environmental concerns may require a different method, with some stations storing their fuel in container tanks, entrenched surface tanks or unprotected fuel tanks deployed on the surface. Fuel is usually offloaded from a tanker truck into the tanks through a separated valve, located on the filling

station's perimeter. Stored fuel travel from storage tanks through the underground pipes to the dispense pumps.

The underground petrol station was developed by U-cont OY Ltd in Finland in 1993. Afterwards the same system was used in Florida, U S A. above ground modular petrol station were built in the 1980s in eastern Europe and especially in Soviet Union, but they were built in other parts of Europe due to the stations' lack of safety in case of life.

2.1.2 Historical Background of Petrol Station

The first gas/petrol station was the city pharmacy in Wiesloch, Germany, where Bertha Benz refilled the tank of the first automobile on its maiden trip from Mannheim to Pforzheim way back in 1888. Gas station come in all shapes, forms and Sizes, running the gamut of American Culture from a posh stone colonial in scardale, New York, to a greasy tin shack on a Georgian back road. In 1885 sylvanius F. Bowser founded SF. Bowser Pump Company which was self-contained and included the storage barrel, the plunger and a hand success and soon became known as a Petrol Station.

By 1890, he adapted this unit to pump gasoline in addition to kerosene for the lighting industry and the first true gas pump was born. S.F. Browser continued to refine, improve and sell his new indoor "Petrol Station to general stores and the first automobile repair garages beginning in 1893. Between the years 1893 and 1905, early motorists often filled automobile fuel tanks using the "drum and measures" method. Gasoline, stored in bulk steel drums, would be gravity fed into five-gallon measuring cans the poured directly through funnels into the automobile fuel tank. Bowser was able to develop the first outdoor "Petrol Station" pump that could dispense kerosene or gasoline. The Bowser self-measuring gasoline storage pump

consisted of a square metal tank enclosed in a secure wooden cabinet. The growth of the auto industry was staggering starting with four cars, in 1896 it expanded geometrically.

In 1909 there were 312,000 in 1919 7,565,000 and in 1929, 26,501, 000. The increase in stations and the level of competition was never far behind. As a result of this, retailing of gasoline is a large and complex industry. The companies are divided into main categories: Majors and independents. Majors are big, national, vertically integrated companies. They produce, refine, transport distribute and retail petroleum products. Retail outlets are only minor parts of their operation, with most stations being leased to local dealers. The independents deal mainly in retailing, usually purchasing their gas and oil from the majors.

Petrol station was in the main stream of America life by 1930. The office and canopy style of the 1920s did not promote service, and when it did the grease racks and pits were placed outside. The 1930s produced the basic recipe for petrol stations, an office/saleroom, restrooms and two service bays all enclosed in a simple box. The pumps were outside and the canopy was often eliminated. The standard oil commissioned clause and daub, architects to design a standard unit for production of service station from 100 to 200 annually. The result was a station of glass and metal in the international style that still has a good contemporary look.

The Shell oil company has been promoting its scallop motif since 1926 on standardized "stefco" canopy stations. New prototype were introduced in 1936 including one developed by insulated steel construction company, made up of insulated steel sand-which sections that require no skeletal frame. During the 1940s the highway system was expanded and a need to service people as well as cars

developed. Innovative Structural Systems and Construction methods have often been employed in new stations. They have been fanciful and functional.

In 1947, a major sales innovation was introduced, self-services. Modern cars require less frequent service, often just gas. The first station by D.A. Birchett, ARIBA in 1955 with its use of glass panels' functional lines give an "overall air of cleanliness and efficiency". The modules allow for stations of varying sizes on different sites using standard components. A mobile station was designed by Welton Becket PAIA in 1957 for the Samford University Campus using a six-foot module.

2.2.1 Petrol Station Regulations in Nigeria

Petrol station location and siting requires a control measure and the standard conditions needed for rendering service(s) to the general public which should be guided by a legal in order to ensure strict compliance to such control and standards. Non-compliance with safety practices and rising environmental pollution has been characterized with majority of petrol stations all over the nation. Long queues at several petrol stations all over the country have been observed as a result of petroleum product scarcity, Ambituni, Amezaga and Emeseh, (2014).

More concentration and consideration on measures which reduce hazards are very important in the present time. The planners should also look into likely hazards in planning and developing methods of mitigating damage that might cause hazards, risk and vulnerability, Mshelia et-al, (2015). Hence, the necessity for well design location and operation of petrol stations should be of leading importance. This is therefore, the responsibility of DPR and the state ministries for town planning to register and regulate the downstream petroleum sector including the petrol station business (Murtala, 2015).

In Nigeria the ministry of petroleum resources has a department of petroleum resources (DPR). The DPR comprises of four (4) divisions namely: Resources Management Division, Inspection Division, Technical Control Division and Services Division. The service division has three (3) branches known as Economics, planning and statistics, (Murtala, 2015).The author (Murtala, 2015) also revealed the DPR procedure guide for grant of approvals to construct and operate a petroleum products retail outlet (2007). Before commencing the business, the following have to be submitted;

1.Three (3) copies of approved plan showing the building existing or proposed on the site and the relation to the roadways and adjoining properties.

2.A certificate signed by the chief Federal/State fire officer or by an officer authorized in that behalf, that the arrangements proposed for the prevention of fire at the site are satisfactory

3.A certificate by the Area/Town planning Authority for the construction of a petrol station on the proposed site.

4.A certificate signed by the divisional police officer or a superior police officer in charge of the police motor traffic that he is satisfied that the site and layout of the proposed petrol station do not constitute an unnecessary traffic hazard.

5.Evidence that company applying is duly registered as a limited liability company by the appropriate Federal Ministry/Corporate Affairs Commission to deal in petroleum products.

6.Tax receipt and/or tax clearance certificate for the preceding three years.

2.2.2 Physical planning standard before operating petrol station by DPR

In accordance with the DPR manual before operating petrol station one has to certify some physical planning standards which are as follows,

1.Land should be zoned for Commercial/Industrial use or be designated specifically for the purpose in a subdivision.

2.The parcel of land should not be less than 33x33 square meters or equivalent of two plots of land allow for the free flow of traffic.

3.A petrol filling station should be sited 400 meters away from the next petrol station

4.A petrol station should be sited 50 meters away in all angles of the build-up area to create a buffer zone for the residential house- the buffer zone can be devoted to any non-residential land use.

5.That the distance from the edge of the road to the nearest pump will not be less than 15 meters.

6.The total number of stations within 2km radius of the siteshould not be more than four (4) including the one under construction.

7.Filling station should not be located less than 100 meters form school, hospital, theaters, clinics and other public and semi-public buildings.

8.The site (for filling station) should not lie within NNPC/PPMC pipeline right of way or PHCN transmission or railroad lines.(Murtala, 2015).

Table 2.1: Spatial requirements for development of petrol filling stations in Oyo state

S/N	PLANNING STARDARD CRITERIA	MINIMUM STANDARD	REMARK
1.	Plot size	Minimum size of 1080m ² (Two Plots)	Plot dimension should not be less than 45m (length 24m (width). Plot with regular shape should be bigger.
2.	Distance between existing PS	300m along the same side of the road	Opposite location or siting shall not be allowed.
3.	Plot frontage width	24.0m	
4.	Plot boundary setback to dual carriage truck a other roads	45.0m 30.0m 15.0m	
5.	Setback of service station to the center of adjoining road expressway trunk a other roads	40.0m 80.0m 35.0m	
6.	Setback of pumps to the center of adjoining road: expressway trunk a other roads	74.0m 30.0m 30.m	
7.	Drive way width (in/exit)	9.0M	
8.	Radius of kerbline	6.0M	
9.	Setback of service station to dwelling house (s)	7.0M	
10.	Location in relation to vertical or horizontal bend	Site must not be on a curved (horizontal) bend and vertical (higher or sloppy) gradient.	
11.	Location in relation to power line, rail line, pipeline, stream etc.	As required in partial standards	

Source: Oyo State Ministry of Physical Planning and Urban development, reference number TP435/VOL 111/70, (July 2015).

2.2.3 Safety Measure Required of a Typical Petrol Station

Safety practice in petrol stations both by the service provider and customers is of great importance so as to prevent the potential health risks that could affect human health and the environment. According to Health and Safety Authority (2015), Petrol stations are particularly hazardous workplaces which required to be licensed by Local Authorities because they store flammable liquids. Adherence to legislative requirements contained in the Dangerous substance (Retail and Private Petroleum stores) regulation of 1979, S.I. 311 of 1979 when appropriate, other appropriate legislation following industry best practice.

- (a) Ensure all staff are adequately trained (retain training records)
- (b) Storage tanks and dispense pumps are adequately maintained and monitored.
- (c) Appropriate wet stock management procedures are used.
- (d) Identify hazardous areas and control all sources of ignition use appropriate warning and hazard signs. These could be categorized as follows;

Vehicle Movement Control Measure

There is considerable movement of cars and other vehicles on the forecourt which could lead to accidental collision with structures, people and other vehicle. Therefore,

1. Devise a safe system of traffic movement, e.g. a one-way system for entering and exiting the forecourt.
2. Display clear information/warning signs setting out the traffic control arrangements.
3. Provide sufficient designated parking areas close to the shop and away from the pumps.
4. Provide mechanical protection to vulnerable structures such as fuel tanks and liquefied petroleum gas (LPG) storage areas.

Hazardous Substances Control Measures

Some items of stock and chemical used in the car wash and for general cleaning can be harmful. Exposure to them through use, accidental spillage or leaks, can cause respiratory problems, dermatitis or chemical burns. The following measures should be highly considered;

1. Store all hazardous chemical in their original containers.
2. Obtain information on all substances stored and used in the premises from manufactures hazard data sheets.
3. Train staff and provide appropriate protective clothing.

Fire risks control measures

Obstructed exits e.g. by stock and/or accumulation of packaging can prevent escape and provide fuel for fire. To avoid this, the following measures are highlighted.

1. Clear rubbish regularly (remember sand used for cleaning or disposed off safely, by a hazardous waste disposal company if necessary).
2. Keep all escape routes and fire exits clear and make regular check to ensure that this is the case.
3. There should be a prompt maintenance of fire extinguisher. Engine should be switch of while refueling and ensure present of sand box

Compressed air system control measures

The main risk arises from above of this equipment and from over inflation of vehicle tyre.

1. Make sure that the air system is located within sight of the shop attendant to ensure constant supervision.
2. Display clear information on the use of the air system e.g. the driver should check the use of the equipment.

Violence to staff control measure

Robbery of goods or cash may place staff at risk of violence therefore, consider the use of closed circuit television, panic alarms and other security measures e.g. the use of pay windows at night.

Fuel vapour recovery boot

Most pumps must have government regulated vapour recovery boots on their nozzles, which limits the release of gas vapour while refueling car. A similar system is used by the station when a tanker arrives to refill the underground tanks.

2.2.4 Hierarchy of hazard control

These provide a policy framework which ranks the type of hazard controls in terms of adequate risk reduction. The controls are as following in hierarchy order

1.**Eliminating control:** this involves the removal of the hazard entirely which can be done by changing a work process in a way that will get rid of a hazard

2.**Substitution control:** this is an act of replacing the hazard with a safer alternative. Substituting for something else that would be non-hazardous or less hazardous to workers.

3.**Engineering controls (safeguarding technology):** this seeks to design safer mechanism to keep the hazard from reaching the worker e.g. using noise dampening technology to reduce noise level, enclosing a chemical process in a Plexiglas “glass box” using local exhaust ventilation that captures and carries away the contaminants before they can get in the breathing zone of workers etc.

4.**Administrative control (training and procedures):** this involves coaching for safer human behaviour and changes in workplace policies and procedures such as labeling systems, warning alarms, training, reducing the time of exposure of worker, to workplace hazard.

5. Personal Protective Equipment: this involves the use of Personal Protective Equipment for controlling hazards by placing the equipment directly on workers bodies e.g. respirator gloves, hard hats, ear plugs, boots, protective clothing etc. (nycosh.org/-/Hierarchy-of-Hazards....) (<https://en.m.wikipedia.org/wiki/personal-protective-equipment>)

2.3.1 Health risks associated with Petrol and its constituents

Petrol (Gasoline) is a complex mixture of hydrocarbons which might either comprises of certain quantities of ethanol or additives such as tertiary butylmethyl ether as anti-knock agents which help to increase the octane rating (Sunadda, 2006). Mixture of hydrocarbons consist of Olefins n-paraffin and aromatics and naphthenes. Only the n-paraffines exhibit an opposite effect while increasing the octane rating of the petrol, (Sunadda, 2006).

The aliphatic and acyclic components in petrol vapour take about 95% while aromatics are less than 2% (Sadiqua and Rathna, 2012). The aromatic components are mainly the mixture of benzene C_6H_6 toluene C_7H_8 and the xylenes which are regarded as important petrochemical intermediates and at the same time as valuable components of petrol (Kasali et-al 2011). The abbreviation used for four related compound is (BTEX). These compounds are excessively synthesized chemicals with worldwide annual production of 8-10 million tons of benzene, 5-10 million ton of toluene, 5-10 million tons of ethyl-benzene and 10-15millions tons of xylenes (Frederic and Michael, 2010).

Benzene content of petrol has factually been in range 1-5%. Complete 8 hour exposure to benzene concentrations in distribution and retail operations average less than 1 parts per million (PPM), but its exposure can reach 2-3PPm within a very short time (Sadiqua and Rathna, 2012).

Table 2.2: Reported concentrations of (BTEX) in the environment

Air (Ng/m ³)	Benzene	Toluene	Ethylbenzene	Xylenes
Remote rural area	0.2-16	0.5-260	0.2-1.6	20.1-3
Industrial Centre with high traffic density	Up to 349	Up to 1310	Up to 360	Up to 775
Water (ppb or Ng/L)		< 1-15	< 0.1-1.8	< 0.1- 1.2
Surface Water	< 0.1-2.1	< 1-15	< 0.1-1.8	< 0.1- 1.2
Contaminated Surface Water	Up to 100	NA	Up to 15	Up to 32
Groundwater	< 0.1-1.8	< 1- 100	< 0.1-1.1	<0.1 -0.5
Contaminated Ground water	Up to 330	Up to 3500	Up to 2000	Up to 1340
Drinking water	< 0.1-5	< 1-27	< 1-10	<0.1-12

Source: Frederic and Micheal, 2010. A short primer on benzene, toluene, ethyl benzene and xylenes (BTEX) in the environment and in hydraulic fracturing fluids, Griffith University –Smart water Research Centre

Table2. 3: Estimated daily intake of BTEX Compound

BTEX Compound	Benzene (Ng/m³)	Toluene (Ng/m³)	Ethylbenzene (Ng/m³)	Xylene (Ng/m³)
Air Breathing	90-1300	2-12000	2-3600	70-2000
Cigarette	1800	2000	40 ^a	Up to 190 ^a
Food	Up to 250	Up to 64	NA	NA
Drinking	Up to 10 ^b	Up to 43	Up to 20 ^b	Up to 24 ^b

Source: Frederic and Micheal, 2010. A short primer on benzene, toluene, ethyl benzene and xylenes (BTEX) in the environment and in hydraulic fracturing fluids, Griffith University –Smart water Research Centre

2.3.2 Benzene exposure and its health effects

Benzene is a naturally volatile aromatic constituent of petroleum which occurs in the air from emission from burning coal and oil, automobile exhaust and petrol stations which capable of degraded rapidly in the upper part of the atmosphere. Benzene is also described as an organic chemical compound which is a colourless and flammable liquid with a pleasant, sweet smell. It is industrially used as a solvent and precursor in the production of drugs, plastics, dyes, synthetic rubber and petrol (Sunadda 2006). Benzene is well known for its myelotoxicity, genotoxicity and carcinogenic effects and can be exposed to both domestically and occupationally. This is as result of the very prevalent use of benzene containing petroleum products, which include motor fuel and solvents.(Mahdy et-al, 2015)

Another significant source of exposure is an Active or Passive tobacco smoke, (World Health Organization; 2010). Benzene is said to be a components of indoor and outdoor pollution. The ambient outdoor air have a global average of six (6)

micrograms per cubic meter (Ng/m^3) (range $2\text{-}9\text{Mg}/\text{m}^3$) meanwhile, the benzene levels inside residences or offices in most cases are higher than that of outside. The level is also still higher in homes with garages and the ones engaged by smokers. Higher levels of benzene in air could be a threat to people living around petrochemical manufacturing site, petrol station, petroleum-refining operation or hazardous waste sites. Exposure or contact with benzene via food, beverages or drinking water is not as high as exposure through inhalation and absorption across intact skin in experimental animals (Sunadda, 2006).

Health effects of benzene

Health-wisely, exposure to benzene has a great impact on human ranging from carcinogenic to non-carcinogenic effects

Carcinogenic effects of benzene

Benzene is well known as Group. Carcinogenic substances to human which is capable of causing Cancer of the tissues from white blood cells (increase incidence of leukemia).oral Cancer slope factor said to be between the range of 1.5×10^{-2} to 5.5×10^{-2} and that of inhalation is 2.9×10^{-2} all in $(\text{Mg}/\text{Kg}/\text{day})^{-1}$. (Sunadda, 2006)

Non- carcinogenic effects of benzene

This can be classified into Acute and Chronic effects

1. Acute Effect of benzene

Neurological symptoms of benzene inhalation involve the following: drowsiness, dizziness, confusion, tremors, headaches and unconsciousness (Sunadda, 2006) and (WHO, 2010). Benzene liquid vapour exposure can irritate the skin eyes and upper respiratory tract in humans (Sunadda, 2006). In a study, it was emphasized that, neurologic, immunologic and hematologic effects were significant to inhalation and oral exposure (Sunadda, 2006). Also, exposure to both benzene and alcohol can shoot up the toxic effect in human (Sunadda, 2006) and (WHO, 2010)

2. Chronic effect of benzene

Exposure to benzene can alter the production of blood cells (erythrocytes and leucocytes) from bone marrow in humans which result in aplastic anaemia. Damage of immune system leading to decreased host resistance to infection has also been reported in animal inhalation and oral exposure to benzene. (Sunadda, 2006) and (WHO, 2010), Structural and numerical aberrations of chromosome in human micronuclei, sister Chromatid exchange and sperm head abnormalities seen in laboratory treat. Species treated in vivo. In vitro studies, chromosomal aberrations and mutation were seen in laboratory animal cells and that of human cells in vitro. (WHO,2010). Benzene was also noticed for its fetotoxic in mice and rabbits following maternal exposure by inhalation resulting in reduction in birth weight. It is not, however, teratogenic in experimental animals even at maternally toxic does (W.H.O, 2010).

2.3.3 Toluene exposure and its health effects

Toluene is a natural constituent of crude oil and tolu tree. It is product of petrol and other fuels processes from petroleum and in the process of coke making from coal. It is widely recognized as methylbenzene or phenyl methane, water insoluble in liquid. It is said to have a benzene-like smell, smell of paint and thinners (Sunadda, 2006)

Toluene is release mainly into the environment during the product ion, transport and utilization of petrol containing 5-8% toluene. Toluene concentration in air is low in remote area, in suburban areas the concentration level is 5-25Ng/m³ (1.3-6.6ppb) while in area with high traffic density, it is 1,310Ng/m³ (350ppb). In petrol station, concentration level of toluene is as high as 9000Ng/m³ (2400ppb) which car refilling can meaningful add to daily toluene intake (Frederic and Micheal 2010). Reactivity of toluene with other pollutants speaks for its short-lived in ambient air (Sunadda, 2006). Toluene is a common indoor contaminant (Frederic and Micheal 2010). Toluene

becomes one of the most abused hydrocarbon solvent when it is been inhaled intentionally.

Toluene occasionally found in drinking water supplies and contaminates it because; it is as frequently chemical present in hazardous waste, petroleum waste, industrial effluents and sludge disposal sites. Usually, levels of toluene in drinking water is relatively low when compare to other volatile chemicals (Sunadda, 2006).

Health effects of toluene

Toluene happens to be a non-carcinogenic (Group D) substance. Since toluene cannot be excreted through urine, feces or sweat due to its low water solubility, it is however, metabolized with its 95% been oxidized to become benzyl alcohol while the toxic metabolites are created by the remaining 5% that are ring oxidized to epoxides which form glutathione conjugated that damage cells severely (Sunadda, 2006).

Overall health effects of toluene are classified into Acute and Chronic effects

1. Acute Effect of Toluene

Exposure to toluene can cause Cardiac arrhythmia and if ingested can lead to severe depression of the central nervous system in humans. It was also documented that Central nervous system and respiratory infection could be an acute effect of toluene exposure in animals (Sunadda, 2006)

2. Chronic Effects of Toluene

Central nervous system depression in humans, irritation of upper respiratory and eyes, sore throat, dizziness, headaches and difficulty with sleep are noted of exposure to toluene in human. Inflammation and degeneration of the nasal and respiration epithelium with slight adverse effects on the liver, kidney and lung were the consequence of toluene in rodent. Mild effects on kidney, liver and reproductive were also discovered in human.

2.3.4 Ethyl-benzene exposure and its health effects

Ethyl-benzene is referring to as aromatic hydrocarbon of crude oil which is produced in huge amount via combination of petrochemicals benzene and ethylene in an acidically catalyzed chemical reaction. Ethyl-benzene when subjected to catalytic hydrogenation gives Vinyl benzene (hydrogen gas and styrene). This is very useful in petrochemical industry to produce styrene. The styrene is used in production of polystyrene which is used for making plastic materials. (Sunadda , 2006).

Ethyl-benzene is released into the environment from industries and vehicle emissions and especially in indoor environment through the use of consumer products such as pesticides, liquid process photocopies and plotters, carpet glue, fabric and leather treatment that contain ethyl-benzene, solvent, adhesive, automotive products, paint and varnishes. Ethyl-benzene is about 1-2% in petrol. At urban sites the level of concentration of ethyl-benzene is ranging from 0.74 to 360Ng/m³ (0.1-83ppb) while at the rural sites the levels are generally <2Ng/m³ (< 0.46ppb). In contaminated ground water at a solvent recovery facility, the concentration of ethyl-benzene is up to 28000ppb. It is <0.1ppb in uncontaminated ground water while it is much higher in ground water contaminated through industrial facilities, waste disposal and oil spillage (Frederic and Micheal, 2010).

Health Effect of Ethyl-benzene

Ethyl-benzene is a group D, non-carcinogenic substance has a great effect health-wise when one is been expose to it. Series of health effect causal by ethyl-benzene exposure are also grouped into acute and chronic effects.

1. Acute Health Effects of Ethyl- benzene

Exposure to ethyl-benzene could result in respiratory effects such as throat irritation and chest constriction. Acute inhalation of ethyl benzene leads to neurological effects such as dizziness while eye irritation also comes up when in contact with

eye. Pulmonary effect, central nervous system, liver and kidney problems, including eye irritation are as a result of ethyl-benzene inhalation in animals.

2. Chronic Health Effects of Ethyl-benzene

Animal studies have shown a development effects and incidence of extra ribs, inhalation of ethyl benzene gives effects on blood, livers and kidneys while in humans, no development of reproduction effect was recorded.

2.3.5 Xylene exposure and its health effects

Xylene is natural component of petroleum and coal tar which is a colorless and sweet smelling gas. It is also produced from petroleum as a synthetic chemical and can be smelled in the air at 80% parts of xylene per billion parts of air (ppb) (Sunadda, 2006). Typically, xylene level has been measured high in urban and industrial area with $775\text{Ng}/\text{m}^3$ (178ppb). The background xylene levels in ambient air are around $1\text{Ng}/\text{m}^3$ (0.23ppb) while it is around $3\text{Ng}/\text{m}^3$ (0.69ppb) in suburban areas. At times, the levels of xylene present in an indoor environment most especially in buildings with poor ventilation can be higher than outdoor level while that of surface and ground waters are low ($<0.1\text{ppb}$) (Frederic and Micheal, 2010). Small amount of xylene is present in airplane fuel, gasoline and cigarette smoke (Sunadda, 2006).

The clear, colourless liquid with a sweet aromatic odour (xylene) has three isomers known as Ortho; Meta and Para-xylene. They are mixed in varying proportion or exist singly in most cases usually; the major constituent is m-xylene. Xylene is combustible at room temperature. Although, it is not soluble in water but readily mixes with organic solvent. Xylene does float on water surface since it is less dense than water (Sunadda, 2006).

Xylene is used as a solvent in industries. It is significantly used in as a cleaning agent and as a thinner for paint. It is used in paints and varnishes. It is also used as a solvent in the printing, rubber and leather industries (Sunadda, 2006). Exposure to xylene

could either be through inhalation or skin/eye contact which could be a result of occupational exposure. When the soil and underground water are affected contaminated by petroleum products from damaged underground storage tank, humans may come into contact with the soil and underground water which could lead to a serious health effect (Sunadda, 2006).

Health Effects of Xylene

Exposure both in short period or long periods, too high or low level of xylene account for several health implication in humans and animals. The health effects of xylene which is categorized as (group D) Non carcinogenic substances are classified into Acute and chronic effects. The substances Xylene, (o-xylene, m-xylene and p-xylene) cause these health effects.

1. Acute Health Effect of Xylene

Dermal exposure to xylene in human causes transient skin irritation, dryness and scaling, irritation of the nose and throat as well as dyspnea. When ingested, it prompts a gastrointestinal effect such as nausea, vomiting and gastric discomfort/neurological effects. Inhaling toluene and xylene cause more than additive respiratory and neurological toxicity in humans and animals (Sunadda, 2006).

2. Chronic Health Effect of Xylene

Exposure to xylene in humans could lead to neurological effects such as headaches, dizziness, tremors, fatigue, anxiety, in coordination impaired short-term memory and ability to concentrate. It also renders human with abnormal EKG (electrocardiogram), impaired pulmonary function, severe chest pain and increased heart palpitation while it affects lung in rodents. Reproduction effect is also noticed as a result of exposure to xylene. Kidney is said to be affected from oral exposure while livers and central nervous system are affected from inhalation in animal (Sunadda, 2006).

2.4 Recommendation for Mitigating Health Risks of BTEX

Health risk due to exposure of BTEX can out rightly be controlled by several means which are slated as follows:

i. By Reducing the Exposure

Best practices in location, design and extraction at petrol station should be considered. Children, the vulnerable, should be isolated from indoor exposure to vehicle emissions, hence, dwelling places should be separated from places where BTEX containing products and vehicles are kept and indoor use of influent oil and gasoline heating should be discouraged. Improvement should be made in designing and regular monitoring of engine settings to reduce emissions from vehicle exhausts. Moreover, there should be prohibition of smoking inside dwelling buildings and avoidance of domestic use of BTEX containing products, (W.H.O, 2010).

ii. By Education

Education in respect to the appropriate use of Personal Protective Equipment (PPE), hygiene and collective Protection measure is needed to be encouraged. Educational activities should be conducted to discourage the use of benzene or petrol for degreasing in industry and domestically and as cleaning agents. There should also be public awareness as touching the source of exposure to BTEX and risk minimization measures. (W.H.O, 2010) and (Laurelize et-al, 2014).

iii. By Eliminating the Use

Policies and legislation should be developed and implemented to remove BTEX from consumer products. There should be development and use of alternative solvents in industrial processes points and glue (WHO, 2010).

2.5 Health Risk Associated with PS

The air, water, food, climate and the available space for movement constitute the human's environment in which her health majorly lies on. Most of human's poor health condition are often caused by adverse effects of the constituent of environment such as water, soil and air pollution, poor housing conditions and several vectors of disease. The main factors responsible for environmental pollution are via human activities such as industrialization, urbanization and the occurrence of factors which promote the successfulness of vectors of diseases (Parks, 2007).

Afolabietal, (2011), embarked on a descriptive cross-sectional study on Assessment of Safety practices in filling Stations in Ile-Ife south Western Nigeria. The study aimed at determining the level of awareness of hazards and Safety measures among filling station attendants and assesses the prevailing safety practices in filling Station in Ile-Ife. Therefore, the result of the study indicated that, 94% of the respondents with the median (range) age of 24 (18-57) years were aware of safety measures with fire extinguisher being the most common safety measure known (54%). The most common hazard stated by the study was Fire hazard at (94%). It was also revealed that, setbacks from the road and residential areas were lesser than 30 meters in 90% and 48% of the filling station respectively. Comparing station owned by conglomerates to those owned by independent private marketers, the ones owned by conglomerates had better safety measures. The study was able to determine the level of awareness of hazard and safety practices in petrol station which makes it very relevant to the current study.

Another study was conducted by (Ahmed etal, 2014) on Health, Risk and Safety of petrol station in Minna Town: An over view, which was synonymous to that of (Afolabi et-al, 2011) in all ramifications but with the exception of their study location. Physical assessment of the petrol station in the study areas was also

embarked upon which makes the study similar to the current study but determining the community perception about the health impacts of petrol station allows the current study to stand out. Both Afolabi et-al (2011) and Ahmed et-al (2014) did not put the residents around the vicinity of the petrol station into consideration in which the current study gives a great priority.

Marta, Laureize, Clarice, Mara, Joana and Leticia (2012) published an article on 'Risk Perception and Occupational Accident'. The study was conducted among Gas station workers in Southern Brazil which aimed at identifying the perceptions of gas station workers about physical, chemical, biological and psychological risk factors in which they were exposed to in their work place, types of occupational accidents involving gas station workers and to reports the development of a socio environmental interventions as a tool for risk communication to gas station worker. From the results, the following types of risk were pointed as physical (88.2%), chemical (93.7%), physiological (64.3%), and biological (62.4%). Regarding occupational accidents, out of the study sample size, 94.1% of gas station workers reported it while 74.2% reported fuel contact with the eyes (0.05%). The study therefore concluded that, as the gas station workers perceive the risks, they tend to relate it with the presence of occupational accidents and as an evidence of their working environment's dangerous nature.

A cohort study was carried out by Festus et al. (2013) on Plasma Renal Function among Petrol Station Attendants in Owerri, South-East Nigeria. The study involved 50 Petrol Station Attendants as a test group and 50 non-petrol Station Attendants who were healthy as a control group. From the two groups, health profiles and Venous Blood Samples were obtained for the analysis of Plasma creatinine, Na^+ , K^+ , Cl^- and HCO_3^- using standard laboratory procedures. In conclusion, the study suggested that, there is an association between renal function impairment and nephrotoxicity and

exposure to petroleum vapours, and that its impact depends on time. The study was able to assess the renal function of individual who are occupationally exposed to petrol vapour. This also tried to affirm the health risk related to petrol station which makes it so useful and sensible to the current study.

A similar study was conducted by Eltayeb, Nageeb and Ali Kodi (2014) on Blood level among fuel station workers at Khartoum City. This was done to determine the levels of lead in blood of 50 Sudanese males employed in fuel stations in Khartoum city. A control group of 42 non-exposed healthy men were enrolled in the study. The study also made use of flameless atomic absorption for blood lead measurement. The study revealed that blood lead is significantly elevated in the fuel station Workers in Khartoum city (P value = 0.000). It was concluded that, fuel pumping filling Workers are at risk of lead exposure toxicity and its Health implications.

Also, Robert, Abena and Louis (n.d.) conducted a study to assess the impact of fuel filling Stations on the Environment in Ghana. The study was a comprehensive survey of 33 fuel stations, and 85 service station attendants, mechanics, sales persons, lubes bay attendants and vehicle washers. The study used both secondary and primary data. From the findings of the study, it was concluded that, the respondents might not have adequate knowledge about the implication of the absence of some systems to minimize or curb the health risk related to petrol station. It was also concluded that, most of the station violated all the requirements for all six critical compliance factors studied. On the issues of inhalation as a health hazard, 73% of the respondents who work at the various fuel stations felt they inhale petroleum vapour on a regular basis. These have made the study so relevant to the current study which aimed at investigating knowledge and perception relating to health impacts of petrol stations.

Isabel, Murta, Enrique, Antonia and Jonathan (2010), worked on assessing the impact of Petrol stations on their immediate Surroundings which was aimed at evaluating the extent to which petrol stations affecting their surroundings. The adopted method was based on the fact that the ratio of the concentrations of aliphatic and aromatic hydrocarbons pollutants in the air of the petrol stations and their surroundings (basically determined by vapour emissions from unburned gasoline differs) from the ratio found in urban air, which is majorly instigated by emissions from automobiles. They emphasized that, the spatial limit of influence of petrol stations in any direction would be the first point, moving array from the station where the ratio becomes equal to the urban background ratio. Methodology applied by the authors involves multipoint measuring campaigns of the air at the studied Petrol Station and built-up area in general. Limiting the concentrations of chemicals of concern irrespective of their sources is indispensable for effective protection of Health, (Isabel et-al. 2010).

In a similar study carried out by Mschelia et al, (2015) on Environmental effects of petrol Stations at close proximities to Residential Buildings in Maiduguri and Jere, Bornu State, Nigeria. The study was specifically aimed at examining the presence of those petrol stations vis-à-vis residential houses within 100m radius of location in the township, hazard associated with their activities/operation and the perception of residents/petrol stations workers on the effects pose by those petrol stations. The finding of the study shown that, most of the petrol station did not observe the guidelines for siting such facility which eventually posing health threat to the people residing in a close proximity to the petrol station. Hence, the study advocated for the state legislature to enact law forbidding either individuals or Government from converting plots of land for siting petrol station within the township forth with and that, any means of either of the two sides to convert the use of any land within township should be resisted by the people and the court.

El-Mahdy, Radwan, Kharoub and Halawany, (2015) also conducted a study on chromosomal Abnormalities among Petrol station workers occupationally exposed to benzene. The study aimed at evaluating the genotoxic effects of occupational exposure to benzene through cytogenetic analysis at low level of exposure and also, investigated the possibility of liver and kidney affection. Methodology used was a case control study. It was shown that, concerning exposure period, the frequency of various types of chromosomal aberration was high during first few years of exposure and reduces with increasing duration. Also, liver function tests were said to be higher in workers with statistically difference between exposed workers and control group. Gasoline station workers who were occupationally exposed to mutagenic and carcinogenic agent were also prone to a significant effect on their Health Condition. Series of abnormal Health effects on Human body most importantly; myelotoxicity, genotoxicity and carcinogenic action were traced to long period of exposure to benzene. Various systems such as endocrine, immune and central nervous system were also identified as effected too (El Mahdy et-al, 2015).

A publication by Intrinsik Environmental sciences Inc and McDaniel Lambert Inc, (2013) on phase 2-Human Health Risk Assessment of Oil and Gas Activities in North eastern British Columbia revealed that, various human health effect were actually associated with living or working near oil and gas development activities. A conflicting results concerning cancer incidence rates with ecological studies more often, indicating a potential association between oil and gas development and increased Cancer rates. These were discovered through the conduct of a community and Occupational studies. Many other health outcomes such as Respiratory disease, Reproductive effects, neurological effects, acute effects, cardiovascular effects and autoimmune disease were revealed.

Afrifa et-al, (2015) worked on Health Risk Assessment of Heavy Metal Exposure from Soil Dust at selected Fuel Filling Stations in Accra, investigated on Heavy metal contamination in soil dust at fuel filling station and the human health risk. Energy Dispersive X-ray Fluorescence Analysis Technique (EDXRP) was used. The study sampled two fuel filling stations based on vehicular density. Soft touching brush and plastic dust pan were used to gather and collected dust sample from two different area; petrol and diesel fuel pump location within the Petrol station facility into self-sealed polythene bag which were pre-cleaned with acetone. In the soil collected from the station eighteen elements were identified in each soil sample. The analysis revealed that, the enrichment factors ranged from insignificant at the moderate contamination of heavy metal elements at the Petrol stations.

Several environment impacts of petrol station were identified in a study carried out by Sangotola et al (2015) on the effect of petrol stations in Nigeria. The impacts listed include the followings; road accident as a result of movement of vehicles during scarcity of fuel which could result in accident collision with structure, people and other vehicles; environmental pollution through the introduction of volatile organic compounds in petroleum motor spirit into the air which could cause damage to life in such environment; hazardous substances exposure via use in service station, accidental spillage or leakage which result in respiratory problem and dermatitis; violence to staff as a result of high rate of criminal activities for instance, robbery in which could lead to injury or loss of life.

2.6 Summary of Literature Review

Petrol filling station could be seen as a facility, a structure or a place where petroleum products such as Petrol (PMS), Diesel (AGO), Kerosene (DPK), Liquefied Natural Gas (LNG), Oils and lubricants are sold to the end users. Occasionally, other services such as repairs, car wash and supermarket are delivered in some petrol filling station.

All over the country today, there have been spontaneous establishment of the facility as a result of high demand and consumption rates of petroleum products and other services which are actually provided in the facility, thus, alarming a grave public health importance.

There are laid down rules and regulation concerning physical planning standard and spatial requirements for development and operation of petrol filling station by the authorities in charge which according to various literatures, these rules and regulation are not strictly considered by many business owners as many mushroom petrol filling station evaded the nation which are consequently posing a great deal of health impacts to lives dwelling around the vicinity of the facility.

Therefore, considerable number of health impacts of petrol stations have been identified by several literatures which include exposure to BTEX (harmful constituents of petroleum products); environmental pollution (for instance; noise and air pollution); risk of fire outbreak; traffic congestion/ accident, underground water contamination as a result of oil spillage from ruptured tanks and pipes, exposure to risk of antisocial activities such as criminal/violence vices, arm robbery e.t.c.

In Nigeria several studies were carried out on the health effects and safety practices in petrol station. These effects are directly or indirectly affect lives especially human being. Among these studies include Afolabi, (2011) on assessment of safety practices in filling stations in Ile-Ife, South Western Nigeria. The study found out that 94% of the respondents were aware of fire hazard with 54% for fire extinguisher as the common safety measure known. It was also shown that station owned by conglomerates had better safety measures compared to those owned by independent private marketers. This could be valuable baseline information as the current study area is dominated by the independent private marketers.

Festus et-al, (2013) also assessed plasma Renal function amongst petrol station attendants in Owerri, South-East Nigeria. It was suggested by the study that renal function impairment and Nephrotoxicity are associated with exposure to petroleum vapour and it is time dependent. Also, Christopher et-al (2013) found out disordered menstrual characteristics and female sex hormone profile as well as future reproductive impairment as the effects of gasoline inhalation of female gasoline station Attendant in Uyo metropolis of South-south Nigeria. The prevalence of menstrual disorders among the exposed and unexposed woman was 37.2% and 28.5 respectively.

Ahmed et-al, (2014) also carried out study on health, risk and safety of petrol stations in Minna Town: An over view. The aim of the study was similar to that of Afolabi, (2011) in every sense only that 91% respondents in the study know about importance of safety measures. While, Muritala (2015) worked on location analysis of filling stations on Kano metropolis. It was shown by the study that most of the filling stations satisfied the minimum requirement of 15 meters distance from the road (96%). Equally 98% met the minimum distance of 100 meters from the health care facilities. However many station had not met the criteria of 400 meter minimum distance to other stations where located on same roadside and when not to separate by any road or street.

More so, Mshelia et-al (2015), carried out study on environmental effects of petrol stations at close proximities to Residential Buildings in Maiduguri and Jere, Borno State, Nigeria. The study revealed that the guidelines for siting petrol stations have not been adhered with by most of the petrol stations which were located much earlier than the residential houses close to them. Apart from the importance of petrol station

to the economy, its location needs to be guided by a strictly defined environmental rule, Mshelia et-al (2015).

It is therefore noted that certain behavioral factors such as perceived susceptibility, perceived severity, perceived barrier, perceived benefits, likelihood of taking action and cue to action could result in compliance and adherence with laid down rules and regulation guiding the establishment and operation of petrol station as this might enhance healthy living of the dwellers around the facility. On the same note, five levels of influence for health related behaviors and condition such as intra personal level, inter personal level, institutional factors, community factors and public policy could if been applied adequately, bring a positive trend to the development and running of petrol filling station.

The gap in which the current study intend to address could be clearly and evidently claimed as touching, knowledge and perception on health impacts of petrol stations among adult residents in Atiba Local Government Area Oyo State, with the aims of assessing the level of knowledge and perception on health impact of petrol station and compliance with government regulations on safety practices and siting of petrol station. To the best knowledge of the researcher no study has ever been done to that regard in the aforementioned study site.

2.7 Conceptual Framework

This study considered two models in order to facilitate selection of some pertinent variables which are related to the research questions and objectives for measurement.

These models are Ecological perspective model and health Belief Model.

2.7.1 Ecological Model

This model deals with an interaction between and interdependence of factors within and across various levels of a health problem. The model focuses factors that could

expose people at risk for displaying a certain health behavior that affects related factors in an individual, between individual, communities, society and policy related were actually considered. This study also, pin-point people's interactions with their physical and socio-cultural environments. Five levels of influence for health related behaviours and condition identified and defined as follows:

1. Intrapersonal level: This includes individual characteristics that influence behavior, such as Attitudes, beliefs, personal traits and knowledge

2. Interpersonal level: This occur primary groups and interpersonal processes which involves friends, family, colleagues whose role impacted individual behavior.

3. Institutional factors (Community level): this has to do with rules, regulation, policies and informal structures which may affect recommended behavior.

4. Community factors (Community level): this involves standards, social networks and norms which exist as formal or informal among individuals group and organization.

5. Public policy: this refers to certain regulation, guidelines and law that regulate or support healthy actions and practices for prevention, early detection, control and management of health risks hazard and disease by various tiers of government.

Application of Ecological Model to Knowledge and Perception of the Health Impact of Petrol Stations in Atiba Local Government Area.

1. Intrapersonal level: At this level, individual characteristics which involve socio-demographic traits such as level of education, gender, knowledge, perception, beliefs and attitudes could have serious effectson government regulation safety practices and siting of petrol station. Adequate knowledge about Health Impacts associated with Petrol Station could trigger high level of compliance with safety and siting regulations concerning siting of the station. The Variables to be measured at this level will influences socio-demographic characteristics.

2. Interpersonal level: At this level, primary group including friends peers and Colleague that provide social identity, unit of identity and role definitions for the

community members and Petrol Station dwellers involving the owners and workers. It is the responsibility of each community members to influence on another's behavior either in a positive direction or otherwise depending on their personal characteristics. Moreso, all the stakeholders who were involved in siting and running of the affairs of petrol stations are likely to adhere strictly with the laid down regulations regarding safety and siting of the facility.

3. Institutional level: This level is interested in the organizational rules, regulations, policies and Informal structure regarding safety, siting and activities in petrol stations. As these seriously influence the behaviors of all stakeholders involve in establishment of petrol station in which when they are strictly observed, may promote the recommended healthy behavior to improve the community health status.

4. Community factor: This examines community norm, beliefs, formal or informal social norms, standards and social network among individuals, groups and organizations which could influence siting and running of Petrol Station. If the community has a wider knowledge about health implication and perceived the implication as a threat to their health, it will stand to oppose any act of indiscriminate siting and running of petrol station within the community.

5. Policy level: This focuses the role of Government at various tiers to put healthy policy and laws in place and where these are in existence their compliance should be adequately monitored while the violators should be mercilessly dealt with. These will help to support healthy actions and practices for mitigating Health implications of petrol station on the entire community.

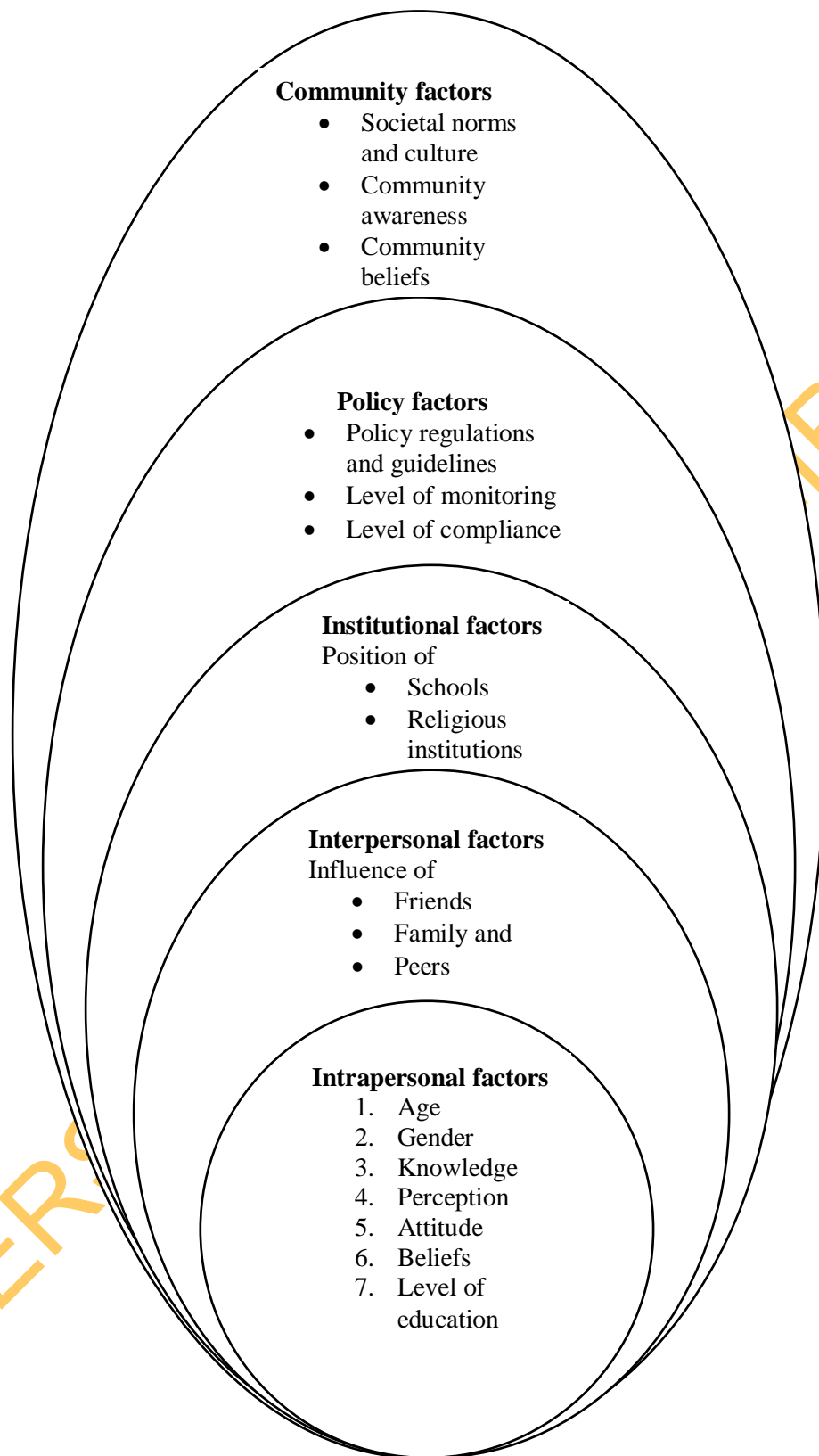


Fig: 2.1 Application of Ecological Model to the Study

2.7.2 Health Belief Model

This model emphasizes the individuals' perceptions of the threat posed by a health problem, the benefits of avoiding the threat and factors influencing individual decision to act. This model happens to be one of the oldest and most popular health behavior theories in the field of Public Health.

Health Belief Model (HBM) consists of six constructs which provide useful framework for designing both short-term and long-term behaviour change strategies. The six constructs of HBM influence people's decision about whether to take action to prevent Health risks, early detection and disease control or not. These constructs involve the following:

1. **Perceived susceptibility:** This is all about individual beliefs about the chances of getting a condition
2. **Perceived Severity:** An individual beliefs about the seriousness of a condition and its consequences
3. **Perceived Benefits:** This focuses individual beliefs about the effectiveness of taking action to reduce risk or seriousness.
4. **Perceived barriers:** This emphasizes individual beliefs about the material and psychological costs of taking action
5. **Cues to action:** This involves factors that activates readiness to change
6. **Self-Efficacy:** This refers to individual confidences to perform an action successfully.

Application of Health Belief Model (HBM) to Knowledge and Perception of the Health Impact of Petrol Stations in Atiba Local Government Area.

1. **Perceived Susceptibility:** If the community members have adequate knowledge of the health impact associated with petrol stations. They consider themselves to be susceptible to the risk of the health impact. As they perceived to be susceptible, they will eventually rise against unhealthy manner in sitting and running of petrol station

within the community. In this while, socio-demographic characteristics of the community members serve as modifying factors which will be influenced by variable to measure.

2. Perceived Severity: Perception of community members about seriousness of the Health impact associated with Petrol Station indicates whether or not to take specific action. If they perceive the implication as a serious health risk there is likelihood for all the stakeholders involve to clamour for healthy condition in siting and running of petrol station within the community.

3. Perceived Benefits: Perception of the community member about the benefits involves in going against poor sitting and running of petrol station will reduce their exposure to Health impacts associated with petrol station and its severity.

4. Perceived Barriers: Perception of the community members and other stakeholders of the cost of taking healthful actions on sitting and running of petrol station are outweighed by the benefit. When adequate information, orientation and education about health impact of petrol station are provided therefore, there will be prompt response to compliance to safety and sitting regulation of petrol station.

5. Cues to Action: Increase the knowledge and awareness of community members and other stakeholder in establishing petrol station on Health impact of the facility through media such as Television, Radio, newspaper, information from life witness of any adverse incidence associated with petrol station. These will trigger readiness to act as recommended by the regulating bodies to ensure health promotion.

6. Self-Efficacy: The community member and all other stakeholders see the confidence in themselves to take necessary healthful action. The community members show confidence in themselves to seek against indiscriminate sitting of Petrol Station and the workers in those petrol stations put all safety practices in place.

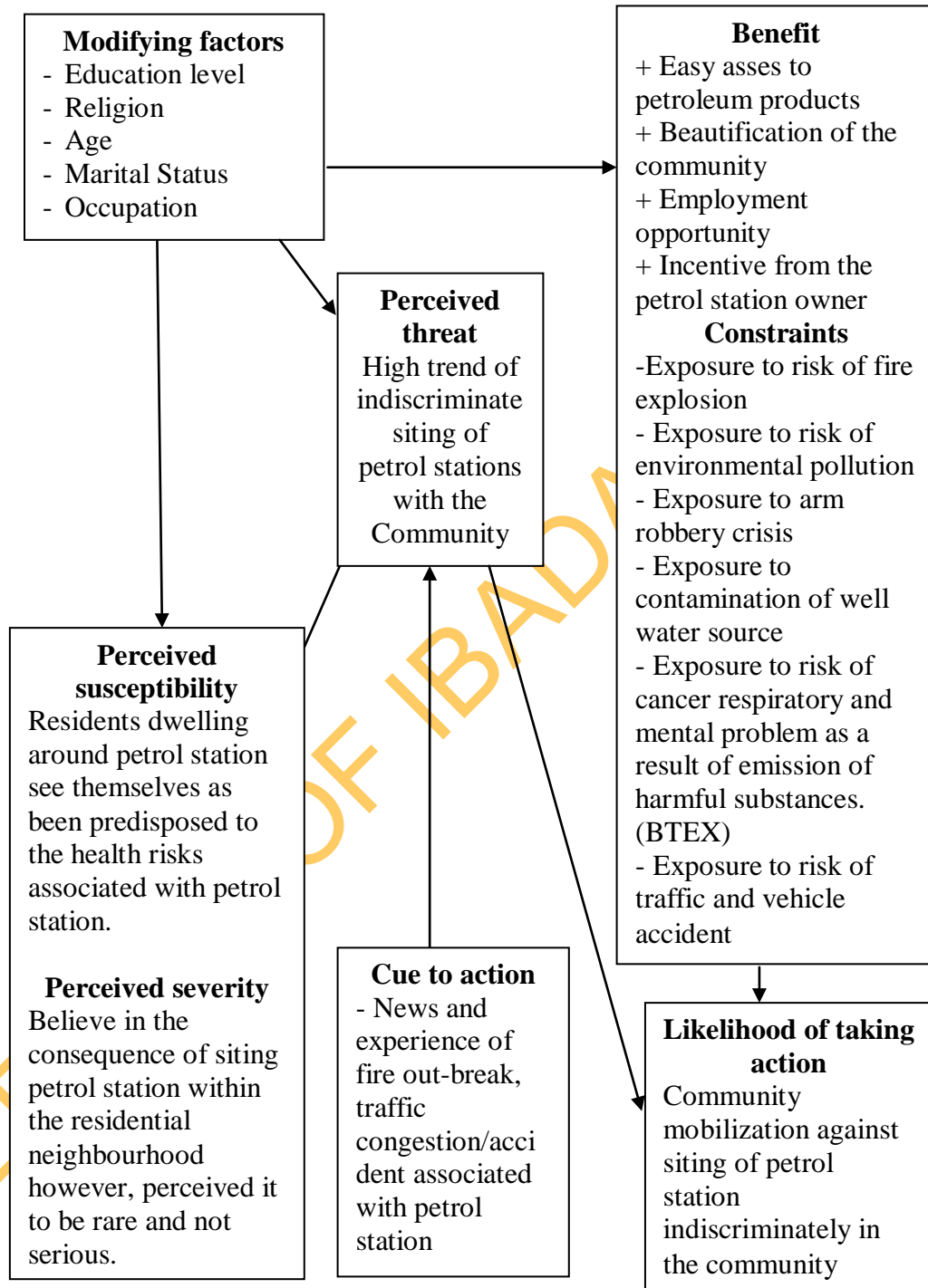


Fig. 2.2 Application of HBM to the study

CHAPTER THREE

METHODOLOGY

3.1 Study Design and Scope

The study adopted a descriptive cross-sectional survey research design. This design was considered to be adequate for the study. This study was limited in scope to investigate knowledge and perception of the respondents relating to petrol station and health.

3.2 Study Area

This study was conducted in Atiba Local Government Area (LGA) of Oyo State. The LGA has an area of 1,757km² and a population of 168,246 at the 2006 census with a population projection of 199,420 as at 21-03 – 2011. It was created out of the defunct Oyo Local Government Area on the 1st day of October 1996 by the then Federal Military Government led by the Late General Sani Abacha with its headquarters at Ofa-Meta but its temporary secretariat was located at Akunlemu Oyo.

The LGA is bounded in the north by Ogo-Oluwa and Oriire Local Government Areas, in the east by Oyo East Local Government Area and in the west by Oyo West Local Government Area. The LGA has ten wards namely: Oke Afin I, Oke Afin 2, Aremo, Bashorun, Agunpopo 1, Agunpopo 2, Agunpopo 3, Asipa 1, Asipa 2, and Asipa 3. The major towns and villages in the area are Agunpopo, Oke-Ebo, Isale Oyo, Sabo, Oke-olola, Basorun, Aafin, Asipa, Koso, Sakutu, Agbaluasa, Aremooke, Otefon, Ijawaya, Igbonla, Gboburo, Baale, Agbaakin, Arinkinkin, Onire-Bara, Ajiroba, Araoye, Ida-ogun, and a host of others.

The major indigenous occupations of the people of Atiba LGA are farming, trading, transportation, traditional craftworks, gari processing, and bread baking and general

merchandise. In the present time, establishment of petroleum products retail outlets has been proliferated all over nook and cranny of the LGA. There are 58 existing petrol stations in the LGA and many others are still under construction. There are four (4) petrol stations in each of ward 2,4,5,6 and 7. In ward 8, the existing petrol stations are eight (8). Ward 9 has the highest number (30) of petrol stations which account for more than half of the entire population of petrol stations present in the LGA.

The LGA has several Maternity homes which include those at Aafin, Koso, Idaogun, Ilowa-gbade, Otefon, Igbonla, Agunpopo, Isale Oyo e.t.c. It also controls many dispensaries such as Aafin dispensary, Isale Oyo dispensary, Ajiroba dispensary, Onire-bara dispensary, Igbonla dispensary, Otefon dispensary, Idaogun dispensary. It also has health posts at Isale-Oyo and Onire-Bara e.t.c.

Atiba LGA has over 100 public and private, nursery and primary school. It has over 30 public and private, junior and senior secondary schools; One College of Education, (Emmanuel Alayande College of Education, Oyo) and Ajayi Crowther University.

3.3 Study Population

This research work focused Adult residents of both sexes who reside around petrol stations in Atiba Local Government Area of Oyo State.

3.4 Sample Size

Sample size for this study was estimated from the following SP. formula for single proportion (Araoye, 2004).

$$N = \frac{Z^2 pq}{d^2}$$

Where;

N = Minimum Sample Size

z = Standard normal deviation set at 1.96 normal interval

p = Prevalence value of health effect associated with petrol station as reported in a similar study conducted in Maiduguri and Jere, Borno State, Nigeria = 38.05%

q = Proportions that does not have the characteristics being investigated ($q = 1-p$), $q = 1-p$ ($1-0.3805=0.6195 =0.62$)

d= Degree of accuracy set at 0.05 (Precision set at 5%)

Therefore, the sample size $n= \frac{1.96^2 \times 0.3805 \times 0.62}{0.05 \times 0.05}$

N = 362.6

10% attrition rate was calculated as follow $\frac{362.6 \times 10}{100} = 36.26$

Hence, the sample size was $362.6 + 36.26 = 398.86$; this was subsequently approximated to 399

The calculated sample size (399) was shared evenly among the existing and functioning 57 petrol stations in the study area.

Thus, $399 \div 57 = 7$ respondents from the vicinity of each functioning P. S

3.5 Sampling Techniques

The study adopted multi-stage sampling techniques to select the participants from the study population. To achieve this, the study area was firstly stratified into ten wards. For second stage, seven out of the ten wards were purposively selected due to the presence of petrol station. These wards include ward two, four, five, six, seven, eight and nine. The next stage, stage three, involves a random selection of seven houses which were located very close to each of the functioning petrol stations in each of the seven wards purposively selected.

In the fourth stage, one eligible participant who is an adult (≥ 18 years old), either male or female was chosen from each of the selected houses using simple balloting or purposive method where applicable. Altogether, 399 consenting participants were selected for the study.

Furthermore, out of fifty-eight existing petrol station surveyed during the course of this study, fifty-seven functioning ones were selected since they are all accessible (see appendix VII for the list of petrol stations)

3.6 Study Variables

The variables which this study measured are categorized into dependent and independent variables. The dependent variables include knowledge, perception, compliance and safety practices while the independent variables were level of education, gender and age.

3.7 Inclusion and Exclusion Criteria

The study participants involved only consenting adults, both male and female residents who live around functioning petrol stations in the study area. While on the contrary, non-consenting adults, both male and female who do not reside around petrol stations within the study area were excluded from the study.

3.8 Instrument for Data Collection

The researcher used a semi-structured questionnaire and two different observational checklists to obtain data for this study. The questionnaire is divided into 3 sections namely sections A, B and C while the two checklists constituted sections D and E. Section A contains items to collect socio-demographic information of the respondent. Section B was designed to assess level of knowledge on the Health impacts of petrol station among the respondent. Items contained in section C were used to determine

perception of the health impacts of petrol stations among the respondents. Section D sought to assess the level of compliance with required government regulation on siting of petrol station and lastly, section E embedded items that were used to identify safety practices that exist in petrol stations.

The semi-structured questionnaire was written in English Language and translated to Yoruba Language (being the indigenous language spoken by most people in the study area) by an expert who is versed in both English and Yoruba languages. The Yoruba version was given to another person who is also versed in both Yoruba and English languages to translate back to English for consistency (see appendix I, II, III and IV).

3.9 Validity and reliability of the Instrument

Validity of the instrument

The instrument was subjected to face and content validity. This was done to determine the ability of the instrument to measure what it is designed to measure (Golafishoni, 2003). The draft questionnaire was given to the researcher's supervisor and other lecturers in the departments for review. One expert from environmental health and another one from community medicine, both from Faculty of Public Health, University of Ibadan, were also consulted for review of the draft instruments. The experts who reviewed the instruments criticized the draft instruments and offer useful suggestions. Their inputs were harmonized and taken in account in preparing the final version of the instruments.

Reliability of the Instrument

Golafishani (2003) explains reliability as the consistency and the stability of an instrument relating to the information in which the instrument is designed to collect. Therefore, in order to establish the reliability of the instrument, it was pre-tested using 10% of the study sample size among adult residents dwelling around petrol stations in Oyo East Local Government Area of Oyo State.

In order to determine the internal consistency of the instrument, Cronbach's Alpha was computed and a reliability coefficient of 0.7 was obtained for the questionnaire. This value was considered by the researcher as an acceptable level of reliability in agreement with Ogundare, (2008) that, value above 0.5 is an acceptable reliability value.

3.10 Training of Research Assistants

Ten (10) research Assistants (RAs) were recruited and trained for the study. The recruited RAs were those who were familiar with terrain of the study site and could speak both English and Yoruba languages fluently. During the training exercise, the RAs were taken through the contents of the instruments as well as objectives and methodology of the study. They were taught how to ask questions in a polite manner without causing any emotional and psychological harm to the respondents. The essence and ways of obtaining informed consent from the respondents were also emphasized during the training. Multiple methods which included brief lectures, demonstration and return demonstration and role play were used in training the RAs. The trained RAs were involved in the pretest exercise which created an opportunity for them to gain practical experiences relating to data collection.

3.11 Data Collection Procedure

The researcher carried out a feasibility study in form of community diagnoses in order to have deeper understanding of the area. The community diagnoses presented an opportunity for the notification of the locations of petrol stations in the study area. Data were collected using semi-structured questionnaire (see Appendix I) with the help of ten well trained Research Assistants (RAs).

The RAs are indigene of the study site. The RAs comprise of five males and five females so as to make it gender sensitive. Three (3) out of these RAs were HND holders while the remaining seven (7) RAs were degree holder. They all had experience relating to research and were versed in both English and Yoruba languages. The three (3) RAs who had HND helped to collect data at the petrol stations while each of the remaining seven (7) RAs was deployed to each ward. Data collection took place from 2pm to 4pm for about a month and half. Only Sunday was exempted because of the various religious activities scheduled for the day. Ward nine has the highest number of petrol station (See Appendix VII). Therefore, those RAs who were deployed to wards like 2,4,5,6 and 7 which have minimal numbers of respondents were redeployed to ward 9 for effectiveness and efficiency.

Purpose of the research, informed consent, voluntariness and confidentiality of the interview were adequately explained to each respondent. Only the respondents who gave their consent were interviewed. The respondents who could read and write and so wished to complete the questionnaire by themselves were given the privileged to do so while those who could not read and write were interviewed in Yoruba language by the RAs. Some of the respondents (especially at petrol stations) provided responses to some questions reluctantly and many at time not willing to give response to some questions due to their tight scheduled.

In all, three hundred and seventy (370) questionnaires out of three hundred and ninety administered were considered valid by the researcher due to attrition and incompleteness. Likewise, fifty-seven functioning petrol station out of fifty-eight existing ones as at the time of this study were studied. The entire process of data collection was adequately monitored by the principal investigator.

3.12 Data Management and Analysis

The researcher with the help of the RAs edited and numbered each copy of the administered questionnaire. The researcher developed a coding guide to code and entered the data in each questionnaire into a designed template on the statistical package for social science (SPSS) version 20 for analysis. Thereafter, the data were analysed using descriptive statistics and inferential statistics such as Chi-square test and Fisher's exact test at $P = 0.05$.

The knowledge of respondents was assessed using a 40- point knowledge scale (see Appendix V for the scale including scores) hence. The mean score was calculated. Scores for the knowledge were classified as follows; poor (0-12), fair (13-26) and good (27-40). Moreover, a 10-point perception scale was used to determine perception of the respondents. Perception scores were categorized into favourable (≥ 5) and unfavourable (< 5). (See Appendix VI for the perception scale and scores). The mean perception score was then calculated. A structured observational check list was used to assess the level of compliance with government regulations on siting of PS. The mean of each item measured in the petrol stations were generated. Also, another structured observational checklist was used to identify safety practices that exist in each PS and frequency distribution for the variables identified was generated. The generated results are presented in tables and chart in chapter four.

3.13 Ethical Consideration

The study proposal was submitted to Oyo State Ministry of Health Research Ethic Committee for ethical approval. Informed consent was obtained from respondents prior to enrollment into the study. Ethical issues like confidentiality, right to decline interview at any time or stage and non-exposure to risk were discussed with each respondent before the interview. The study participants were informed that their participation in the study is absolutely voluntary and that data collected would be purposely used for the research work. Only those who gave informed consent were

recruited for the study.(See Appendices VIII &X).In order to ensure confidentiality of the information, identifiers such as name, phone number and any other means of identifying each participant were not required duringthe course of the interview. However, only serial / identification numbers were given to each questionnaire to aid proper recording.

UNIVERSITY OF IBADAN LIBRARY

CHAPTER FOUR

RESULTS

4.1: Socio-demographic details

The socio-demographic details are presented in table 4.1. Three hundred and seventy respondents were recruited for this study and fifty eight petrol stations were also observed for compliance with environmental safety practices.

A little above half, (50.8%) of the respondents were males while majority (62.2%) were of the Islamic faith with few being Traditional worshipers. The mean age of the respondents was 36.6 ± 11.6 . A little below half, (49.5%) were aged 31 – 50 years, 38.4% were lesser than 30 years, 11.6% were between 51 and 70 years and only 0.5% were above 70 years of age. Majority, (63.0%) reported that they were married, some, (30.5%) were single, and few, (3.2%) were widowed. Most (94.1%) respondents were of the Yoruba ethnic group while few, (4.3%) were Hausa's. A little below half, (48.9%) of the respondents were residents of ward 9, and few, (15.1%) were in ward 8 (Table 4.1). Table 4.2 indicates the respondents' level of education where majority, (63.6%) of the respondents had tertiary education, 23.4% had secondary education and only 13.0% had primary/Arabic or Islamic education. Some, (28.4%) of the respondents were civil servants, 21.4% were petty traders and few, (16.2%) were contractors

**Table 4.1: Respondents' sex, religion, age, marital status and wards
(N=370)**

Socio-demographic variables	Frequency	%
Sex		
Male	188	50.8
Female	182	49.2
Religion		
Islam	230	62.2
Christianity	132	35.7
Traditional	8	2.2
Age*(in Years)		
≤30	142	38.4
31-50	183	49.5
51-70	43	11.6
>70	2	0.5
Marital Status		
Single	341	94.7
Married	14	3.9
Widowed	2	0.6
Separated	2	0.6
Cohabiting	1	0.2
Ethnic group		
Yoruba	348	94.1
Hausa	16	4.3
Igbo	6	1.6
Ward number in Atiba Local Government**		
Ward 2	28	7.6
Ward 4	21	5.7
Ward 5	28	7.6
Ward 6	28	7.6
Ward 7	28	7.6
Ward 8	56	15.1
Ward 9	181	48.9

*Mean age= 36.6±11.6

Table 4.2: Respondents' level of education and occupation

Level of education (N=363)	N	%
Primary/Arabic or Islamic studies	47	13.0
Secondary	85	23.4
Tertiary	231	63.6
Occupation(N=370)		
Civil servant	105	28.4
Petty trading	79	21.4
Business/Contractor	60	16.2
Farming	42	11.4
Artisan	30	8.1
Student	29	7.8
Fulltime house wife	9	2.4
Others	16	4.8

4.2:1 Knowledge of health impact of petrol stations siting in residential area.

A little above half, 56.1% of the respondents reported being aware that some chemicals present in petrol can cause diseases for people who live around petrol stations (figure 4.1).

Respondent's awareness related to chemical substances which could be present in petrol is presented in table 4.3. Majority, (63.0%) of the respondents had never heard of toluene. Majority, (62.0%) of the respondents were not also aware of ethylbenzene. A little above half (58.3%) of the respondents have never heard of xylene.

The respondent's knowledge of the health condition that can be caused by noise generated in petrol station is shown in table 4.4. Many, (42.2%) of the respondents stated erroneously that noise generation by petrol station can cause cancer. Majority, (84.1%) of the respondents correctly stated that noise pollution can cause sleep disturbance. Majority, (67.3%) of the respondent stated that noise generation can cause increased blood pressure.

The respondents' knowledge of the chemical compounds in petrol / petroleum products which are harmful or not harmful is presented in table 4.5. More than one third, (39.8%) of the respondents correctly stated that benzene is harmful to health. Many, (33.3%) of the respondents correctly stated that toluene present in petroleum products is harmful to human health. 19.5% of the respondents correctly stated that sodium is not harmful, and few, (9.2%) of the respondents correctly stated that renin is not harmful.

The respondents' knowledge of diseases which can be caused by drinking water which is contaminated by petrol or petroleum products is presented in table 4.6. Many, (31.6%) of the respondents wrongly stated that drinking petroleum contaminated

water can cause Glaucoma. A little half, (47.7%) of the respondents correctly stated that drinking petroleum contaminated water could cause leukemia (cancer of the blood.). Majority, (58.9%) of the respondents correctly stated that polluted water could cause kidney problems. The other diseases correctly reported to be associated with drinking of water which is contaminated by petroleum products included irritation of stomach 65,8%,vomiting 78.9% and reduced blood clotting 41.4%.(see details in table4.6).

Table 4.7 presents the respondents reported health conditions that can be caused by staying close to a petrol station. Majority, (82.2%) of the respondents correctly stated that living near a petrol station have some health problem associated with it. A little above one third, (35.5%) of the respondents correctly stated that headache is a health problem that could be caused by exposure to any petroleum products. Majority (60.8%) of the respondents correctly indicated that noise pollution from petrol stations can lead to mental stress. A little bellow four fifth, (75.9%) of the respondents rightly stated that the noise generated from petrol stations can lead to hearing problems. (See table 4.7 for details).

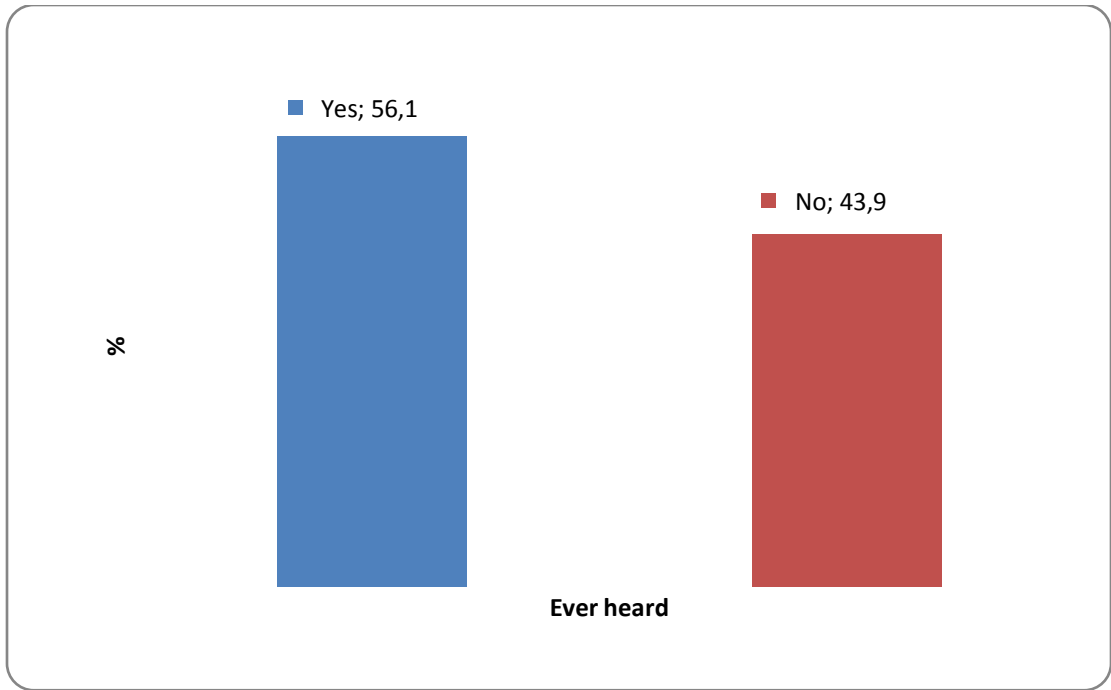


Figure 4.1 Ever heard that some chemicals present in petrol can cause disease

UNIVERSITY OF IB

ARY

Table 4.3: Respondents' awareness of chemical substances in petrol

Chemical substances present in petrol	Yes (%)	No (%)	Total (%)
Toluene	137(37.0)	233(63.0)	370(100)
Ethyl-benzene	138(38.0)	225(62.0)	363(100)
Xylene	151(41.7)	211(58.3)	362(100)
Benzene	173(47.8)	189(52.2)	362(100)

UNIVERSITY OF IBADAN LIBRARY

Table 4.4: Respondents' knowledge of the health conditions that can be caused by noise generated in petrol stations

Diseases that noise pollution could cause	True (%)	False (%)	Don't know	Total (%)
Cancer	104(28.2)	156(42.3)*	109(29.5)	369(100)
Sleep disturbance	311(84.1)*	25(6.8)	34(9.2)	370(100)
Increased Blood pressure	249(67.3)*	44(11.9)	76(20.5)	369(100)
Diabetes	45(12.2)	199(53.8)*	126(34.1)	370(100)
Stress	239(64.6)*	75(20.3)	56(15.1)	370(100)
Anxiety	240(64.9)*	54(14.6)	76(20.5)	370(100)
Glaucoma	99(26.8)	94(25.5)*	176(47.7)	369(100)

*Correct answers

Table4.5: Respondents' knowledge of chemical components of petroleum products which are harmful or not harmful.

Chemical compound	Effects on health			Total
	Harmful (%)	Not harmful (%)	Don't know (%)	
Renin	122(33.1)	34(9.2)*	213(57.7)	369(100.0)
Benzene	147(39.8)*	56(15.2)	166(45.0)	369(100.0)
Sodium	123(33.3)	72(19.5)*	174(47.2)	369(100.0)
Toluene	123(33.3)*	51(13.8)	195(58.2)	369(100.0)
Alkaloids	131(35.4)	45(45.2)*	194(52.4)	370(100.0)
Ethyl-benzene	156(42.4)*	36(9.8)	176(47.8)	368(100.0)
Hydrochloric acid	168(45.4)	31(8.4)*	171(46.2)	370(100.0)
Xylene	136(36.9)*	53(14.4)	180(48.7)	369(100.0)

*Correct answers

Table 4.6: Respondents' knowledge of diseases that can be caused by drinking water that is contaminated with petrol or petroleum products

Diseases that drinking water that is contaminated by petrol or petroleum products could cause	True (%)	False (%)	Don't know
Glaucoma	117(31.6)	70(18.9)*	183(49.5)
Leukemia(cancer of the blood)	176(47.7)*	73(19.8)	120(35.5)
Kidney problem	218(58.9)*	61(16.5)	91(24.6)
Pneumonia	124(33.6)	67(18.2)*	178(48.2)
Liver problem	241(65.1)*	43(11.6)	86(32.2)
Epilepsy	87(23.6)	142(38.5)*	140(37.9)
Irritation of the stomach	243(65.8)*	46(12.5)	80(21.7)
Typhoid	206(55.8)	56(15.2)*	107(29.0)
Vomiting	292(78.9)*	21(5.7)	57(15.4)
Reduced blood clothing	153(41.4)*	65(17.6)	152(41.1)
Malaria	161(43.5)	78(21.1)*	131(35.4)
High blood pressure	196(53.1)*	56(15.2)	117(31.7)

*Correct answers

Table 4.7: Respondents' knowledge of the health conditions that can result from living close to a petrol station

Consequences of staying close to a petrol station	True (%)	False (%)	Don't know
Petrol stations can cause some health problems to people who live near them	305(82.2)*	16(4.3)	49(13.2)
Headache is never a health problem caused by exposure to any petroleum products	154(41.7)	131(35.5)*	84(22.8)
People who live around petrol stations can suffer mental stress	225(60.8)*	66(17.8)	79(21.4)
Noise generated from petrol stations can lead to hearing problems	281(75.9)*	41(11.1)	48(13.0)
Breathing in petroleum products by females can affect their menstruation	127(34.3)*	82(22.2)	56(43.5)

*Correct responses

4.2.2: Association between respondents' knowledge and their Socio-demographics characteristics

The categories of knowledge among the respondents are presented in table 4.8. The mean knowledge score was 17.2 ± 7.6 points. Majority (69.2%) of the respondents had fair knowledge, 24.1% had poor knowledge while only 5.9% respondents had good knowledge.

The categorization of respondents knowledge scores by sex are presented in table 4.9. Majority (67.0%) of the male respondents had fair knowledge while only 8.0% of the same population had good knowledge. Similarly, 67.0% of the female respondents had fair knowledge compared with 7.7% who had good knowledge.

Comparison of respondents' knowledge scores by level of education is presented in table 4.10. Almost half, (48.9%) of the respondents with primary/Arabic or Islamic education had poor and fair knowledge while only 2.1% had good knowledge. Of those with secondary education, 61.2% had fair knowledge while 37.6% and 1.2% respectively, had poor and good knowledge. Majority, (76.2%) of the respondents' with tertiary education had fair knowledge while only 8.7% of the same population had good knowledge.

Table 4.11 contains the categorization of respondents' knowledge scores by age. Majority (72.5%) of respondents whose age were 30 years or lesser had fair knowledge, 22.5% had poor knowledge while 4.9% of the same age category had good knowledge. Similarly, majority (68.9%) respondents who were between 31 and 50 years had fair knowledge while 7.7% had good knowledge. (See table for details).

Categorization of respondents' knowledge score by religion is shown in table 4.12. Majority (63.0%) of respondents who were of the Islamic faith had fair knowledge. Similarly, 75.0% of respondents who were of the Christian faith had fair knowledge while 28.3% had good knowledge. (See table for details)

Table 4.13 shows categorization of knowledge by marital status. Majority (69.0%) of the respondents who were single had fair knowledge. Similarly, 71.2% of respondents who had married had fair knowledge while 6.4% of the same population had good knowledge. Half (50.0%) of the respondents who were widowed had poor knowledge. All (100.0%) of the respondents' who had divorced had poor knowledge. (See table for details).

Table 4.8: Categorization of knowledge scores among respondents

Knowledge Categories*	Frequency	Percentage (%)
Poor (≤ 12 points)	92	24.9
Fair ($>12 \leq 26$ points)	256	69.2
Good (≥ 27 points)	22	5.9
Total (40 points)	370	100.0

*Mean knowledge score = 17.2 ± 7.6

A 40-point knowledge scale was used to assess the respondents. Knowledge scores ≤ 12 was rated poor, scores $>12 \leq 26$ were rated fair while those ≥ 27 were rated good.

Table: 4.9: Categorization of respondents' knowledge scores by sex

Sex	Knowledge Categories			Total (%)	X ²	Df	p-value
	Poor (%)	Fair (%)	Good (%)				
Male	47(25.0)	126(67.0)	15 (8.0)	188 (100)	0.218	2	0.897*
Female	42(23.1)	126(67.0)	14(7.7)	182 (100)			
Total	89(24.1)	252(68.1)	29 (7.8)	370(100.0)			

*Not significant at P>0.05

UNIVERSITY OF IBADAN LIBRARY

Table: 4.10: Categorization of respondents' knowledge by level of education

Sex	Knowledge Categories			Total (%)	X ²	Df	p-value
	Poor (%)	Fair(%)	Good (%)				
Primary/Ara	23(48.9)	23(48.9)	1 (2.1)	47(100.0)	36.2	4	0.000**
bicIslamic							
Secondary	32(37.6)	52(61.2)	1(1.2)	85(100.0)			
Tertiary	35(15.2)	176(76.2)	20(8.7)	231(100.0)			
Total	90(24.8)	251(69.1)	22(6.1)	363(100.0)			

**Significant at P<0.05

Table: 4.11: Categorization of respondents' knowledge scores by age

Age group (in years)	Knowledge Categories			Total (%)	**X ²	Df	P-value
	Poor (%)	Fair(%)	Good (%)				
≤30	32(22.5)	103(72.5)	7(4.9)	142 (100)	6.9	6	0.314*
31-50	43(23.5)	126(68.9)	14 (7.7)	183 (100)			
51-70	16(37.2)	26 (60.5)	1 (2.3)	43 (100)			
>70	1(50.0)	1(50.0)	0(0.0)	2(100)			
Total	92(24.9)	256(69.2)	22(5.9)	370(100.0)			

* Not significant at P>0.05

Table: 4.12: categorization of respondents' knowledge score by Religion

Religion	Knowledge Categories			Total (%)	**X ²	Df	P-value
	Poor (%)	Fair (%)	Good (%)				
Islam	65(23.3)	145(63.0)	20(8.7)	230(100)	9.508	4	0.052*
Christianity	24(18.2)	99(75.0)	9 (6.8)	132 (100)			
Traditional	0(0.0)	8 (100.0)	0 (0.0)	8 (100)			
Total	89(24.1)	252(68.1)	29 (7.8)	370(100.0)			

* Not significant at P>0.05

Table: 4.13: categorization of respondents' knowledge score by marital status

Marital status	Knowledge Categories			Total (%)	**X ²	Df	P-value
	Poor (%)	Fair(%)	Good (%)				
Single	22 (19.5)	78(69.0)	13 (11.5)	113(100)	1.887	4	0.750*
Married	52 (22.3)	116(71.2)	15 (6.4)	233 (38.8)			
Separated	6 (66.7)	3 (33.3)	0 (0.0)	9(100)			
Divorced	3(100.0)	0(0.0)	0(0.0)	3(100)			
Widowed	6(50.0)	5(41.7)	1(8.3)	12(100)			
Total	6 (2.1)	82(28.7)	198(69.2)	370(100)			

* Not significant at P>0.05

4.3: Respondents' perception of the health impacts of petrol stations

Respondents' perception about health impact of petrol station is presented in table 4.14. Majority (62.2%) of the respondents did not share the view that fire outbreak in petrol stations cannot spread to surrounding buildings while few, 23.8% agreed. Many, (33.8%) of the respondents opined that the benefits of siting petrol station close to houses outweigh the disadvantage. Majority, (47.8%) of the respondents did not share the view that petrol station is not a major source of environmental pollution in the community. More than half, (58.9%) of the respondents did not share the perception that siting petrol station close to residential houses cannot lead to any serious health problem. Majority, (70.3%) of the respondents opined that the noise from petrol station prevents the residents from having quality sleep (see table for details).

Table 4.14: Respondents' perception on the health impact of petrol stations

Perception Statements	Agree (%)	Disagree (%)	Undecided (%)
Fire outbreak in petrol stations cannot spread to surrounding buildings.	88 (23.8)	230 (62.2)*	52 (14.1)
The benefits of siting petrol station close to houses outweigh the disadvantage.	125 (33.8)	138 (37.3)*	107 (28.9)
Petrol station is not a major source of environmental pollution in our community.	131(35.4)	177 (47.8)*	62(16.8)
Siting petrol station close to residential houses cannot lead to any serious health problem.	89 (24.1)	218(58.9)*	63 (17.0)
The noise from petrol station prevents the residents from having quality sleep.	260 (70.3)*	54(14.6)	56 (15.1)
Petrol or petroleum products cannot contaminate wells sited close to them.	104 (28.2)	195(52.8)*	70(19.0)
The traffic congestion occasionally caused by petrol station is not a major problem in this area.	137(37.2)	156(42.4)*	75(20.4)
Petrol stations should not be built near residential areas as it can attract criminal activities.	269 (72.8)*	43 (11.6)	57(15.6)
Petrol stations should not be sited close to residential houses because of noise pollution.	276 (74.7)*	45 (12.3)	47 (13.0)

***Correct responses**

4.3.1 Respondents' perception of petrol stations

The mean perception score of the respondents was 5.1 ± 2.1 . Majority, 66.3% of the respondents had a favourable perception while less than one third, (33.4%) of the respondents had an unfavorable perception (See table 4.15).

Table 4.16 shows the categorization of perception by knowledge. Majority (73.4%) of the respondents who had fair knowledge had a favourable perception, while 15.0% of the respondents who had poor knowledge had favorable perception. 0.8% of the respondents who had good knowledge had unfavourable perception. A little above half, (54.8.4%) of respondents who had fair knowledge had unfavourable perception while 26.6% had unfavorable perception (See table for details).

Table 4.15: categorization of perception among respondents

Perception* Categories	Frequency	Percentage (%)
Favourable (≥ 5)	246	66.6
Unfavourable (≤ 4)	124	33.4
Total	348	100.0

*Mean perception score = 5.1 ± 2.1

A 10 point scale was used to assess the perception with a score of 0-5= unfavourable perception and a score of 5-10 as a favourable perception.

Table 4.16: categorization of perception by level of knowledge

Knowledge Categories	Perception categories		Total (%)	**X ²	Df	P-value
	Unfavourable (%)	Favourable (%)				
Poor	55 (44.4)	37(37.1)	92 (100)	48.983	2	0.000*
Fair	68 (54.8)	188 (73.4)	256 (100)			
Good	1 (0.8)	21(93.1)	22(100)			
Total	124 (33.8)	246 (66.9)	370(100.0)			

*Significant at P<0.05

4.4 Observational assessment on the compliance with the government regulation on sitting of petrol stations.

All (100%) of the petrol stations which were observed in this study were privately owned. Table 4.17 presents the distribution of petrol stations by ward. More than half, 52.6% of the respondents are from ward 9. Some, 14.0% were from ward 8, few, 7.0% were from each of ward 2, ward 5, ward 6 and ward 7 respectively.

Plot sizes of the petrol stations were represented in Table 4.18. The mean plot size of the petrol station was 1.37 ± 0.67 . Many, 59.6% of the petrol stations have 1 plot, 17.5% of the petrol stations have 1.50 plots while few, (14.0%) of the petrol stations have 2.00 plots of land (See table for details).

Table 4.19 contains petrol stations plot frontage width. The mean distance of the plot frontage width = 23.3 ± 11.5 . Majority, 56.1% of the petrol stations had a frontage width between the ranges of 15-23 meters. A little below half, (43.9%) has between 24-60 plot frontage width. The mean frontage boundary setback of the petrol stations = 0.45 ± 1.1 . Majority, (78.9%) of the petrol stations had 0.00 meter off frontage boundary setback to the road (See tables 4.19 and 4.20 for details).

The Radius of Kerbline to petrol stations was shown in table 4.21. Majority, (94.7%) of the petrol stations had a radius of kerbline of 0.00 meter. 1.8% of the petrol stations had a radius of kerbline that falls within the range of 1.00 -19.00 meters.

Table 4.22 presents setback petrol stations to the nearest dwelling house (in meters). The mean setback = 9.1 ± 14.2 . Many, (50.9%) of the filling stations had 0-6 meters setback to the nearest dwelling house while, 22.8% had between 7-12 meters setback to the nearest dwelling house.

Table 4.23 represents the setback of the petrol stations pumps nearest to the center of the road. The Mean= 1.9 ± 0.8 , from the pump to the center of the road. 31.6% had 0-6 meter distance from their pumps to the center of the road while 52.6% of the petrol stations had 7-12 meters setback from their pumps to the center of the road (See table for details).

Compliance with government regulation on siting petrol station was summarized in table 4.24. Many, (64.5%) of the petrol stations had a drive in way. About one third, (35.1%) of the petrol stations was located on a vertical higher bend plot. Just 1.8% of the petrol stations are located on a vertical sloppy gradient. Evidence of town planning was found at some, (26.3%) of the petrol stations. (See table for more details).

Table 4.25: represents the reported reason for non-availability of evidence of town planning approval. Some, (47.6%) of the respondents attributed their non-availability of town planning approval to unmet demands by the town planning and development authorities while more than half, (52.4%) of the respondents chose not to disclose the reasons for their non-approval (table 4.25). The length of time taken to obtain town planning approval was summarized in table 4.26. Many, (57.1%) of the respondents said it took them more than a month to get a town planning approval, while few, (28.6%) of the respondents said it took them a month to get the town planning approval (See table 4.26 for details).

The mean of the setback of the petrol station to the center of adjoining road= 7.0 ± 8.1 meters. Majority, (73.7%) of the petrol stations had between 0-12 meters setback to the center of adjoining road distance while 26.3% of the petrol stations had their set back between 13-25 meters, (Table 4.27).

Table 4.28: shows the distance of petrol stations to public facility and nearest residential houses. The mean distance of petrol stations to public facility = 56.1 ± 69.1 . Majority, (68.4%) of the filling stations had a distance of 0-50 meters to the nearest public facility such as hospital while few, (21.1%) had a distance of > 100 meters. The mean distance of the petrol station to the nearest residential house = 20.2 ± 26.2 . Majority, (93.0%) of the filling stations had a distance of 0-50 meters, while few, (3.5%) of the petrol stations had a distance of $\geq 100-150$ meters. (See table 4.28)

Safety practices which exist in petrol stations were showcased in table 4.29. More than one third, (38.6 %) of the petrol stations made use of fire extinguisher. More than half, (57.9%) of the petrol stations had sand box. Majority, (78.9%) of the petrol stations had 'no smoking' sign. Few, (28.1%) of the petrol station had a no use of phone signs. Majority, (87.7%) of the petrol stations have a good nozzle sign. Few, (14.0%) of the petrol stations have a proper waste disposal method. Majority, (61.4%) of the petrol station has a fuel vapour recovery boots. 33.3% of the petrol stations have a one way for entry and exiting the forecourt. Only 3.5% of the petrol stations have panic alarm. Similarly, 3.5% of the petrol stations have a compressed air system while just 1.8% of the petrol stations have the Environmental impact annual report (EIAR) for the year 2015 (See table for details).

Table 4.17 **Distribution of petrol stations by wards**

Ward number in Atiba Local Government** (N=57)	N	(%)
Ward 2	4	7.0
Ward 4	3	5.3
Ward 5	4	7.0
Ward 6	4	7.0
Ward 7	4	7.0
Ward 8	8	14.0
Ward 9	30	52.6
Total	57	100

Table 4.18 Plot size of petrol stations (in meter)

Plot size(m)	Frequency	Percentage (%)
0.50	1	1.8
1.00	34	59.6
1.50	10	17.5
2.00	8	14.0
2.50	2	3.5
4.00	2	3.5
Total	57	100

Mean plot size = 1.37 ± 0.67

Minimum Standard for Plot Size = Not lesser than 45m (length) and 24m (width)

Table 4.19: Petrol stations plot frontage width (in meter)

Plot frontage width	Frequency	Percentage (%)
15-23 Meters	32	56.1
24-60 meters	25	43.9
Total	57	100.0

Mean=23.3±11.5

Plot frontage width standard = 24.0m

UNIVERSITY OF IBADAN LIBRARY

Table 4.20: Petrol stations frontage boundary setback to the road (in meters)

(N=57)

Plot space in meters	Frequency	Percentage (%)
0.00	45	78.9
1.00	5	8.8
1.20	1	1.8
1.90	1	1.8
2.00	1	1.8
2.70	1	1.8
3.00	1	1.8
4.00	1	1.8
6.00	1	1.8
Total	57	100.0

Mean=0.5±1.1

Plot frontage boundary setback standard=15.0meters

Table 4.21: Radius of Kerbline to Petrol stations

Radius of kerbline(in meters)	Frequency	Percentage (%)
0.00	54	94.7
1.00	1	1.8
17.50	1	1.8
19.00	1	1.8
Total	57	100.0

Mean= 0.7±3.4

Standard Radius of kerbline =6.0m

UNIVERSITY OF IBADAN LIBRARY

Table4.22: Distance of PS to the nearest dwelling house (in meters)

Plot in meters	Frequency	Percentage (%)
0-6 meters	29	50.9
7-12 meters	13	22.8
13-19 meters	11	19.3
20-25 meters	2	3.5
26-30 meters	2	3.5
Total	57	100.0

Mean =9.1±14.2

Distance of PS to the nearest dwelling house Standard =7.0m

Table 4.23: Setback of pump to the center of the road (in meters)

Distance in meters	Frequency	Percentage (%)
0-6	18	31.6
7-12	30	52.6
13-19	7	12.3
20-26	1	1.8
27-30	30	1.8
Total	57	100.0

Mean=1.9±0.8

Standard setback of pump to the center of the road = ≥15-30

Table 4.24: Observational checklist on compliance with governmental regulation on siting of petrol station

Indicators	Present (%)	Absent (%)
Drive way in	37(64.9)	20(35.1)
Vertical Higher	20(35.1)	37(64.9)
Vertical sloppy	1(1.8)	56(98.2)
Evidence of Town planning approval	15(26.3)	42(73.7)
Building plan approved by the town planning authority.	12(21.1)	45(78.9)
Availability of development approval or clearance	14(24.6)	43(75.4)

Table 4.25: Reported reason for non-availability of evidence of town planning services

Reasons for non-availability of town planning approval	Frequency	Percentage (%)
I did not meet the requirements	20	47.6
I prefer not to discuss the reasons	22	52.4
Total	42	100.0

UNIVERSITY OF IBADAN LIBRARY

4.26: Reported length of time to get a town planning approval

Time taken respondents to get approval from the town planning office	Frequency	Percentage (%)
A month	4	28.6
More than a month	8	57.1
Less than a year	1	7.1
More than a year	1	7.1
Total	13	100.0

Table 4.27: Setback of the petrol station to the center of adjoining road (in metres)

Distance in Meters	Frequency	Percentage (%)
0-12	42	73.7
13-25	15	26.3
Total	57	100

Standard distance =35m

UNIVERSITY OF IBADAN LIBRARY

4.28: Distance of petrol station to public facility

Distance of petrol station to public facility*	Frequency	Percentage (%)
0-50 Meters	39	68.4
51-100 meters	6	10.5
>100 meters	12	21.1
Total	57	100

Distance of petrol station to the nearest residential

house**

0-50 Meters	53	93.0
51-100 meters	2	3.5
100 -150 meters	2	3.5
Total	57	100.0

*Mean=56.2±69.1

*Standard distance=100m

**Mean=20.2±26.2

**Standard distance=50m

Table 4.29: Availability of safety equipment for effective practices in petrol station

Safety Equipment	Present (%)	Absent (%)
Fire Extinguisher	22(38.6)	35(61.4)
Sand Box	33(57.9)	24(42.1)
No smoking sign	45(78.9)	12(21.1)
No use of phone sign	16(28.1)	41(71.9)
Switch off engine while refueling sign	11(19.3)	46(80.7)
Use of personal protective equipment	4(7.0)	53(93.0)
Hazard warnings	2(3.5)	55(96.5)
Good nozzle handling	50(87.7)	7(12.3)
Proper waste disposal method	8(14.0)	49(86.0)
Fuel vapour recovery boots	35(61.4)	22(38.6)
Traffic warning sign	0(0.00)	57(100)
One way for entry and exiting the forecourt	19(33.3)	38(66.7)
Enough packing area from pumps	24(42.1)	33(57.9)
Close circuit television	2(3.5)	55(96.5)
Panic alarm	2(3.5)	55(96.5)
Compressed air system	2(3.5)	55(96.5)
Environmental impact annual report (EIAR for the year 2015)	1(1.8)	56(98.2)

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Socio-demographic characteristics

The ages of the respondents ranged from 18-73 years with a mean of 36.6 ± 11.6 . This simply means that the target population was within the age bracket termed as adult. These are set of people who are older enough and mentally advanced to be able to solely make a decision. An adult is a person older than 19 years of age unless national law defines a person as being an adult at an earlier age (WHO, 2013).

This study strictly catered for gender equality to the extent that both male and female respondents are almost of equal number with just a slight difference. The population of male respondents is just an average (50.8%) of the entire respondents. This result greatly opposes that of a study conducted by Afolabi et al (2011) at Ile-Ife Nigeria where the majority (72%) of the respondents were male and that of Marta et al, 2012 at southern Brazil where male dominated at 90.5% over their female counterpart.

Majority (94.7) of the respondents in this study were single and mainly Yorubas. These results might be due to the fact that the study location is a Yoruba land which is located in the south west zone of the country. This finding shows a great deal of conformity with a study carried out at southern Brazil by Marta et al, (2012) where 85.5% of the respondents were ethnically white and a little above average (52%) were single.

Also, more than half of the respondents had attained a level of tertiary education which serves as an indication for their fair and good knowledge categories where most of this set of people had fair and good knowledge than cross tabulating

respondents knowledge by level of education and statistically significant at $p < 0.05$. This finding denounces that of the study zone at Minna Town by Ahmed et al, 2014 where just 26.0% of the respondents attained Tertiary education.

Meanwhile, 62.2% of the respondents were of Islamic faith. Larger percentage of the respondents were civil servant as showcased from the finding of this study, whereas, a divergent results were shown in a study conducted in the Niger Delta region of Nigeria by Kponee, Chiger, Kakulu, Vorhee, Heige-Bernays, (2015) where most of the respondents were Christian and tradesmen.

5.2 Awareness and Knowledge of health impact of petrol stations

The finding from this study established that a little above half of the respondents were aware that some chemicals which are present in petrol can cause disease for people who live around petrol station while they have no/inadequate awareness of chemical substances such as Benzene, Toluene, Ethylbenzene and Xylene which could be present in petrol. These chemical substances of petrol (BTEX) among the numerous constituents of petroleum products are known as the most toxic compound in which their vapour exposure lead to environmental problem and health effect on people (Christopher et al 2013; Sunadda 2006).

The level of knowledge of the respondents on either the chemical compounds in petrol/petroleum products are harmful to health or not, about one third of the respondents stated that, Benzene, Toluene, Ethylbenzene and Xylene (BTEX) are harmful to health which has actually shown that many people in the community are still ignorant/do not have adequate knowledge about the harmful effects of the concerned chemicals. The harmful effects of BTEX occur based on the length of exposure, the amount of BTEX exposure and the one been exposed to among the chemicals because benzene is known as the most toxic (Frederic and Michael, 2010).

Concerning knowledge of health conditions that can be caused by noise generated in petrol stations, finding from this study recognizes, increased blood pressure, stress, and anxiety with the inclusion of sleep disturbance which has the highest percentage (84.1%) of the respondents who shared their view. There is increase in environmental problem and hazard to human when noise and vibration are high and continuous which as a result pose several health problems such as hearing loss, headaches, high blood pressure, and loss of concentration (Abdel-Rahman 2008).

This study also show cases the knowledge of the study respondents of the diseases which can be caused by drinking water is contaminated by petrol/petroleum products. More than two third of the respondents indicate liver problem, stomach irritation and vomiting as the consequence of drinking water which is polluted by petroleum product while high blood pressure and kidney problem were mentioned by half of the number of respondents. This result is in tandem with the finding of a study carried out at Niger Delta region of Nigeria by Kponee et al (2015). The health effects that may result from drinking liquids containing high proportion of benzene include irritation of the stomach, convulsions, dizziness, vomiting, rapid heart rate, coma, sleepiness and death (Fredric and Michael, 2010).

Health conditions that can result from living close to a petrol station were highlighted in this study. A little below one third stated that breathing-in petroleum products by females can affect their menstrual cycle. This agrees with a study conducted in Uyo Nigeria by Christopher et al, (2013) where the prevalence of menstrual disorders among the exposed women was 37.2%. Breathing –in petroleum products or petrol by female may interfere with ovarian functions leading to disordered menstrual characteristics and female sex hormone profiles as well as future reproductive impairment. It is also revealed by about one third of the study participants that headache is never a health problem caused by exposure to petroleum product. The assertion made by Fredrick and Michael, (2010) that exposure to lower concentration

(700000-3000000ppb) of benzene can cause headache unconsciousness, tremor, confusion etc.

Conclusively, the knowledge score of the respondents was termed as fair with the mean knowledge score of 17.2 ± 7.6 .

5.3 Perception on health impacts of petrol stations

The most popular hazard attributed to petrol station is fire outbreak which predisposes the residents in the neighbourhood to a great risk. (Afolabi et al, 2011; Mshelia et-al). the finding of this results therefore shows the favourable perception of the respondents toward the statement that fire outbreak in petrol stations cannot spread to surrounding building where most (62.2%) of the respondents were not in support of the assertion. The escalation of fire could be so easy in petrol station since most of the fuels that are sold there are highly inflammable which are capable of given off vapours and when mixed appropriately with air can lead to a forceful fire explosion if a source of ignition is provided (Afolabi et al, 2011).

Some (35.4%) of the respondents opined that, petrol station is not a major source of environmental pollution in their community which is in contrary to the finding of a study carried out by Mshelia et al (2015) on environmental effects of petrol stations at close proximities to residential buildings in Maiduguri and Jere, Borno state, Nigeria. Mshelia et al (2015) revealed that, air pollution is the most pertinent environmental pollution which residents who live around petrol stations are exposed to as a result of the engines in use and movement of vehicles in and out of the facility to refueling and other maintenance services. Due to vulnerability, bad odour and air pollution, petrol stations have to be located far away from the dwelling places (Muritala, 2015).

Regarding traffic congestion, this study attempts to determine the perception of the residents if the traffic congestion which is occasionally caused by petrol station is not a major problem in their area. About a little below half (42.2%) of the respondents did not share their view regarding the earlier statement about traffic congestion. In a supportive motion, traffic congestion caused by petrol station was perceived as a severe danger at 40% based on the magnitude of danger variable by the residents in relation to the distance between the petrol stations and their residential houses (Mshelia et al, 2015). Traffic congestion is regarded as an environmental problem associated with petrol station due to loading and offloading of passengers and goods at petrol station located next to the road intersection and junction (Sangotola et al, 2015).

Nevertheless, many (58.9%) of the respondents did not confirm with the statement that siting petrol station close to residential houses cannot lead to any serious problem. To affirm this perception, Mshelia et al (2015) highlights various of health problems such as skin problem, sight problem general ailment with the most prevailing one, respiratory problem rates at 38.05% which affects some of the residents who live nearby petrol station and workers of the petrol station as a result of breathing in air which has been polluted by fuel.

Also, the finding of this study report 52.8% of the respondents who were of the belief that petrol or petroleum products can contaminate wells. This finding shows a good understanding of the possible vulnerability of underground water by petroleum products. The result is in congruence with that of a study conducted in Niger Delta Nigeria by Nigeria by Nriagu, et al (2016).

5.4 Assessment of compliance with government regulation on siting of petrol station

All (100%) of the petrol stations which are involved in this study were owned by independents marketers with just a little below half being sited in Ward 9. This finding is in contrast to that of a study conducted by Afolabi (2011) where petrol stations are owned by both conglomerates and independent private marketers. Since all the petrol stations are assessable all of them were observed. The findings of this study shows that mean plot size of these petrol stations as 1.37 ± 0.67 with many (59.6%) of the petrol station were located in just a plot of land. This finding has shown a wide range of deviation from minimum standard set by the government which is 1080meter square station in order to allow free flow of traffic.

In this study, a little below average of the petrol stations being observed were able to meet up the plot frontage width standard of 24.0m, while the mean plot frontage width obtained by is 23 ± 11.5 which still serves as an indication for non-compliance with government spatial requirement expected of a petrol station establishment. The mean distance of petrol stations frontage boundary setback to the road derived from this study is 0.5 ± 1.1 against the minimum standard (15.0 meters) of spatial requirement. This result is similar to that of the study conducted by Afolabi et al 2011 at Ile-Ife where majority 88.9% of the petrol stations had <30m setback from the road.

It was also shown from the finding of this study that 50.9%, a little above average of the petrol station studied did not satisfy the minimum standard of 7.0m of Oyo State government regulations on siting of petrol station. This finding is almost on the same pace with the result of Afolabi et al, (2011) at Ile-Ife which 52.0 represent the percentage of petrol stations that had <30m distance from residential area meanwhile, the hazard level of poorly sited petrol station within residential zone may lead to disaster at some point in time (Ahmed et al, 2014).

This study also discovered that very many of the petrol station in this study area did not have an evidence of town planning approval, building plan approved by the town planning authority and development approval or clearance. To probe further, the reasons for non-availability of town planning approval was investigated while more than average of the respondents choose not to disclose the reasons but others made it known that they did not meet up with the requirement. This might therefore be the major cause of an uncontrolled level of indiscriminate siting of petrol station within the community. In summary, the findings from this study could be attested by the assertion made by Ahmed et al, (2014) from the result of their study which was conducted at Minna, Niger State Nigeria that, most petrol stations owned by private owner/independent petroleum Marketers did not ensure adequate safety equipment and not comply with the laid down regulation regarding development of petrol station. Perhaps, the permitting requirements are just on paper or the regulating bodies are not cracking down on violators, Robbert et al, (n.d).

5.5 Assessment of safety practices that exist in petrol station

Almost all the fuels which are sold in a typical petrol station have the potential to toxicate the environment if they are been released and consequently bring about a grave health effects on humans if not properly handled therefore, safety of people and protection of the environment are of greater need at petrol station. (Afolabi et al 2011).

The findings of this study as regard availability of equipment and safety practices that exist in petrol stations show that majority of the petrol stations had ‘No smoking sign’ adequately displayed all over the stations. This is in accordance with the studies been carried out in Ile-Ife south Western Nigeria, and in Minna town Niger State on assess of safety practices in filling stations where display of ‘No Smoking sign’ was recognized in all (100%) of the filling station that were assessed (Afolabi et a,l 2011 ; Ahmad et al 2014)

This study also found out that 80% of the petrol stations did not have any sign illustrating 'switch off engine while refueling' but in a similar study, the finding on such safety practice contradicts the recent result where many (60%) of the filling stations made provision for switch off engine sign. (Ahmed et al 2014).

It was clearly shown that many of the petrol stations did not display any fire extinguisher however; reverse is the case in some other studies. Majority, (74% and 90%) of the petrol stations were said to have their fire extinguisher well displayed and adequate to dispenser ratio, (Afolabi et al 2014; Ahmed et al 2014). The most commonly known safety measure in petrol stations was functional fire extinguisher which obviously explains the reason why fire hazard has been reported as the most frequent hazard in the facility,(Ahmed et al,2014).

According to the finding of this work, the 'No use of phone sign' was absent in the majority (71.9%) of the petrol stations. Invariably, no tangible evidence from any literature that cell phones can ignite fire at a petrol station and the result of the finding is almost the same where 76% of the petrol stations were reported as use of phone by Ahmed et al (2014) and very few of the petrol station were also reported to have 'No use of phone sign' by Afolabi et al, 2011.

5.6 Implication of findings for Health Promotion and Education

The findings from this study have health promotion education implication therefore; health promotion and education strategies which involve a multiple intervention can be used to tackle some of the identified challenges. These could entail strategies such as public enlightenment, Advocacy and Policy formulation and implementation.

Public enlightenment campaign could create awareness and influence knowledge, perception and attitudes, and seeks for political will for action. This strategy could involve the use of posters, leaflets, chats, jingles, television, radio, magazine and billboards to reach a large number of people at a (Whitekar, Haileysus, Swahn and Saltzman, 2007). This strategy helps to increase people's awareness; knowledge and perception of the health impact associated with petrol station hence, discourage the act of indiscriminate siting of petrol station within the residential site while the residents too perceive themselves to be susceptible to the health impacts and the impact to be severe. Therefore, the involvement of both the regulatory bodies, community members and petrol station owner on the establishment of petrol station will foster an ideal manner to promote health.

Advocacy could be done through methods such as media advocacy and lobbying by the interest groups (e.g non-governmental organizations and civil groups). It is often entails use of other strategies such as communication, community organization, partnership e.t.c. These could be used to seek for healthy policies formulation and implementation to control the haphazard trend of petrol station establishment within the community. Also to change the status quo of negligence on the part of the regulatory bodies saddled with environment protection and siting and running of petrol station for periodical inspection and strictly penalize the erring operator in order to curb the ugly trend and promote public health.

Policy formulation and implementation regarding healthy and ideal manner of siting and maintaining petrol station should be unanimously made by various agencies and ministries that are directly or indirectly concerned about establishment of the facility. If these policies are strictly adhered with by both the petrol station owners and the residents thus, reduces the health risks associated with the station and the vulnerability of the risks.

Therefore, the combined use of two or more of the afore-mentioned health promotion and education strategies can positively affect the knowledge and perception of not even the residents alone but petrol station owners and attendants inclusive and to raise their critical consciousness on the comorbidity of physiological and psychological health effects due to chronic exposure to sustained environmental pollution by petroleum products from filling stations. Adopting this strategy implies that, the weakness of one strategy is catered for by the strength of the other ones if multi strategies are employed (Krumeich, Weijts, Reddy and Meijer-Weitz 2001; Lambert and Mckevitt, 2002

5.7 Conclusions

This study investigated knowledge and perception of the health impacts of petrol stations among adults residing near Petrol Stations in Atiba Local Government area, Oyo State, Nigeria. The findings of the study indicate that, overall, knowledge of the respondents on health impacts of petrol stations was fair and their perception was favourable. However, great gaps exist in the knowledge and perception of siting petrol filling station close to residential areas with almost one third, (33.8%) of the respondents reported that the benefits of siting petrol station close to houses outweighs the disadvantage and more than one third, 41.1% stating that siting petrol station close to residential houses cannot lead to any serious health problem. Though, this situation could be addressed through a well-designed public enlightenment programme, an important public health promotional education strategy that has potential for reaching a large number of people to create awareness and influence their knowledge and perception.

This study also revealed that, majority of the petrol filling stations within the study area have fallen short in meeting the minimum standard of the government concerning siting of the station and the issue of safety practices was belittled in most

of the stations. Advocacy and policy formulation and implementation could be appropriate to right the wrongs in this case.

The findings of this study suggest that, the indiscriminate petrol filling station development poses a great risk to the entire community and therefore necessitate the need for more concentration on healthy measures to reduce hazards in the community. The planners should look into likely hazards in planning and developing methods of mitigating shortcomings that might cause hazards, risk and vulnerability. Hence, the necessity for well-designed location and operation of petrol station with adequate supervision of DPR and the state ministry of planning and urban development to register and regulate the downstream petroleum sector including the petrol station business (Murtala, 2015).

5.8 Recommendations

The recommendations based on the findings of the study are as follows:

1. The general public should be enlightened on the dangers associated with indiscriminate siting of petrol stations in residential areas
2. The government, through its regulatory agencies should ensure absolute compliance with regulations and guidelines concerned with establishing petrol stations
3. There should be formulation of policies that will ensure that major and independent marketers of petroleum products support their host communities to prevent and/or tackle exposure and contamination by petroleum products

REFERENCES

- Abdel-Rahman, S.M. 2008. 'Environmental Impact Assessment of Pump noise', Twelfth international water technology conference, IWTC 12, mechanical and electrical research institute, national water research center, Egypt.
- Adeniyi E.A, 2006. Compendium of Economic, tourism and Natural Resources Potentials of Oyo State and its 33 Local Government Areas.94-95.
- Afolabi O.T, Olajide F.O and Omotayo S.K. 2011. Assessment of safety practices in filling station in Ile-ife, South Western Nigeria.*Journal of Community Medicine and Primary Health Care* 23(182):9-4.
- Ahmed S., AbdulRahman A.S, Kovo A.S, Ibrahim S., Okoro E.O. and Agbo A.A. 2014. 'Health, Risk and Safety of Petrol Stations in MinnaTown.Anoverview.Department of Mechanical Engineering FUT Minna, Niger State, Nigeria'.*World Appl. Sci J*, 32(4):655-660.
- Ambitunni,A. Amezaga,J. and Emeseh,E. 2014.Analysis of safety and environmental regulations downstream Petroleum Industry Operations in Nigeria; problem and prospects. *Elsevier journal of environmental development*, 43-60.
- American Heritage Dictionary, 2011.The American heritage dictionary of the English language,Fifthedition.Available at [http://www.hmhco.com/shop/books/theamerican-dictionary of the english language-fifth-edition](http://www.hmhco.com/shop/books/theamerican-dictionary%20of%20the%20english%20language-fifth-edition).
- Ayodele, S.J. 2011.Spatial distribution of Petroleum filling station in kaduna North. Retrieved on 5th March,2013 from [www.scrib.com/Samuel Ayodele 1](http://www.scrib.com/Samuel%20Ayodele%201).
- Afrifa C.G, Ofosu F.G., Bamfud S.A, Atiemo S.M., Aboh L.J.K, Gyampo O., Ahiamadjie H., Adeti J.P. and Arthur J.K. 2015. 'Health Risk Assessment of HeavyMetal Exposure from soil Dust at selected fuel Filling stations in Accra', Ghana.*International Journal of Science and Technology*, 4(7): 289-294.

Christopher E. E, koofreh D, Nyebuk D, 2013. 'Effects of Gasoline Inhalation on Menstrual characteristics and the Harmony profile of female Petrol Pump Workers', *Journal of Environmental protection*, University of Uyo, Uyo, Nigeria. 65-73.

Daniel I. Vieyra 1979 "Fill E r up": an Architectural History of America's Gas Stations New York: Macmillan Publishing co. ISBN 0-02-622000-8.

Department of the Environment Industry Profile 1996.Road Vehicle Fueling Service and repair garages and petrol stations.

Ehinlomen, C. and Adeleke, A., 2012. 'An Assessment of the distribution of petroleum products in Nigeria', *Journal of business management and economic*3 (6):232-241.

Eltayeb T, Nageeb A and Ali k, 2014: 'Blood lead level among fuel station Workers at khartoum City Sudan', *American Journal of Research Communications*. 2(6):74-82.

Festus, O.O, Dada, F.L, Iweka, F.K, Eyanfe, A.O, Osagie, R.N, Osagie, E.V, Akinyang, E.E, Fan-Osuala, C. 2013. 'Plasma Renal Functions Amongst 'petrol station' Attendants in Owerri, South-East, Nigeria', *International Journal of Community Research*.34-38.

Frederic L. and Michael B. 2010, a short primer on benzene, toluene, ethyl benzene and xylenes (BTEX) in the environment and in hydraulic fracturing fluids, Griffith university-smart water Research Centre.1-7.

Genovese,P. 2014, "Full-service Gas station" Inlurie Maxine N; mappen marc. *Encyclopedia of New Jersey*, Piscataway.New Jersey; Rutgers university press.

Golafshani,N.2003.'Understanding reliability and validity in qualitative research'.*The Qualitative Report*, 8(4):597-606.

Hanekm, 2001, Guidelines for the construction and upgrade of filling stations and Associated Tank Installations, Agricultural, Conservation, Environmental and

Land Affairs, Diamond Corner Building, 68 Eloff and Market street, Johannesburg. South Africa.1-7.

International Agency for Research on Cancer (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 100) [summary in Baan R et al. 2009].

A review of human carcinogens—Part F: Chemical agents and related occupations. *The Lancet Oncology*, 10(12):1143–1144.

Isabel M. Morales T, Marta D.M, Enrique G. F, Antonia B .C, Jonathan B. R 2010, assessing the impact of petrol stations on their immediate surroundings, University of Murcia, Spain, *Journal of Environmental Management*, 1-9.

Joseph O.A, 2014, ‘knowledge, Attitude and compliances with occupational Health and safety practices among pipeline products and marketing company (ppmc) staff in Lagos’, *Merit research Journals of Medicine and Medical Sciences*, 2(8):158-173.

Journal of Community Medicine and Primary Health care 2011. 23,(1&2)

Kasali A.A., Olusegun A, Femi P, Aliyu H and Adakole I, 2011. Petroleum Chemistry, National Open University, Nigeria. ISBN: 978-058-309-2

Krumeich, A.; Weijts, W.; Reddy, P. and Meijer-Weitz, A. 2001. ‘The benefit of anthropological approaches for Health promotion research and practice’. *Health Education research*, 16(2):121-130.

Laurelize P.R, Marta R Cezar-V, Marlise C.V, Clarice A. B, Mara S.S, Valdecir Z.C, 2014. ‘Use of Personal Protective Equipment by Gas Stations Workers’: A Nursing Contribution, *Text Context Nursing*, Florianopolis, 194-202.

Linnet MS, LIDG et al 1996. Clinical features of hematoperetic Malignances and Related Disorders among Benzene- exposed workers in China: *Environ Health persp.* 104:1159-1163.

Martal Regina Cezar-Vaz, Laurelize P.R, Clarice A.B, Mara R.S, Joana C.V and Leticia S.C 2012. Risk Perception and Occupational Accidents: A study of

- Gas Station Workers in southern Brazil, *International Journal of Environmental Research and Public Health*, 1-16. www.mdpi.com/journal/ijerph.
- METI. 2010. Report into future service stations
- Mshellia, A.M, John A. and Emmanuel D, 2015. Environmental effects of petrol stations at close proximities to Residential Buildings in Maiduguri and Jere, Borno state, Nigeria, *IOSR Journal of Humanities and Social Science (IOSR-JHSS)* 20 (4): 1-8.
- Ms. S.T, 2006. 'Risk Assessment of BTX vapor Exposure to Workers at Gasoline Service Station', kasetsart University, 1-21.
- Murtala M, UBA 2015. Location Analysis of Filling stations in Kano Metropolis, Nigeria, Department of Geography, Faculty of Science, Ahmadu Bello University, Zaria, Nigeria.1-27.
- National Population Commission of Nigeria (web).
- N.M El Mahdy, N.M Radwan, H.S. Kharoub and F. El-Halawany 2015.chromosomal Abnormalities among petrol station Workers Occupationally Exposed to Benzene, *British Journal of Applied Science and Technology*, bj(168):502-513.
- Ogundare, S.F 2008, Invitation to Research Methods in Education. Lagos: Pavlov Publisher.
- Oyo State Ministry of Physical Planning and Urban development, July, 2015. 'Reviewed spatial requirements for development of petrol filling stations in Oyostate'. A circular letter with referencenumber TP435/VOL 111/70
- Petroleum Enforcement Liaison Group, Aug 2009. Petrol Station and Guidance on managing the risk of Fire Explosion (The Read guide).17-19
- Post office with map of LGA NIPOST. Archived from the original on October 2009. Retrieved 2009-10-20.

- Richard G, 2012.choosing sustainability: A case study of service stations, Entrepreneurial Practice Review, Antioch University New England, keene, New Hampshire.46-63.
- Robert A.B, Abena O. and Louis D, Jr. A (n.d), AAssessing the impact of Fuel Filling stations on the Environment in Ghana, Ghana Technology University College Accra, Ghana.1-6.
- Sadiqua B and M.B. Rathna, 2012. Pulmonary Function Tests in petrol Filling Workers in Mysore city, karnataka, India, Original Article, 12-16.
<http://www.pps.org.pk/PJP/8-1/Sadiqua.pdf>
- Spencer,2004.“mobile phones as Fire Risks” (BBC News online)
<http://newsbbc.co.uk/i/hi/programmes/clinckonline/3986509.stm> Retrieved 2010-08-22.
- U.S. Department of Health and Human Services, ‘Theory at a Glance’ A Guide for Health Promotion Practice (2nd.Edition), National Institute of Health.pp10-14
- U.S. E PA, now epa.gov: National Institutes of Health www.nih.gov
- Whitaker, D.J.; Haileyesus, T.; Swahn, M. and Saltzman, L.S.2007.‘Differences in frequency of violence journal and report injury between relationships with reciprocal and nonreciprocal intimate partner violence’. *America journal of public health*, 97:941-947.
- W.H.O, 2010.Preventing Disease through Healthy Environments, Exposure to Benzen: A Major Public Health Concern.
- W.H.O,2013.Definition of key terms, consolidated ARV guidelines.www.who.int/hiv/pub/guidelines/arv2013/intro/keyterms/en/
- Yerevan A, 2008.Risk management outline to petrol Operations, Armenia Social Protection Systems Strengthening Project, USAID SO 3-4, USAID Armenia 111-C-00-06-00067-00.([nycosh.org/-/Hierarchy-of-Hazards....](http://nycosh.org/-/Hierarchy-of-Hazards...))
(<https://en.m.wikipedia.org/wiki/personal-protective-equipment>)

APPENDIX I
QUESTIONNAIRE

KNOWLEDGE AND PERCEPTION OF THE HEALTH IMPACTS OF PETROL STATIONS AMONG ADULTS RESIDING NEAR PETROL STATIONS IN ATIBA LOCAL GOVERNMENT AREA, OYO STATE, NIGERIA.

Dear Respondent,

I am a post graduate student of the Department of Health Promotion and Education, University of Ibadan, Oyo State. I am carrying out a study on knowledge and perception on health Impact of petrol station among adult residents in Atiba Local Government Area of Oyo State on which the instrument is designed to collect relevant information.

I humbly request you to please spare me some minutes of your precious time to respond to this questionnaire to the best of your knowledge. Kindly note that, data collected from you will be purposely used for this research work and will be kept confidential as none of your identifiers will be required since this exercise is not examination or a test. Hence, your responses or views cannot be traced to you.

However, your consent to participate and to sincerely supply correct information will be appreciated. You are free to ask questions about the study in the course of responding to the questions. Mind you, participation in this study is absolutely voluntary.

Thank you for your cooperation.

Yours faithfully,
Adebayo, AdekunleGafar

For Office Use Only

Date of interview
Serial Number
Interviewer's Name

SECTION A: Socio-demographic Variables

Instruction: Please tick (√) the appropriate response(s) to the questions in this section. In some cases, however, simply supply the needed information in the blank space(s) provided.

1. **Ward:**
2. **Area/Community:** (2b) **Nearest P.S. Code**
3. **Age at last birthday (in years):**
4. **Sex/Gender:** (1) Male (2) Female
5. **Highest Level of Education:** (1) Arabic/Islamic (2) Primary
(3) Secondary (4) NCE (5) Polytechnic (OND)
(6) Polytechnic (HND) First Degree (8) Postgraduate education (Masters)
and above (9) Others (specify).....
6. **Marital Status:** (1) Single (2) Married (3) Separated
(4) Divorced Widowed Others (specify)
7. **Ethnicity:** (1) Yoruba (2) Hausa (3) Igbo (4) Others
(specify).....
8. **Religion:** (1) Islam (2) Christianity (3) Traditional
(4) Others (specify).....
9. **Occupation:** (1) Farming (2) Petty trading
(3) Business/Contractor (4) Full time housewife (5a) Civil
Service (5b) If you are a civil servant, kindly specify your job (6)
Others (specify)

SECTION B: Knowledge on Health impacts of Petrol Station

10. Have you ever heard that some chemicals presents in petrol can cause one disease or the other for people who live around petrol stations? Tick (√) either (1) Yes
No
11. If yes, to question 10 above name **two** diseases which petrol/petroleum products can cause in the spaces provided. i..... ii.....

12 Table 1 contains a list of chemicals for each indicate by ticking (Yes) if you have ever heard of it or (No) if you have never heard about it

Table 1

B	Chemicals/Substances ever heard	Ever heard(√)	
		Yes	No
12.1	Toluene		
12.2	Ethyl-benzene		
12.3	Xylene		
12.4	Benzene		

13. Petroleum products/petrol is not harmful to peoples' health.

1. True 2. False 3. n't know

14 Table 2 contains a list of health conditions/diseases that can be caused by noise generated in petrol station. For each tick (√) "True if it can be caused by noise generated in petrol stations or tick (√) "False if it cannot be caused by noise generated in petrol stations. If you are not sure tick (√) "don't know.

Table 2

	Health conditions/diseases	Tick(√)		
		True	False	Don't know
14.1	Cancer			
14.2	Sleep disturbance			
14.3	Increased blood pressure			
14.4	Diabetes			
14.5	Stress			
14.6	Anxiety			
14.7	Glaucoma			

15. The table 3 contains a list of some chemicals which can be found in petroleum products, for each tick (✓) if it is harmful or if it is not harmful to health. If you are not sure, Tick (✓) don't know.

Table 3

	Chemicals/ Substances in petroleum products	Tick (✓) whether harmful to health or not		
		Harmful to health	Not harmful to health	Don't know
15.1	Rennin			
15.2	Benzene			
15.3	Sodium			
15.4	Toluene			
15.5	Alkaloid			
15.6	Ethyl-benzene			
15.7	Hydrochloric acid			
s15.8	Xylene			

16. Table 4 contains a list of health conditions/diseases that can be caused by drinking water which is contaminated with petrol or petroleum products. For each, tick (✓) "True" if it can be caused by petrol or petroleum products. Tick "False" if it cannot be caused by petroleum products. If you are not sure, tick (✓) "don't know".

Table 4

	Health Conditions/diseases	Tick(✓)		
		True	False	Don't know
16.1	Glaucoma			
16.2	Leukemia (cancer of the blood)			
16.3	Kidney problem			
16.4	Pneumonia			

16.5	Liver problem			
16.6	Epilepsy			
16.7	Irritation of the stomach			
16.8	Typhoid			
16.9	Vomiting			
16.10	Reduced blood clotting			
16.11	Malaria			
16.12	High blood pressure			

17. Petrol station can create some health related problems to people who live near them. 1. True 2. False 3. Don't know

18. Headache is never a health problem caused by exposure to any of the petroleum products. 1. True 2. False 3. Don't know

19. People who live around petrol stations can suffer from mental stress.

1. True 2. False 3. Don't know

20. Noise generated from some petrol station can lead to hearing problem.

1. True 2. False 3. Don't know

21. Breathing-in petroleum products/ petrol by females can affect their menstruation.

1. True 2. False 3. Don't know

SECTION C: Perception on Health impacts of Petrol Stations

Instruction: Table 5 contains statements which reflect some peoples' perception or view concerning petrol station and petroleum products/petrol. For each tick (✓)whether you “agree” with it orwhether you “disagree” with it. If you are not certain about your opinion tick (✓)“Undecided”.

Table 5

S/N	Perception related statements	Tick (✓) one response for each		
		Agree	Undecided	Disagree
22.1	Fire outbreak in a petrol station cannot spread to residential building around it.			
22.2	Benefits of siting petrol station close to people houses outweigh the disadvantages.			
22.3	Petrol station is not a major source of environmental pollution in our community.			
22.4	Siting Petrol station close to peoples' houses cannot lead to the occurrence of any serious health problem.			
22.5	People who live around petrol stations are exposed to any health problem.			
22.6	The noises from petrol stations prevent residents around them from sleeping well.			
22.7	Petrol or petroleum products cannot contaminate wells sited close to or near			

	them.			
22.8	The traffic congestion occasionally caused by petrol stations is not a major problem in the areas where they are sited.			
22.9	Petrol station should not be built close to people's houses/residence area because it can attract criminal activities.			
22.10	Petrol station should not be sited close to residential houses because noise from it can cause stress.			

UNIVERSITY OF IBADAN LIBRARY

APPENDIX II

SECTION D: Observational Checklist on compliance with government regulation on siting of Petrol Station

Instruction: Please tick (✓) the appropriate box to indicate your answer(s). In some cases, however, simply measure and record your measurement in meters.

PART ONE

- 1. Ward
- 2. Area/Community..... 3. P.S Code.....
- 4. Type of ownership: (1) conglomerate
(2) Independent Private Marketer

PART TWO

- 5 Plot size of the petrol station:
- 6. Plot frontage width:
- 7. Frontage boundary setback to the road:
- 8. Radius of Kerbline:
- 9. Setback to nearest dwelling house:
- 10. Setback of pump to the center of the road:
- 11. Drive way in/Exit:
- 12. Setback of the Petrol Station to the center of adjoining road:
- 13. Location in relation to Vertical or Horizontal Bend:
 - (13a) Vertical Higher(1) Yes (2) No
 - (13b) Vertical Sloppy gradient (1) Yes (2) No
- 14. (14a) Evidence of town planning approval (1) Yes (2) No
 - (14b) If No, why?
 - (14c) If yes, how long did it take you to obtain it?
 - (14d) Nature of evidence.....
- 15. (15a) Availability of development approval/clearance

- (1) Yes (2
- (15b) If No, why?
- (15c) if yes, how long did it take you to obtain it?
16. Distance of Petrol Station from nearest public facility e.g, school, hospital, theaters, clinics and other semi-public building.....
17. Distance of petrol station to the nearest residential house.....

UNIVERSITY OF IBADAN LIBRARY

7	<u>Vehicle Control Measure</u>		
	1. Traffic warning and signs		
	2. One way system for entering and exiting the forecourt		
	3. Enough packing area away from pumps		
8	<u>Violence to Staff Control Measure</u>		
	1. Close circuit television		
	2. Panic alarm		
9	Compressed air system control measure		
10	Environmental impact annual report (EIAR) for the year 2015		

APPENDIX IV

AKOSILE AWON IBEERE

IMO ATI ERO AWON AGBALAGBA TI WON N GBE NI AYIKA ILE EPO NI AGBEGBE IJOBA IBILE ATIBA, IPINLE OYO, NIGERIA, LORI IPA TI AWON ILE EPO NKO LORI ILERA

Oludahun mi owon,

Moje omo akeko gboye ni agboni iko eko ati mimu agbega ba ilera, ile eko giga fasiti ti Ibadan, ipinle oyo. Mo n se iwadi lori imo ati ero awon agbalagba olugbe ni agbegbe ijoba ibile Atiba ti ipinle Oyo lori ipa ti awon ile epo nko lori ilera, eleyi ti asi ti seto iwe ibeere lati figba iwifun tio wulo/jemo ise yi.

Mofi toyaya-toyaya toro iseju perete ninu asiko yin lati bami dahun awon akosile ibeere yi pelu bi imo yin base to lori won.

Ki e lo mo daju wipe, awon esi yin ni won yio je lilo fun ise iwadi yi nikan, ti ao si tun se won lojowo, leyi ti nkan-kkan ninu awon esi yin ko sile se topa moyin, niwon ba igba ti o kin se idanwo, leyi ti kosi nilo idanimu yin Kankan.

Labe bi o ti wu kori, ma mo riri gbigba lati kopa ati lati fi otito inu so iwifun tio je ododo. Aaye gbayin lati se awon ibeere lasiko ti e ba n fesi si awon akosile ibeere.

Ki e si tun lo mo daju wipe kikopa ninu ise iwadi yi je atinuwa.

Ese fun ifowosowopo yin.

Emini tiyin tooto,

ADEBAYO, Adekunle Gafar

Fun lilo oofisi nikan

Deeti/ijo iforowani lenu wo.....

Nomba

Oruko oluforowani lenu wo.....

IPIN A: Awon iwifun imo nipa ara eni

Ilaana: Dakun se amin (✓) awon idahun ti o ye awon ibeere ni ipin yi. Sugbon o, ni awon aaye miran, sati fesi ti o baye si awon aaye/alafo ti ati pese sile.

1. **Woodu:**
2. **Adugbo/Agbegbe:**
3. **Ojo ori yin ni ojo ibi yin tio koja (ni odun):**
4. **Imo jije ako tabi abo:** (1) Ako(2) o
5. **Ipele eko yin tio gaju:** (1) Kewu kewe (2) Alakobere (3) Girama
(4) Eko olukoni agba(5) le akoko gbogbo nise (OND)
(6) Ipele giga gbogbo nise (HND) (7) ko gboye akoko
(8) Ikeko gboye eekeji ati jubeelo (9) Awonmiran (seladayanri).....
6. **Ipo igbeyawo:**(1) Mi o ti se igbeyawo (2) o ti se igbeyawo (3)
A wa lotooto(4) A ara wa (5) O mi
(6) Awon miran (Se ladayanri)
7. **Eya:** (1) Yoruba(2) ausa (3) Igl
(4)Awon miran (Se adayanri).....
8. **Esin:**(1) Imole(2) agbo (3) A aye
(4) Awon miran (Se ladayanri).....
9. **Ise nse:** (1) Agbe(2) ra-kata (3) owo/agbasese
(4) Iyawo ile (5a) Ise ijoba
(5b) Ti e baje osise ijoba, ejowo e se adayanri ise yin
- (6) Awon miran (Se ladayanri)

IPIN B: Imo lori awon ipa ti ile-epo nko lori ilera

10. Nje eti gbori wipe awon eroja inu epo petiro le fa arun kan tabi omiran fun awon ti won ngbe ni agbegbe awon ile epo? Sami (✓) boya beeni tabi beeko

(1) Beeni (2) Beeko

11. To baje beeni, si ibeere kewa, e daruko awon aarun **meji** ti epo petiro/awon eda epo robi le fa sinu aaye ti a ti pese sile.i. ii.

12 Tabili keni ko akosile awon kemika (eroja) sinu, fun ikookan sami (beeni) tio ba je wipe e ti gbori tabi (beeko) ti o baje wipe e o ti gbo nipa re ri.

Tabili keni

S/N	Kemika/awon eroja tia gbori	Mogbo ri (√)	
		Beeni	Beeko
12.1	Toluini (Toluene)		
12.2	Etiben sin-ni (Ethyl-benzene)		
12.3	Sailin-ni (Xylene)		
12.4	Bensini (Benzene)		

13. Awon eda epo robi/ epo petiro o lewu si ilera awon eniyan.

1. Beeni 2. Beeko 3. Mio mon

14 Tabili keji ko akosile awon ailera/ arun ti won le jeyo latari ariwo tin waye lati ile-epo sinu. Fun ikookan sami (√) si “Otito” tio baje wipe ole jeyo latari ariwo to n waye lati awon ileepo tabi ki e sami (√) si “Iro” tio baje wipe kole jeyo latari ariwo to n waye lati awon ileepo. Ti ko bawa dayin loju ki e sami (√) si “Mi o mo.

Tabili keji

S/N	Ipa lori ilera	Sami(√)		
		Otito	Iro	Mi o mo
14.1	Jejere			
14.2	Idilowo orun			
14.3	Alekun eje ruru			
14.4	Ito suga			
14.5	Idaamu			
14.6	Iberugbojo			
14.7	Aisan oju			

15. Tabili keta ko akosile awon kemika/eroja kan ti ale ri ninu awon eda eporobi sinu. Fun ikokan sami (✓) si ti o ba lewu tabi ti koba lewu fun ilera. Ti koba dayin loju, e sami (✓) si mi o mo.

Tabili keta

S/N	Awon kemika/eroja inu awon eda eporobi	Sami (✓) boya o lewu si ilera tabi rara		
		O lewu si ilera	Ko lewu si ilera	Mi o mo
15.1	Renin-ni (Rennin)			
15.2	Bensin-ni (Benzene)			
15.3	Sodiumu (Sodium)			
15.4	Toluin-ni (Toluene)			
15.5	Akaloidi (Alkaloid)			
15.6	Etibensin-ni (Ethyl-benzene)			
15.7	Aidirokiloriki asidi (Hydrochloric acid)			
15.8	Sailin-ni (Xylene)			

16. Tabili kerin ko akosile awon Ailera/aarun ti mumu omi ti epo petiro tabi awon eda eporobi bati baje sinu, fun ikookan sami (✓) “ Otito” tio baje wipe kole sele latari mumu omi ti epo petiro tabi awon eda epo robi bati baje tabi ki e sami (✓) si “mi o mo.

Tabili kerin

S/N	Ailera/arun	Sami (✓)		
		Otito	Iro	Mio mon
16.1	Aarun oju			
16.2	Jejere inu eje			
16.3	Aisan kidinrin			

16.4	Otutu aya			
16.5	Aisan edo			
16.6	Warapa			
16.7	Ikorira ba inu ikun			
16.8	Iba ponju-ponto			
16.9	Eebi			
16.10	Sise adinku ba idaje			
16.11	Iba			
16.12	Eje ruru/ifupa giga			

17. Ileepo ma nse okunfa awon isoro fun ilera awon ti won ngbe ni tosi won.

1. Otito Iro 3. Mi o mo

18. Ori fifo o le lailai je Aisan ti nkan-kan ninu awon eda epo robi le sokunfa fun eni ti won ba siju si.

1. Otito Iro Mi o mo

19. Awon ti won n gbe ni agbegbe ile epo le ma koju idaamu ninu opolo.

1. Otito 2. Iro Mi o mo

20. Ariwo ti on wa lati ileepo le se okunfa aisan fun igboran.

1. Otito 2. Iro Mi o mo

21. Mimi epo petiro/awon eda epo robi sinu fun awon obinrin le sakoba fun nkan osu won.

1. Otito 2. Iro Mi o mo

IPIN C: Ero lori awon ipa ti ileepo nko lori ilera

Ilaa: Tabili karun kun fun awon gbolohun ti won nise pelu ero awon eeyan nipa ileepo, awon eda epo robi/epo petiro. Fun ikookan, e sami (√) boya “e fara mo” tabi “e o fara mo”. Ti ero yin o bawa dayin loju ki e sami (√) “wipe e nipinu”.

Tabili karun

S/N	Awon gbolohun ti o jemo ero	E Sami (√) Si idahun kan fun ikookan		
		Mo fara mo	Mi o nipinu	Mi o fara mo
22.1	Ijanba ina ni ileepo ko le ran de ilegbe ti o bawa ni agbegbe re.			
22.2	Awon anfaani kiko ileepo sunmo ilegbe awon eeyan tewon ju aleebu re lo.			
22.3	Ileepo o kinse ipele kan gboogi fun ibaje ayika ni agbegbe wa.			
22.4	Kiko ileepo sun mon ilegbe awon eniyan kole sokunfa isele Kankan to lewu fun ilera.			
22.5	Awon eniyan ti won n gbe ni agbegbe ile epo ma n koju eyikeyi isoro ailera.			
22.6	Awon ariwo ti won wa lati ileepo n kodina ki awon olugbe ni agbegbe won lati le rorun sun daada.			

22.7	Epo petiro/awon eda epo robi o le ba kanga ti a gbe si agbegbe tabi sunmo won je.			
22.8	Lilolu irina oko lekookan ti awon ileepo ma nse okunfa o ki n se isoro kan gbogi ni awon agbegbe ti a kowon si.			
22.9	Ko ye ki a ko ile epo sunmo ile awon eeyan/agbegbe ilegbe nitoripe o le se okunfa iwa odaran.			
22.10	Ao gbodo ko ile epo sunmo ilegbe nitoripe ariwo lati ibe le fa ai si ifokan bale.			

APPENDIX V

Scoring of knowledge of the Health impacts of petrol stations

Knowledge of the Health impacts of Petrol Station			
s/n	Variables	Correct/desirable response	Score
10	Have you ever heard that some chemicals presents in petrol station can cause one disease or the other for people who live around them?	Yes	1
11	If yes, to question 10 above name two diseases which petrol/petroleum products can cause in the spaces provided.	Stomach problem, liver problem. Respiratory problem, skin irritation mental stress, vomiting, reduced blood clotting, skin cancer, blood cancer, eye irritation, kidney problem. Headache, menstrual disorder, chromosomal abnormality(ANY TWO)	2
Total Score			3
Knowledge of chemical constituents of petroleum products			
12.1	Toluene	Yes	1
12.2	Ethyl-benzene	Yes	1
12.3	Xylene	Yes	1
12.5	Benzene	Yes	1
13	Petroleum products/ petrol is not harmful to peoples' health	False	1
Total Score			5

Knowledge of health condition caused by noise generated in petrol station			
14.1	Cancer	False	1
14.2	Sleep disturbance	True	1
14.3	Increased blood pressure	True	1
14.4	Diabetes	False	1
14.5	Stress	True	1
14.6	Anxiety	True	1
14.7	Glaucoma	False	1
Total score			7
Knowledge on harmful chemicals of petroleum products			
15.1	Rennin	Not harmful	1
15.2	Benzene	Harmful	1
15.3	Sodium	Not harmful	1
15.4	Toluene	Harmful	1
15.5	Alkaloid	Not harmful	1
15.6	Ethyl-benzene	Harmful	1
15.7	Sulphur	Not harmful	1
15.8	Xylene	Harmful	1
Total Score			8
Health conditions caused by drinking water which is contaminated with petrol/petroleum products			
16.1	Glaucoma	False	1
16.2	Leukemia (cancer of the blood)	True	1
16.3	Kidney problem	True	1
16.4	Pneumonia	False	1
16.5	Liver problem	True	1
16.6	Epilepsy	False	1

16.7	Irritation of the stomach	True	1
16.8	Typhoid	False	1
16.9	Vomiting	True	1
16.10	Reduced blood clothing	True	1
16.11	Malaria	False	1
16.12	High blood pressure	True	1
Total score			12
Knowledge on Some Health problems of petrol station			
17	Petrol station can create health related problems to people who live near them.	True	1
18	Headache is never a health problem caused by exposure to any of the petroleum products.	False	1
19	People who live around petrol stations suffer from mental stress	True	1
20	Noise generated from petrol station can lead to hearing problem	True	1
21	Breathing-in petroleum products/ petrol by females can affect their menstruation.	True	1
Total score			5
Total knowledge score = 40			

40-point scale

Categories of Knowledgescore :

Poor knowledge = 0-12

Fair knowledge = 13-26

Good knowledge = 27-40

APPENDIX VI

Scoring of perception scale

Perception on Health Impacts of Petrol Stations			
s/n	Variables	correct/favourable response	Score
22.1	Fire outbreak in a petrol station cannot spread to residential building around it	Disagree	1
22.2	Benefits of siting petrol station close to people houses outweigh the disadvantages.	Disagree	1
22.3	Petrol station is not major source of environmental pollution in our community	Disagree	1
22.4	Siting petrol stations close to peoples' houses cannot lead to the occurrence of any serious health problem	Disagree	1
22.5	People who live around petrol stations are exposed to any health problem	Disagree	1
22.6	The noises from petrol stations prevent residents around them from sleeping well	Agree	1
22.7	Petrol or petroleum products cannot contaminate wells sited close to or near them	Agree	1
22.8	The traffic congestion	Disagree	1

	occasionally caused by petrol stations is not major problem in the areas where they are sited		
22.9	Petrol station should not be built close to people's houses/residence are because it can attract criminal activities	Agree	1
22.10	Petrol station should not be sited close to residential houses because noise from it can cause stress	Agree	1
Total Score			10
Perception Score			10

10-point scale

Categories of Perception Score

Favourable = 5-10 (i.e. ≥ 5)

Unfavourable = < 5points

APPENDIXVII

Existing and functioning petrol stations in AtibaLocal Government Area,Oyo State, Nigeria

Ward	No of Ps/Ward	Name of petrol station	Assigned code
TWO	1	Oni's Global Concept Ltd. Sakutu-Sabo Oyo	01
	2	Mosfala (Nig)Ltd Sakutu-Sabo	02
	3	Mosfala (Nig)Ltd OkeOlola /Iyalamu	03
	4	Bada Oil OkeOlola	04
FOUR	1	Retas Golden Concept Ltd Idi-Ape	05
	2	Virgo Services Nig. Ltd Idi Ape/Baago	06
	3	AbataGlobal Enterprises Ltd.Adikuta	07
	4	Energy Master, Adikuta	08
FIVE	1	MusalatIntegrated Resources Nig Ltd. Idi-Ose, Agunpopo.	09
	2	UsmanMultiple Options Limited Oke-Olola,Oyagbe Junction	10
	3	OyeolorunPetroleum Investment Ltd OkeOlola	11
	4	AssestsOil \$ Gas, Balelayo, Agunpopo	12
SIX	1	Abebi Oil & Gas, Balelayo, Agunpopo	13
	2	AdemuphyAdikuta	14
	3	Oni's Global Concept Ltd Alara, Agunpopo Junction	15
	4	MolabInternational Invest. Ltd Agunpopo Market	16
SEVEN	1	AzeezAyinla petroleum Nig.Limited,Ajgunle	17
	2	Gold City Oil Limited oke-eboOpp. Survey School	18
	3	MusalatIntegrated Resources Nig. LimitedOke-	19

		ebo	
	4	AjibatPetrol Station Esinele, Baa-samu	20
EIGHT	1	AjigaFilling Station Olooro	21
	2	YunsolPetrol Station Oroki	22
	3	MolabInternational Investment Ltd Ventures Oke-oroki	23
	4	MurtakoFilling Station Oke-oroki	24
	5	3 TFilling Station Sakutu-ogbegbe	25
	6	AjigaFilling Station Sakutu-ogbegbe	26
	7	AdetesGlobal Ventures limited	27
	8	AdelabGlobal Concept EacoedRd.Oroki	28
NINE	1	Olafat Unique Concept Ebu Area	29
	2	LateefTemitopekoso Junction	30
	3	AYBAM Oil & Gas Isunwin, Koso Sabo Rd.	31
	4	SnodatPetroleum Isunwin, koso, Sabo,Oyo	32
	5	The Dominion Intercontinental Ltd. Koso, Sabo, Oyo	33
	6	AzesefIntegrated Service Ltd. KosoArea,Oyo	34
	7	OyeConcept Oil & Gas Nig. Ltd Alaselagarage	35
	8	I.K Elesh Nig. Ltd. Alasela garage, Sabo,Oyo	36
	9	MufutauFadeyioil&gas Sabo area,Oyo	37
	10	K.O Ebe Unique Oil&GasCo. Ltd. Sabo Area	38
	11	SkollyGlobal Invest Elegbo Area, Sabo, Oyo	39
	12	AssestsOil&GasElegbo Area, Sabo, Oyo	40
	13	Assets Oil&GasOlokun-esin, Sabo Oyo	41
	14	OyeolorunPetroleum Investment Erele, Sabo Oyo.	42
	15	AjetunmobiChemical & Petroleum,Otefon Rd.Sabo Oyo	43

16	AjetunmobiChemical&Petroleum, Eleke Road, Sabo	44
17	BY.Yusun Investment Sabo	45
18	ArskolPetroleum Sabo	46
19	Ani'sGlobal Investment Sabo	47
20	OlaremiPrime Int Ltd Sabo	48
21	AlmisrojGlobal Service Limited Sabo	49
22	AjetunmobiChemical&PetroleumCo.Ltd. Iyalamu, Sabo	50
23	LateefTemitopeSakutu-Sabo	51
24	Shaba Petroleum Invest. Okemogi area	52
25	AkYunus Global Nig ltd. Nigeria sabo	53
26	UsmanMultiple Option Kokoogi,Ashipa, Oyo	54
27	KazolaIdeal Concept Nig.Ltd.Mojuwa Area Sabo	55
28	SulrabOil&Gas Co Ltd Eleke Rd. Sabo	56
29	A Opeyemi Unique Concept Ltd Eleke Rd, Sabo Oyo	57
30	Fresh Sn. Jebe Oil And Gas Global Ltd.Alasela Garage Sabo	58

APPENDIX VIII

Informed consent form for respondents

Title of the Research: knowledge and perception of the health impacts of petrol stations among adults residing near petrol stations in Atiba Local Government Area, Oyo state, Nigeria

Name and Affiliation(s) of Researcher(s) of Application(s): This study is being conducted by ADEBAYO, Adekunle Gafar, Department of Health Promotion and Education, Faculty of Public Health, University of Ibadan.

Purpose(s) of Research: To investigate knowledge and perception of the health impacts of petrol stations among adults residing near petrol stations in Atiba Local Government Area, Oyo state, Nigeria. Participant will be required to give correct information that was required by the questionnaire.

Procedure of the research, what shall be required of each participant and approximate total number of participants that will be involved in the research: Three hundreds and ninety-nine adults who reside around petrol stations in the study site would be randomly selected to complete the interviewer administered questionnaire. Participants would be required to give correct information that was required by the questionnaire. Also, all existing and functioning petrol stations within the study site would be studied.

Expected duration of Research and of Participant(s)' involvement: You are expected to be involved in this research only for the period administration of this instrument which may just last for about 10 minutes. You will be required to give correct information during the course of the interview of which will just be once and for all.

Risk(s): You will be exposed to no risk whatsoever during your participation in this research.

Cost(s) to the participant(s), if any, of joining the research: Your participation in this study will not cost you anything. It will only take you about 10minutes only.

Benefit(s): The findings from this study would help to design and enforce healthy and safety policies to mitigate the health impacts of petrol stations.

Confidentiality: All information collected in this study will be given code numbers and no name will be recorded. This cannot be linked to you in anyway and your name or any identifier will not be used in any publication or reports from this study.

Voluntariness: Your participation in this research is entirely voluntary.

Due Inducement (s): You will not be paid any fees for participating in this research.

Modality of providing treatment(s) and action(s) to be taken in case of injury or adverse event(s): No injury or adverse events whatsoever are envisaged in this study

What happens to research participants and communities when the research is over: The outcome of this study will be made available to the community which serves as the study site through the principal investigator. There will be proper briefing about the benefit(s) of the research.

Statement of Person obtaining Informed Consent: I have fully explained this research to _____ and I have given sufficient information including about risk(s) and benefit(s), to make an informed decision.

DATE: _____ SIGNATURE: _____

NAME: _____

Statement of Person giving Consent: I have read the description of the research. I understand that my participation is voluntary. I have enough information about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form and additional information sheet to keep for myself.

DATE: _____ SIGNATURE: _____

S/N: _____

Detailed Contact Information including, Contact address, Telephone, Tax, E-mail and any other information of Researcher(s), Institutional HREC ad Head of the Institution.

If you have any question about your participation in this research, you can contact the principal investigator, Name: ADEBAYO Adekunle Gafar, Department of Health promotion and education, Faculty of Public Health, University of Ibadan, Phone: 08137973031 and E-mail: adeadegafar@gmail.com.

APPENDIX IX



Picture of the researcher collecting data in the petrol station

APPENDIX X

TELEGRAMS.....

TELEPHONE.....



UNIV

MINISTRY OF HEALTH
DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION
PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA

Your Ref. No.

All communications should be addressed to
the Honorable Commissioner quoting

Our Ref. No. AD 13/ 479/ 255

1st November, 2016

The Principal Investigator,
Department of Health Promotion and Education,
Faculty of Public Health,
University of Ibadan,
Ibadan,
Nigeria.

Attention: Adebayo Adekunle

**ETHICAL APPROVAL FOR THE IMPLEMENTATION
OF YOUR RESEARCH PROPOSAL IN OYO STATE**

This is to acknowledge that your Research Proposal titled: "Knowledge and Perception on Health Impacts of Petrol Stations among Adult Residents in Atiba Local Government Area of Oyo State." has been reviewed by the Oyo State Ethical Review Committee.

2. The committee has noted your compliance. In the light of this, I am pleased to convey to you the full approval by the committee for the implementation of the Research Proposal in Oyo State, Nigeria.

3. Please note that the National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, in line with this, the Committee will monitor closely and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of findings as this will help in policy making in the health sector.

4. Wishing you all the best.

Dr. Adebayo Gbolahan
Director, Planning, Research & Statistics
Secretary, Oyo State Research Ethical Review Committee

UNIV