APPRAISAL OF THE COMPLIANCE LEVEL TO ENVIRONMENTAL MANAGEMENT PLAN BY FILLING STATIONS IN KADUNA METROPOLIS, NIGERIA

BY

Amina Muhammad YUNUSA
MSC/SCIEN/ P13SCGS8234

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA-NIGERIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN ENVIRONMENTAL MANAGEMENT

DEPARTMENT OF GEOGRAPHY
FACULTY OF PHYSICAL SCIENCE
AHMADU BELLO UNIVERSITY
ZARIA

APRIL, 2017

DECLARATION

I declare that the work in this Thesis entitled "appraisal of the compliance level to environmental management plan by filling stations in Kaduna metropolis, Nigeria" is a record of my own research work under the supervision of Prof. A.B. Nabegu and Dr. R.O. Yusuf. The information derived from the literatures has been duly acknowledged in the text and a list of references provided. No part of this work has been submitted for the award of degree in any other University.

Amina Muhammad YUNUSA _____ Signature _____ Date

CERTIFICATION

This thesis entitled "appraisal of the compliance level to environmental management plan by filling stations in Kaduna metropolis, Nigeria" by Amina Muhammad YUNUSA, meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

Chairman, Supervisory Committee _____ _____

Prof. A.B. Nabegu Signature Date

Member, Supervisory Committee _____ _____

DR R.O. Yusuf Signature Date

Head of Department _____ _____

Dr. A.K. Usman Signature Date

Dean School of Postgraduate Studies _____ _____

Prof. K. Bala Signature Date

DEDICATION

This research work is dedicated to Almighty Allah; the eternal besought of all, for given me the strength, knowledge and understanding throughout the completion of this programme. I also dedicate this work to my parent Alhaji Yunusa Muhammad and Hajiya Amina Muhammad whom have been praying for its success.

ACKNOWLEDGEMENT

A work of this nature can hardly be completed without the contributions of people who knowingly or unknowingly helped in making the work a success. First and foremost, I am indebted to Almighty Allah, who has been faithful to me in all areas of my endeavor. I thank you Almighty Allah for the strength to go through the rigors of this work.

Words cannot express my appreciations to Prof. A.B Nabegu and Dr R.O. Yusuf for their support and time used to go through the work in detail at any given time and suggesting all necessary corrections to ensure that this work became a successful one. May Almighty Allah bless them and grant their heart desire. Once again, I say thank you.

My deep appreciation to academic and non-academic staff of Department of Geography, Ahmadu Bello University Zaria, for their assistance at various times and ways. I wish to thank Prof. M. Mamman, Prof. E.O. Iguisi, Dr. I.J. Musa, Dr. J.O. Adefila, Dr. R.O. Yusuf, Dr. Y.Y. Obadaki, Dr. B.A. Akpu, Dr. A.K. Usman, Dr. A. Jibrin, Dr. Abas, Mal. S.M. Zubairu, Dr. M. Isma'il and Late Malam Lawal for their immense encouragement and constructive criticism at different points during this research work. I remain internally gratefull. My deep appreciation also extend to my internal Examiners Dr. Hajiya Binta Abdulkarim and Dr. A. Jibrin.

I appreciate the contributions of the head of operations of Department of Petroleum Resources Alh. M.Z. Tambuwal, general manager Kaduna Environmental Petroleum Authority Dr Abdullahi Rigasa, Deputy Controller Federal Fire Service North West Zone Mr. Obisesan. B. Olatunde, a sincere gratitude to the EIA consultant, Mal Nuraddeen Abdullahi. I'm also grateful to Mal Muhammad Isa Kudu, Kaduna Polytechnic.

I am deeply indebted to my beloved parent, Alhaji Yunusa Muhammad and Hajiya Amina Muhammad for their inspiration, moral and financial support during this research work. May Allah reward them abundantly and make Aljannatul-Firdaus their final abode. It's a pleasure to acknowledge the support, care encouragement of my brothers; Umar, Ahmed, Abdullahi, Muhammad, Abubakar and sisters: Rahmat, Ruqayya, Fatima and Aisha and my uncle Abdullahi toward the success of this work. I say thank you.

I will not forget to appreciate the support from my friends and colleagues that have contributed immensely in one way or the other in the course of this program; space will not permit me to mention your names one after the other, thank you very much all.

TABLE OF CONTENTS

Title Page	i
Declaration	ii
Certification	iii
Dedication	iv
Acknowledgement	v
Table of Contents	vii
List of Figures	xi
List of Plates	xii
List of Tables	xiii
List of Appendices	xiv
Abstract	xv
1.0 CHAPTER ONE: INTRODUCTION	
1.1 Background to the Study	1
1.2 Statement of the Research Problem	4
1.3 Aim and Objectives	6
1.4 Hypotheses	7
1.5 Scope of the Study	7
1.6 Significance of the Study	7
1.7 Justification for the study	8
2.0 CHAPTER TWO: CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW	
2.1 Conceptual Framework	10
2.1.1 Filling stations	11
2.1.2 Environmental Management Plan	11
2.1.3 Evolution of EMP	12
2.1.4 Legal basis of EMP	14
2.1.5 Context of EMP	14
2.1.6 Objectives of EMP	17
2.1.7 Scope of EMP	17

2.1.8 Environmental policy 18
2.1.9 Implementation of the EMP 18
2.1.10 Monitoring and auditing 21
2.2 Review of Related Literature 21
2.3 Theoretical Framework of EMP 28
2.4 Innovative and Cost-Effective Approaches to EMP 30
2.4.1 Links between government compliance monitoring and self-monitoring by businesses and filling stations 30
2.4.2 Personal liability for non-compliance 32
2.4.3 The Role of the Public, the Courts and Market Forces in Compliance 32
2.5 Benefits of Compliance and Enforcement 33
2.6 Factors Affecting the Implementation of EMP 33
2.7 Problems Associated with the Operation of Filling Stations 35
2.8 Laws and Regulations Relating to the Operation of Filling Stations in Kaduna 35

3.0 CHAPTER THREE: THE STUDY AREA AND METHODOLOGY

3.1 The Study Area 45
3.1.1 Location and size 45
3.1.2 Geology and relief 47
3.1.3 Climate 47
3.1.4 Soil and vegetation 48
3.1.5 Population 48
3.1.6 Commerce and industry 49
3.1.6.1 Major oil marketers 50
3.1.6.2 Independent marketers 50
3.1.6.3 NNPC retail outlets 50
3.2 Research methodology 51
3.2.1 Reconnaissance survey 51
3.2.2 Types of data collected 51
3.2.3 Sources of data 52
3.2.3.1 Primary sources of data 52
3.2.3.2 Secondary sources of data 52

3.2.4 Sample size and techniques 52
3.2.5 Sampling Design 52
3.2.6 Method of data analysis 53
4.0 CHAPTER FOUR: RESULTS AND DISCUSSION
4.1 Extent of Compliance: Housekeeping Practice 55
4.1.1 Types of Waste Generated in the Filling Stations 55
4.1.2 Method of Solid Waste Treatment/Disposal 56
4.1.3 Effluent Generation at the Lube Bay or During Tank Cleaning 57
4.1.3 Spillage Cases in the Filling Stations 59
4.1.5 Cleaning Spill during Offloading and Unloading 61
4.1.6 Leakage Cases from the Filling Stations 63
4.1.7 Method of Detecting Leakage in the Filling Stations 65
4.1.8 Hazard Communication Channels 66
4.2 Analysis of the Compliance Level among the Three Categories of Filling Stations 68
4.2.1 Checklist for the Compliance to EMP by Filling Stations 68
4.2.2 Hypotheses 69
4.3 Potentials of EMP in the Management of the Environment in the Vicinity of the Filling Stations 70
4.3.1 Quality of EMP in environmental management 71
4.3.2 Level of implementation of the EMP in the filling stations 72
4.3.3 Assessment of the potentials of the EMP in reducing leakages 73
4.3.4 Assessment of the potentials of the EMP to reduce spillages 74
4.3.5 Assessment of the effluent management measures in reducing environmental impact 76
4.3.6 Assessment of the potentials of EMP in fire hazard control 77
4.3.7 Assessment of potential of the EMP in general housekeeping 78
4.4 Constraining Factors to Implementation of EMP in Kaduna 79
4.4.1 Availability of EMP in the filling stations 79
4.4.2 Availability of unit that ensures implementation of mitigation measures 80
4.4.3 Training programmes for workers 81
4.4.4 Recording of reports, injuries, accidents, diseases and dangerous occurrences 82

4.4.5 Current fire service certificate in the filling station 83
4.4.6 Regularity of service line check for leak detection 85
4.4.7 Bottom Plate of every tank being equipped with cathodic protection device 86
4.4.7 Availability of DPR inspection log book in the filling stations 87

5.0 CAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Findings 88
5.2 Conclusion 89
5.3 Recommendations 90
REFERENCES 94
APPENDIX I 102
APPENDIX II 105
APPENDIX III 106

LIST OF FIGURES

Figure	Page
3.1 Kaduna Metropolis	46
4.1 Assessment of the potentials of EMP in fire hazard control	77
4.2 Availability of Training Programmes for Workers	81
4.3 Recording of Reports, Injuries, Accidents, Diseases and dangerous Occurrence	82
4.4 Number of filling station with tank being equipped with cathodic protection device	87

LIST OF PLATES

Plate	Page
Oil Spill in one of the visited stations	60
Fire Outbreak due to major oil spill in one of the studied NNPC managed station	60
Burnt NNPC filling station	61
Affected nearby station	61
Effluent from a leaking tank in the filling station	64
Local Contractor	64
Effluent discharged into the soil within the Filling Station	64

LIST OF TABLES

Table	Page
2.1 Component of a standard EMP	15
4.1 Types of Waste Generated	55
4.2 Method of Solid Waste Treatment/Disposal	55
4.3 Effluent Generation at the Lube Bay or During Tank Cleaning	57
4.4 Spillage Cases in the Filling Stations	59
4.5 Cleaning Spill during Offloading and Unloading	62
4.6 Leakage Case from the Filling Stations	63
4.7: Method of Detecting Leakage in the Filling Stations	65
4.8 Hazard Communication Channels	67
4.9: Checklist of the Compliance to EMP by Filling Stations	68
4.10: Hypothesis	69
4.11 Quality of EMP in environmental management	71
4.12 Level of implementation of the EMP in the filling stations	72
4.13 Assessment of the potentials of the EMP to reduce leakages	73
4.14 Assessment of the potentials of the EMP to reduce spillage	75
4.15 Acceptance of effluent management measures in reducing environmental impact	76
4.16 Assessment of potential of the EMP in general housekeeping	78
4.17: Availability of EMP in the Filling Station	79
4.18: Availability of unit that ensures implementation of mitigation measures	80
4.19: Current Fire Service Certificate in the Filling Station	84
4.20: Regularity of service Line Check for Leak Detection	85

LIST OF APPENDIXES

Appendix	**Page**
I Questionnaire to the management staff of the filling stations	102
II Checklist	105
III Hypothesis calculation	106

ABSTRACT

Environmental Management Plan (EMP) is the strategy an organization is taking to determine how it affects the environment, complies with regulations, keeps track of environmental management activities and meets environmental goals and targets. It also documents key elements of environmental management including the environmental policy, responsibilities, applicable standard operating procedures and Best Management Practices (BMP), record keeping, reports, communication, training, monitoring and corrective action. The compliance of filling stations with the EMP is therefore of optimum importance. This study appraises the compliance level to EMP by petrol filling stations in Kaduna metropolis. For this study, data was obtained from published documents, questionnaire administered to the managers of the filling stations and observation using checklist. Three categories of filling stations sampled include, major marketers, independent marketers and NNPC managed stations. Stratified sampling was used in selecting the filling stations for this study; purposive sampling was used to select respondents. Findings reveal that 80% of the filling stations do not have an EMP. The level of compliance to EMP is higher in the major marketers than in NNPC and independent marketers respectively. The Kruskal-wallis analysis of variance shows statistically, significant differences in the level of compliance between the three categories of filling stations in the study area. This has been proven statistically, where the result shows significant difference in the level of compliance between the 3 categories of filling stations in Kaduna. The findings further revealed that 90% of the filling stations agreed that the EMP followed by a successful implementation and monitoring will improve filling stations level of compliance with environmental laws and regulations relating to operation of filling stations level of compliance reaching almost 100%, and can reduce the identified impacts to an insignificant level. Furthermore, the study also revealed that, only 17% of the filling stations keep

record of reports, injuries, accidents, diseases and dangerous occurrences, 60% lack certification and 47% lack adequate training for workers which serves as constraints to EMP implementation in filling station in Kaduna. Therefore, to improve filling stations compliance with the EMP and to encourage them to avoid government penalties, environmental authorities should prioritize targeted awareness programs to ensure that the filling station and their employees are aware of the EMP. Meanwhile, government can incentivize good behavior by presenting awards for compliance with the EMP.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Environmental management plan (EMP) is an organizational plan or program used in the management of industrial or commercial operations to ensure environmental sustainability (Prepra, 2015). The EMP provides the procedures and processes that should be incorporated into the organization's activities to measure and check in a continuous mode, the compliance with and effectiveness of the mitigation measures recommended to minimizing or eliminating the identified negative environmental impacts of the project throughout its life cycle. In addition, the EMP is also regularly used to ensure compliance with statutory requirements and corporate safety and environmental policies attached to the organization's operations (Prepra, 2015).

An EMP usually is a detailed plan of measures necessary to address the potential impacts identified through the environmental impact assessment (EIA). Those measures are to be undertaken during the implementation and operation of the project to either eliminate or reduce the adverse effects of the project. An EMP includes the specific actions needed to implement the measures. It should clearly stipulate the costs associated with the implementation of the measures, the compensatory measures available should the measures fail to adequately address the adverse effects of the project and the institutional arrangements available to implement the measures, i.e., the agencies, bodies or officers charged with implementing the measures (Ogola, 2007).

The primary objectives of EMP is to provide information that will aid impact management and secondarily, to achieve a better understanding of cause-effect relationships and to improve prediction and mitigation methods. The EMP is also used to establish baseline trends and conditions, measure the impacts that occur during project construction and operation, check their

compliance with agreed conditions and standards, facilitate impact management, e.g. by warning of unanticipated impacts and determine the accuracy of impact predictions and the effectiveness of mitigation measures (Prepra, 2015).

The application of the EMP usually starts from the pre-construction phase, when all the mechanisms required for effective implementation of recommended mitigation measures are put in place. Other components of the EMP usually find application during the project operational phase, as monitoring tools for the compliance of specific environmental attributes with required operational regulatory standards. Also, environmental management actions and protection obligations is delivered with the help of an EMP (Andrews, Darnall, and Gallagher, 1999; Beeby, 2008). It has gained in importance around the world in recent years, with many strategies emerging as the times require (Zailani and Wahid, 2006; Rashed, Hasaneen, Edward, Dwagi, 2008).

The EMP provides a systematic and integrated management framework for an organization to operate their environmental management activities and bring best practice to the entire organization (Morrow and Rondinelli, 2002; Welch, Mori, and Aoyagi-Usui 2002; Zailani and Wahid, 2006). It also provides planning tool to promote sustainable development by integrating environmental considerations into the production process and to mainstream the factory operation to Principle 17 of the Rio Declaration on Environment and Development (Prepra, 2015).

Considering the high risk and dangers associated with petroleum product as a highly inflammable product, its exploration, transportation, offloading, storing and sale points and facilities should not be taken for granted like other products. According to World Health Organization (WHO) (2004), more than 2.3 million lives and properties worth more than N4.5 billion are lost to fire outbreaks associated to petroleum product mishandling. As reported by the European Environmental Agency (1994), apart from creating environmental hazards, petrol can

also pose health hazards if it is inhaled, ingested or come into contact with the skin or eye. European Fuel Oxygenates Association (EFOA) (1999) equally noted that exposure to petroleum vapor with a concentration of between 500ppm and 1000ppm can cause irritation of the respiratory tract. If the situations continue thereafter, such could lead to narcotics effects with symptoms including headache, nausea, dizziness and mental confusion.

Because they deliver, store and dispense fuel, filling stations have unique environmental impacts and requirements. Negligence to the standard requirements and non-compliance to environmental management regulations for filling stations operation poses serious threat on environment, health of the workers and people residing close to the filling station. An EMP in the operation of filling stations therefore is of optimum importance, it will serve as a mechanism for implementing the measures necessary to manage the adverse impacts of the filling stations. A good EMP should provide a systematic framework for anticipating and solving problems, while allowing the flexibility to make changes for environmental protection and sustainable development.

Compliance means the conformity with obligations, imposed by a state, its competent authorities and agencies on the regulated community, whether directly or through conditions and requirements, permits, licenses and authorizations United Nation Environment Programme (UNEP) (2006). Compliance efforts can take a wide variety of forms, including education, technical assistance, voluntary compliance programmes, subsidies and other forms of financial assistance, or incentives, administrative enforcement, civil judicial enforcement and criminal enforcement.

Compliance is a substantial element of environmental management. For this study, the EMP simply suggests that filling stations could reach environmental improved compliance level

to environmental regulation and maintaining best practices by implementing the EMP in their operational activities. The EMP is recognized as a tool that can ensure that filling stations make suitable provision for environmental mitigation, and also describes the methods and procedures for mitigating and monitoring impacts with environmental objectives and targets (Bennett, Kemp, & Hudson, 2016). There is a need to establish that EMPs can manage environmental impacts in order to improve compliance with environmental laws and regulations.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Petroleum products are unrivaled resources in several aspect of human life which are mostly obtained from filling stations. In Nigeria, most filling stations are located within densely built urban space because of the need to maximize access to customers, security and ease of transportation among others. Kaduna like many urban areas has many filling stations to satisfy its inhabitants. Important as filling stations are, they are potential sources of environmental hazards. Apart from the effect of filling stations on the environment, it can also affect the health of the people in the neighborhoods, buyers and the operators of the filling stations. Additionally, petroleum products as flammable liquids can float on the water surface over considerable distances, thereby posing danger away from source. Despite their impact on the environment, their compliance to the EMP is rarely assessed.

Bello and Anobeme (2015) carried out a research on the effects of oil spillage on the properties of soil and environment around the marketing outlets of some petroleum marketing companies in Calabar, Cross River State, Nigeria. The result showed that oil spill have negative effects on the chemical and biological properties of soils viz-a-viz the crops or vegetation in the surrounding.

In the same vein, Kemabonta and Aderemi (2015) carried out a post environmental impact assessment and toxicological evaluation of major emission on selected fauna of the AP filling station, University of Lagos. The animal species used include Mud Crab (*Sessarma huzardi*), Earthworm (*Eudrilus eugeniae*), and Termite (*Macrotermes bellicosus).*The result showed that, for acute toxicity testing for petrol, kerosene and diesel singly against earthworm and crabs, petrol was more toxic, followed by kerosene, then diesel, and that heavy metals were more concentrated in the top-soil and sediments than in plants, animals and water.

Morales, Miñarro, Ferradas, Caracena and Rico (2010) also assessed the impact of petrol stations on their immediate surroundings of the city of Murcia south-east of the Iberian Peninsula using La Fica petrol station as a case study. The researchers sampled air within the filling station and compared the result to what is obtainable in the normal urban air. The result showed that the air at the petrol station does not have the same proportion of Volatile organic compounds (VOCs) as the general city air.

As part of the proactive measures by government to preserve the environment and protect its inhabitant from hazardous waste, the Nigerian government and several states therein have established various governmental authorities and agencies that would ensure efficient and effective mode of managing environmental issues. Kaduna Environmental Protection Authority (KEPA) liaise with relevant department such as Department of petroleum resources (DPR) to manage environmental issues associated with the operation of filling stations and ensuring compliance with the EMP. However there were no clear-cut roles or hierarchy from the federal government on the subject matter, it has compounded the jurisdiction which result in conflict and weak institutional framework and the issue of enforcement i.e., mobile court that are to ensure compliance are no longer functioning, therefore filling stations are built anywhere with no specification.

There is the need to examine the compliance level to EMP by the filling stations in Kaduna, considering the increasing number of filling stations in Kaduna and the growing concern for environmental protection as a central topic of global discourse and its' imperative for sustainable development, constitute the problem of interest to this study. To the best of the researcher's knowledge, none of these previous studies based on the existing literature have assessed the level of compliance to environmental management plan by petrol stations in Kaduna metropolis. Therefore, this study will seek to address the following research questions.

1. What is the extent of compliance to EMP by petrol filling stations in Kaduna metropolis?
2. What is the difference in the level of compliance among the filling stations in Kaduna metropolis?
3. What are the potentials of EMP in the environmental management of filling stations in Kaduna metropolis?
4. What are the constraints to compliance with EMP by filling stations in Kaduna state?

1.3 AIM AND OBJECTIVES

The aim of this study is to appraise of the compliance level to environmental management plan by filling stations in Kaduna. The objectives are to;

i. assess the extent of compliance to EMP by NNPC, major fuel marketers and independently managed filling stations in Kaduna metropolis
ii. compare the compliance level of the three categories of filling stations in Kaduna metropolis.
iii. identify the potentials of EMP in the management of the environment in the vicinity of the filling stations
iv. identify the constraining factors to compliance to EMP in filling stations in Kaduna

1.4 HYPOTHESES

H_0 there is no significance difference in the compliance level to EMP by NNPC, major fuel marketers and independently managed filling stations in the study area.

1.5 SCOPE OF THE STUDY

The scope of this study include: examining the extent of compliance to EMP by NNPC managed stations, major fuel marketers and independently managed filling stations; these include incidence of leakage and fire outbreak, ways of disposing effluent from the fuel stations, update on regulation agencies, certification; comparing the compliance level of the three categories of filling stations in Kaduna metropolis, examine the potentials of EMP in the management of the stations, and also examining of the constraining factors to compliance to EMP in Kaduna metropolis. The spatial scope of this study is the entire Kaduna metropolis. The temporal scope covers January 2016 to May 2016.

1.6 SIGNIFICANCE OF THE STUDY

The content of the EMP includes, fulfilling environmental legislation requirements, setting environmental policy, clarifying objectives and targets for environmental performance, identifying environmental aspects and impacts, mitigating environmental pollution and harmful impacts, training and monitoring, checking and auditing, EMP implementation, communicating with the public, evaluating environmental performance, documenting environmental management, procedures, previewing and continually improving management practices.

Kaduna being one of the largest and populous cities in Northern Nigeria is not an exception to problems associated with filling stations. This is not unexpected given its historical, educational and administrative characteristics with massive socio-economic activities. The proper implementation of EMP in the filling stations in Kaduna will result in improved resource

conservation, reduce (if not eliminate) pollution, minimize negative health impacts and check compliance with environmental legislation. Also, it is expected that the findings from this study shall be of immense importance not only to the operators of filling stations on their commitment toward environmental protection but also to the regulatory agencies in formulating policies that have direct bearing towards addressing environmental related issue. It will also provide a basis for understanding the proficiency of DPR in monitoring environmental compliance and also the determinants of their success and failure. This is the policy significance of the study.

Moreover, appraising the compliance level of filling stations to EMP among the three categories of filling stations in Kaduna will assist in identifying the categories that comply more and the reasons justified. In terms of academic importance, implications from the findings will serve as guide posts for future researcher in Kaduna or elsewhere, i.e., measuring the level of compliance before and after the implementation of the EMP in filling stations.

1.7 JUSTIFICATION OF THE STUDY

Environmental impacts of industrial and commercial activities both local and international corporations are now attracting serious concern from the public, governments, businesses, media and other stakeholders. This concern became more alarming when such incidents as the Bhopal chemical leak of 1984, the Exxon Valdez oil spill of 1989, began to attract public attention. Need for changes in environmental legislation and standards began to gain more prominence in public debates. Many environmental pressure groups gradually emerged calling for a healthier environment. Examples of such pressure groups include Green Peace, Friends of the earth who have advocated for change in how organizations manage their business activities. Many international organizations like United National Division for Sustainable Development (UNDSD), United Nation Environment Programme (UNEP), United Nations Development Programme

(UNDP) and Organization for Economic Co-operation and Development (OECD) are among international organizations currently advocating for better and healthier environmental management (Namakonzi and Inanga, 2014).

In Nigeria, the great concern about the quality of the environment and the increasing effects of new technologies and ever-larger development schemes ushered in the formulation of environmental policies, regulations and standards and application of tools such as EIA, EMP and Environmental Audit (EA). This is to encourage and promote environmental sustainability. In order to ensure environmental protection by filling stations, an EMP is required. It is mandatory in Nigeria as stipulated by Environmental Impact Assessment (EIA) Act Cap E12, LFN 2010. Similarly the multilateral aid agencies, African Development Bank and the World Bank require EMP as part of their conditions for project funding.

CHAPTER TWO

2.0 CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

This chapter is divided into eight sections. Section one explores the key concept in the area of EMP, foundation and evolution, legal basis, context, objectives, scope, environmental policy and Implementation of EMP; section two covers literature on EMP, this review provides a general

overview, identifies knowledge gaps and with a view to establish findings of previous scholars on the subject matter, highlights aspects of the research regarding EMP implementation and evaluation; section three is a presentation of a theoretical framework of the study. Section four concerned the innovative, cost-effective approaches to EMP, section five underscores the benefits of compliance and enforcement while section six examined factors affecting implementation of EMP, section seven addresses the problems associated with the operations of filling stations and lastly section eight- laws and relating to the operations of filling stations.

2.1 CONCEPTUAL FRAMEWORK

2.1.1 Filling Stations

A filling station is a facility where fuel and lubricants for automobiles are sold. A filling station is a retail outlet for mostly petrol and other oil and gas products. A typical station is made up of a courtyard, fuel dispensers, underground fuel storage tanks, an office block and convenience and occasionally shops and mosques. Fuels sold at these facilities include petrol (Premium Motor Spirit [PMS]), Liquefied Natural Gas [LNG], diesel (Automated Gas Oil [AGO]) and kerosene (Dual Purpose Kerosene [DPK]) (Afolabi, Olajide and Omotayo 2011). These fuels are flammable liquids, which can give off flammable vapour, even at very low temperatures. This means there is always a risk of fire or explosion if a source of ignition is present.

2.1.2 Environmental Management Plan

According to EPA (2005), EMP is the action an organization is taking to determine how it affects the environment, complies with regulations, keeps track of environmental management activities and meets environmental goals and targets. It also documents key elements of environmental management including the environmental policy, responsibilities, applicable

standard operating procedures and Best Management Practices (BMP), record keeping, reports, communication, training, monitoring and corrective action.

EMPs are normally prepared as a product of the impact assessment process during the project planning stage and then continue to evolve in scope and depth with subsequent stages of project preparation and implementation. EMPs are therefore important tools for ensuring that the management actions arising from Environmental Impact Assessment (EIA) processes are clearly defined and implemented through all phases of the project life-cycle (Lochner, 2005).

The EMP document can be used throughout the project life cycle – commissioning, mobilization and construction, operation and maintenance and decommissioning. It is regularly updated to be aligned with the project progress from commissioning to mobilization to construction to operation to decommissioning. EMP's outline the environmental impacts, the mitigation measures, roles and responsibilities, timescales and cost of mitigation. EMP is therefore a practical and achievable plan of management to ensure that any environmental impact during all the phases is minimized and lead in the direction of sustainable development.

An important objective of environmental assessment is to develop procedures and plans to ensure that the mitigation measures and monitoring requirements approved during the environmental compliance review will actually be carried out in subsequent stages of the project. Mitigation measures may then be of a more generic nature without compromising its importance to be implemented. The EMP is a dynamic and flexible document subject to review and updating. During the implementation of a project there is always the possibility that unforeseen issues could arise, this EMP should therefore be revised where necessary to mitigate unanticipated impacts (Sajima 2011).

The project proponent is normally responsible for preparation of the EMP. As with other aspects of project planning and impact assessment, good practice requires the effective participation of stakeholders in EMP development. This is particularly important where projects are large, complex, and risky and have significant social and environmental implications. EMPs are often incorporated into environmental permitting conditions and project financing agreements. Their use as regulatory and contractual documents increases the requirement that they are written clearly and with great attention to accuracy, detail and wording.

2.1.3 Evolution of EMP

Environmental Impact Assessment has become an increasingly well-known environmental management tool as a result of demands that is mounted on companies and industries to improve upon their environmental performance. It is now a common tool in the developed nations and is increasingly being functional in developing countries by overseas and local investors. It is applied to a variety of industrial and business activities; from small through medium to large scale concerns. However, it is noticed in many countries that most of the environmental impact assessment (EIA) practice appears to be directed at the scoping and assessment stages of EIA's (Rizzolo, 2006).

The concept of Environmental Management Plans emerged from the field of Environmental Impact Assessment (EIA). Following the prediction of potential impacts and an evaluation of their significance, the next key stage in the impact assessment process is the development of mitigation measures to prevent, minimize or offset significant adverse impacts. For projects which proceed, these measures must then be formally integrated into the project design. In impact assessment theory, this step is considered part of the environmental impact assessment (EIA) follow-up process.

The document which clearly describes the measures to be incorporated into further stages of project implementation and operation, and how this will be done, is termed as EMP. They provide an essential link between the impacts predicted and mitigation measures specified within an impact assessment report and final design, implementation and operational activities. EMPs may be given legal status by being referred to or incorporated into environmental permits, financing agreements and other contractual documents.

The mitigation, monitoring and management components of EIA's have received less attention at formulation and implementation level. Recently, attention is being focused on the need to demonstrate that impacts can be monitored and managed. The EMP is the plan constructed during the process of EIA that provides a description of the methods and procedures for mitigating and monitoring impacts. It promotes the awareness and use of best practice environmental management by site operatives during construction and operative phase (Rizzolo, 2006).

2.1.4 Legal Basis of EMP

The authorization to undertake the construction and operation of the project may be subject to compliance with other environmental legislation, such as legislation related to: water; air quality, hazardous substances; storage, transport and disposal of waste; occupational health and safety; traffic and transportation; cultural and heritage resources; and noise. Compliance with environmental legal requirements is an essential project consideration and therefore needs attention in the EMP. As affirmed by Lochner (2005), failure to meet legal environmental requirements could result in the withdrawal of environmental authorization for the project and effectively result in operations having to cease until such non-compliances are addressed.

The relevant legal requirements could stem from the requirements of national, provincial or local government authorities. International compliance requirements could also apply. For

example, if the World Bank is a lender to a proposed project, the Bank's various guidelines would apply. Projects locating within a particular development initiative (e.g. business park or industrial development zone) could be subject to additional legal conditions or guidelines that need to be included in the EMP (e.g. visual guidelines for all developments in the area; or specifications for re-vegetation, waste management or water conservation in the area) (Lochner, 2005).

2.1.5 Context of EMP

In Nigeria, EMP must be carried out by all industrial enterprises. The Federal Ministry of Environment of Nigeria has laid down procedures for conducting the EMP and enforces the Decree No. 86 of 1992, through the National Environmental Standards and Regulations Enforcement Agency (NESREA) which sets out the requirements, procedures and methods for conducting such exercises.

EMPs are intended to document the actions necessary to prevent or minimize predicted negative impacts, and to apply standardized 'best practice'. The issues traditionally addressed within EMPs are listed in Table 2.1

Table 2.1: Components of a standard EMP

EMP Component	How to address
Summary of impacts	The predicted adverse environmental and social impacts for which mitigation is required should be identified and briefly summarised. Cross referencing to the EA report or other documentation is recommended.
Description of mitigation measures	Each mitigation measure should be briefly described with reference to the impact to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should be accompanied by, or referenced to, project design and

	operating procedures which elaborate on the technical aspects of implementing the various measures.
Description of monitoring programme	The monitoring program should clearly indicate the linkages between impacts identified in the EIA report, measurement indicators, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions.
Institutional arrangements	Responsibilities for mitigation and monitoring should be clearly defined, including arrangements for co-ordination between the various actors responsible for mitigation.
Implementation schedule and reporting procedures	Frequency and duration of mitigation measure should be specified in an implementation schedule, showing links with overall project implementation. Procedures to provide information on the progress and results of mitigation and monitoring measures should also be clearly specified.
Cost estimates and sources of funds	These should be specified for both the initial investment and recurring expenses for implementing all measures contained in the EMP, integrated into the total project costs, and factored into loan negotiations.

Source: World Bank, (1999)

The EMP contains commitments that are binding on the proponent. It can be translated into project documentation and provide the basis for a legal contract that sets out the responsibilities of the proponent. In turn, the proponent can use the EMP to establish environmental performance standards and requirements for those carrying out the works or providing supplies.

2.1.6 Objectives of EMP

An EMP has the following objectives:

a. maintenance of quality of environment adequate for good health and well-being
b. use of the environment and natural resources for the benefit of present and future generations

c. restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and the principle of optimum sustainability in the use of natural resources and ecosystems
d. raise awareness of all staff and promote understanding of the essential linkages between the environment, resources and development and;
e. encourage individual staff and the members of the nearby community to participate in environmental improvement efforts.

2.1.7 Scope of EMP

An EMP has two core goals: pollution prevention and compliance with environmental regulations. According Ogola (2007), an EMP consist of a set of mitigation, monitoring and institutional measures to be taken during the implementation and operation of the proposed project to eliminate adverse environmental impacts, offset them or reduce them to acceptable levels. The EMP also include the actions needed to implement these measures, including features such as: Mitigation based on the environmental impacts reported in the EIA, description with technical details of each mitigation measure, and also monitoring objectives that specifies the type of monitoring activities that will be linked to the mitigation measures.

The EMP also provide a specific description of institutional arrangements i.e. who is responsible for carrying out the mitigating and monitoring measures (for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). Additionally, the EMP includes an estimate of the costs of the measures and activities recommended. It should consider compensatory measures if mitigation measures are not feasible or cost effective and also, it must be operative throughout the whole project cycle. (Welford 1996).

In summary therefore, the generic scope of an EMP include the following:

- Definition of the environmental management objectives to be realized during the life of a project (i.e. pre-construction, construction, operation and/or decommissioning phases) in order to enhance benefits and minimise adverse environmental impacts.
- Description of the detailed actions needed to achieve these objectives, including how they will be achieved, by whom, by when, with what resources, with what monitoring/verification, and to what target or performance level. Mechanisms must also be provided to address changes in the project implementation, emergencies or unexpected events, and the associated approval processes.
- Clarification of institutional structures, roles, communication and reporting processes required as part of the implementation of the EMP.
- Description of the link between the EMP and associated legislated requirements.
- Description of requirements for record keeping, reporting, review, auditing and updating of the EMP (Lochner 2005).

2.1.8 Environmental Policy of EMP

In an EMP, environmental policy provides a summary of the Project Proponent's existing policies, guidelines and commitments to the environment. An overview should be provided of corporate governance structure of the Project Proponent, to convey the hierarchy of responsibilities within the company/organisation for matters relating to health, safety and environment. In the case of a local authority being the Project Proponent, the commitments to be highlighted could include service delivery, environmental protection and social responsibility (Lochner 2005).

Company/organisation guidelines or policies relating to health, safety and environment (e.g., corporate commitment to capping greenhouse gas emissions) should also be provided. This is particularly relevant for international companies who may have corporate policies that are applied

world-wide across their operations and also the environmental commitments of the parent company/organisation for that particular project (Lochner 2005).

2.1.9 Implementation of the EMP

The use of EMPs and their derivatives varies. Typically they are implemented during project construction and operation, but they may also be used during detailed design (to adjust the design and tender documents), tendering (to ensure that the selected contractor is socially and environmentally competent), pre-construction (for example, to ensure that adequate pre-project baseline surveys are carried out or that land acquisition is implemented fairly), and decommissioning.

Responsibility for implementation of the EMP will be described in the EMP document itself. Overall responsibility rests with the project proponent (owner/operator), who will have legal responsibilities for performance under domestic legislation and probably additional contractual duties with respect to the project financing agencies (and, increasingly, with affected people). Typically, large and complex projects necessitate the establishment of a specialized unit dedicated to management of the social and environmental issues. Responsibility for physical implementation of the various measures described in the EMP will vary according to the type and timing of the measure. For example, civil works contractors are often required to prepare and implement comprehensive EMPs during construction, utility operators must develop and implement detailed operating rules for reservoirs, line agencies may undertake statutory monitoring activities, local governments will implement land use and zoning plans, and local and international NGOs may partner with the proponent to assist in, for example, biodiversity conservation and community development in upper watersheds. A key process during EMP implementation is monitoring and evaluation (M and E), checking that the measures described in the EMP are being undertaken in

the right place, at the right time, to the right standard, and that importantly, the measures are effective. In addition, the M and E system should be alert to the unexpected issues and impacts which invariably arise during project implementation (INECE 2009).

An important aspect of EMP implementation is the EMP financing. Cost categories are EMP preparation and EMP implementation. EMP implementation in turn has two major cost elements: programme implementation and administrative overheads. These elements cover many sub-elements each of which may be a major programme in its own right, for example, public participation, environmental flow determination, compensation and resettlement, monitoring, or human resources development. EMP implementation proceeds most smoothly when all costs have been identified in advance, fully budgeted, and an adequate contingency allowed for the inevitable unforeseen tasks. Inadequate funding for EMP preparation invariably results in inadequate funding for EMP implementation, with unwelcome cost and budgetary surprises (INECE 2009).

2.1.10 Monitoring and Auditing

One major purpose of an EMP is to define a project's environmental (social and cultural setting) monitoring programme. Environmental and social performance monitoring is necessary at many different levels, firstly to check compliance with agreed commitments and standards and secondly to monitor the effects of the project in case of any need for remedial action by project management. Monitoring programmes normally describe the ecosystem (or social system) component at risk, with a link to the impact predicted in the EIA and define the indicators to be measured, the methods to be used, the sampling frequency, threshold levels that will trigger management action and reporting systems.

A 2007 study showed that while about 60% of submitted EIAs in Nigeria were approved, only 31% of the projects were being monitored (Yusuf, Agarry & Durojaiye, 2007). It is necessary

to monitor whether the proposed mitigation measures are being implemented and if they are, how they are working. The implementation of a project design may reveal gaps in the EIA that were not previously observed but which need to be addressed. Lee (2000), has stressed that the effectiveness of an EIA is dependent on the degree of success in integrating assessment findings into decision-making in the planning and project cycle and that this is frequently low in developing countries, resulting in poor links with project implementation.

Specifically, the monitoring section of the EMP provides a specific description, and technical details, of monitoring measures that includes the parameters to be measured, the methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate) and definition of thresholds that will signal the need for corrective actions; Monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and to furnish information on the progress and results of mitigation, in order to ensure regulatory and other requirements are being met, it is often necessary to undertake regular environmental monitoring.

Auditing is a specialized monitoring procedure which systematically checks an organization's compliance with specific requirements, such as operational procedures and standards. Audits are an essential component of quality assurance systems such as formal EMP. Internal audits check on performance and compliance. Periodic independent audits are required to obtain and maintain certification. Review audits should be undertaken regularly to ensure the EMP is achieving its objectives and to refine operational procedures to meet this goal.

2.2 REVIEW OF RELATED LITERATURE

At present, there are many environmental management tools in use, such as environmental impact assessments, environmental audit, substance flow analysis, life-cycle assessments and

EMP (Emilsson and Hjelm, 2002). These tools provide environmental information and assist environmental management in order to make organizations more environmentally friendly. Of these tools, EMP is one of the most commonly used in organizations worldwide (Zutshi, Sohal, and Adams (2008); Nawrocka and Parker (2009)). Therefore, a range of related literature has been reviewed to establish the findings of previous scholars on the subject matter.

Ibrahim (2014) assessed the legal and institutional framework for the prevention of environmental degradation by oil and gas companies in Nigeria. The study examined the laws, regulations and policies geared towards environmental protection and prevention of environmental degradation by these companies especially in the Niger-delta region. The research critically discussed the various institutions that are charged with the responsibilities of implementing these laws. The law and regulations discussed by the researcher were limited to upstream sector (exploration, refining and production operation of oil and gas). The end point of the product is majorly filling stations. This research work will examine the compliance to the laws and regulation relating the operation of filling stations.

Afolabi, Olajide and Omotayo (2011) carried out a research on the assessment of safety practices in filling stations in Ile-ife, south western Nigeria. Data were collected using an interviewer administered questionnaire and an observational checklist. The result showed that the median (range) age of respondents was 24 years and 94% were aware of safety measures with fire extinguisher being the most common safety measure known (54%). Fire hazard was the most common hazard known (94%). Set backs from the road and residential areas were less than 30 metres in 90% and 48% of the filling stations respectively. Stations owned by conglomerates (multi-national oil producing companies) had better safety measures compared to those owned by independent private marketers. They further recommended that more efforts should be made to

train filling station attendants and regular assessment of facilities should be conducted to ensure that safety standards are maintained. There is need for further studies to evaluate the reasons for non-compliance with regulations by the filling stations.

Similarly, Famiye, Kuttu & Anarfo (2013) in a study to assess challenges of EMP implementation in Ghanaian firms, documented that in all, fifty three environmental representatives were surveyed, the results show that, implementation cost and "too much paper work" seems to be the two most important factors that hinders the implementation of EMP in Ghana. This is consistent with Ayirebi-D Ayirebi-Dansoh, and Amoah, (2012), Goodchild (1998), Bansal and Hunter (2003), Hillary (1998) and Hillary (1997a). This was followed by the cost of certification (Bansal & Hunter, 2003), the quality of consultants, the time involved and the exposure of the organizations to regulatory bodies (Mostek, 1998). This study considered certain factors that hinder the EMP implementation in Ghana. Apart from these factors, there is also the need to look at other external and internal factors especially, knowledge on the EMP as a tool for environmental management, equipments for environmental monitoring, training and education, reports and record keeping, etc that can also affect the implementation of this plan.

In a study conducted by Sergio (2012) on the emission of BTEX (benzene, toluene, ethybenzene, and xylenes) from gas station on the atmosphere, they concluded that the concentration of these gases were appreciably higher in filling stations than what was found in location with high vehicular flux. In fact, they concluded that the concentration levels at the gas stations were similar to those found in tunnels. It is based on this assertion that Kanyi (2005) in a previous study on factors affecting environmental best practice compliance among retail fuel service stations in Thika East Sub-County Kenya concluded that gasoline offers a great advantage by powering cars and buses, but is composed also of four chemicals that are toxic to humans –

benzene, toluene, ethyl benzene, and xylene. When pumping gasoline into vehicles, the vapour escapes into the atmosphere and can get into people's lungs when they breathe and also be deposited on their skin. Gasoline also evaporates very quickly and pollutes the atmosphere. Certain chemicals called volatile organic compounds (VOCs) (such as benzene) react with sunlight and form smog in urban areas. Moreover, spills of gasoline can contaminate water supplies. These among other negative effects of petroleum products call for proper management and compliance of best practice among all persons handling petroleum products. The work of Sargio establishes that filling stations emit VOCs gasses at an alarming rate much more than what is found in tunnels. Whether there are, or no regulations on the limits of emission as well as EMP implementation for filling stations in Ghana were not discussed.

Ahmed *et al* (2015) determine the level of awareness of hazards and safety measures among Petrol Filling Stations and assess the prevailing safety Practices in Petrol Filling Stations in Minna metropolis of Niger State Nigeria. Data was collected using interview, administered questionnaire and an observation check list which cut across risk, health and hazard sub considerations. The result shows that 65% of the Station Attendants are not properly trained on safety. 45 of Minna Petrol Filling stations do not conform to Department of Petroleum Resources (DPR) siting rules as setbacks from the road and residential areas were less than 30 meters. Independent Petroleum Marketers shows no concern on people selling Petroleum products in gallon, right in front of their Stations. Conglomerate owned Stations like the Nigeria National Petroleum Cooperation (NNPC) Retail Outlets- (State owned), have better safety measures and orientations compared to those owned by independent marketers. In this study, the authors adopted a qualitative empirical approach and therefore the result cannot be generalized to establish prevalence of the incidence of lack of safety measures in all the filling stations in Minna nor can the result be use to highlight the

varying level of significant differences of non-compliance among NNPC, major and independent fuel marketers in the Minna.

Ahmed, Ghauri and Bazmi 2013 assessed the current state of health, safety and environmental standards (HSE) and activities on fuel filling stations in Pakistan, the focus was on fuel filling stations in Pakistan by observing the compliance of the safety guidelines versus non-compliance to the guidelines that can be implemented for reducing the exposure and potential risks of filling stations. The findings revealed that guidelines were present but site personnel showed reluctance in practicing these standards and was attributed to lack of formal education programme on HSE, lack of strict requirement by the enforcement agency for authentic data collection and reporting, lenient enforcement of the law, lack of technically qualified personnel for inspection services that can recognize or evaluate occupational hazards and lack of inter agency coordination at the government level.

Another study conducted was by Resources and Environmental Management Services (REMS) (2010) on environmental audit report of Dhaka terminal and Mongla plant in Bangladash. The methodology adopted for this audit is initial review of the EMP and list out the various activities being carried out at the terminal and the plant to check physically weather environmental performance, health and safety aspects etc. are in compliance with guidelines provided in the EMP. The audit result presented in matrix form to check for compliance of each of the environmental, health and safety measures suggested in the EMP. From the result, there is a level of compliance with most of the measures recommended in the EMP of the EIA approved by the Department of Environment (DoE) for environmental clearance of both the terminal and the plant. The only non-compliance observed is in environment aesthetics (green seeking) of the Mongla plant. This was because no plantation has been initiated as there is no excess land for this. The major

recommendation put forward is that the company should conduct to audit and monitor the performance of the company on regular basis.

Furthermore, an analysis on progress reports done by National Emergency Management Agency in December 2003 in Kenya concluded that the fuel stations in the entire country that had achieved 100% compliance were less than 15%. This resulted to the petroleum products marketing companies and independent dealers being put on notice by NEMA to remedy the situation failure to which the facilities would be closed down. In January 2004 NEMA published a notice for all petroleum and petrochemical products storage and marketing facilities owners to conduct an initial EA for all their respective facilities in accordance with the published Environmental Standards, the applicable laws and regulations in Kenya and best international practices using an environmental auditor chosen from a pool of consultants trained and certified by NEMA (NEMA, 2004).This was to enable the facility investor evaluate the status of their site facilities and establish whether any petroleum products had been released to the environment and if so to what extent and propose mitigation measures to address the non-conformances and prepare monitoring plans with regard to the continuity of the facilities operation. The initial report was to be submitted and registered with NEMA, jointly by the owner and the consultant. Subsequently NEMA analyzed the report, for the sites submitted, picking out and assessing the magnitude of non-compliance and advised the respective owners on whether the facility would be required to stop operations and shut down immediately or would be allowed to operate with an improvement order to address the non-compliance.

Mshelia, Abdullahi and Dawha (2015) carried out a research on the environmental effects of petrol stations at close proximities to residential buildings in Maiduguri and Jere, Borno State, whereby three household heads around each of the 35 sampled petrol stations were randomly

sampled. The finding revealed that the guidelines for siting petrol stations have not been adhered to by most of the petrol stations thereby posing serious hazards on residence in close proximity to them. They therefore recommended that the State legislature should enact law forbidding either government or individuals from converting plots of land for location of petrol stations within the township forthwith.

EPA (2003), carried out an audit of environmental risk assessment at 22 retail fuel outlets in rural and metropolitan Victoria in South-east of Australia, where it was found that old steel tanks used without cathodic protection were generally believed to present the greatest risk of developing leaks. The audit found that these were in use at one-third of the sites audited. The majority of retail fuel outlets used inventory control as the sole means of leak detection to prevent soil and groundwater contamination and there were many different methods of inventory control, of varying accuracy, being used. The audit report therefore indicates that there are highly variable environmental management standards across this industry and that under current controls a significant risk to the environment is posed by their operation.

Similarly, Mohammed, Musa and Jeb (2014) analyzed the location of filling stations based in Metropolitan Kano against the Physical Planning Standards using GIS. The findings revealed that most of the station satisfied the minimum requirement of 15 meters distance from the road (96%), 98% met the minimum distance of 100 meter from the health care facilities. However many station had not meet the criteria of 400 meter minimum distance to other stations where located on same road side and when not separated by any road or street. The finding therefore showed that there is minimum compliance to environmental regulation in the construction phase and hence the need to examine compliance level at the operation phase.

Makelene 2015 investigates the potential to improve firms' compliance with environmental standards by implementing an EMP within a public firm and a private firm in South Africa. The study used methods of inspection, observation, impact assessment, implementation, and monitoring to answer the research question. In both firms under study, the results showed no compliance with environmental law during initial site inspection and impact assessment. However, the implementation of EMPs in both firms improved compliance with environmental laws to nearly one hundred percent. As a result, EMPs were successfully implemented and monitored, improving the firms' compliance with environmental laws and reducing negative environmental impacts to an insignificant level.

From the forgoing literature, it is quite clear that a lot of studies in the area of environmental impact of filling station and compliance to regulation have been carried out. However, this present research is to determine the extent of environmental compliance to EMP by filling stations in Kaduna whose activities portend potential threat to environmental quality and safety.

2.3 THEORETICAL FRAMEWORK OF EMP

In the last few years, the enactment of environmental regulations owing to man's footprint on earth's resources has made businesses to monitor their environmental impacts. Filling stations are potential sources of hazard to the environment, the residents within where the filing stations are located and also the workers in the station. Monitoring of these filling stations therefore becomes imperative in order to make sure they comply with the existing regulation. As a result, a number of models and theories have been developed which attempt to explain environmental compliance to regulation. These include standard theory of rational choice (Becker 1992), theory of responsive regulation (Ayres and Braithwaite, 1992) and ISO14001 model (ISO 1996) among others.

At the broadest level, the theories underlying environmental monitoring reflect two different government approaches to achieving compliance. Broadly speaking, they tend to fall into either: (1) "rationalist" model (Becker 1968) that focus on deterrence and enforcement as a means to prevent and punish non-compliance by changing the actor's calculation of benefits and costs, or (2) "normative" models (Becker 1968) that focus on cooperation and compliance assistance as a means to prevent non-compliance.

The rationalist theory posits that regulated actors follow the logic of consequence. Put simply, everyone acts to maximize their own self-interest. If it is "cheaper" to violate an environmental requirement, then regulated actors will do so. Therefore, rationalists argue that policies must "deter" this behavior by raising the "costs" of non-compliance. Accordingly, they advocate deterrence-based enforcement. Generally, for a policy to have a deterrent effect, the individual or organization must believe that: There is a high probability of being caught, the response to violations will be swift, certain and fair; and lastly, the punishment will be severe enough to outweigh the benefits of non-compliance (International Network for Environmental Compliance and Enforcement [INECE] 2009). Deterrence may be enhanced either by expanding monitoring activities, improving enforcement capacity to investigate and prosecute violations, raising penalties, or increasing awareness of enforcement. Normative theory posits that regulated actors follow the logic of appropriateness and often act in good faith. Compliance occurs (or does not occur) largely because of the regulated actor's "capacity" (*e.g.* knowledge of the rules, and financial and technological ability to comply) and "commitment" (*e.g.* perception that the rule is fair). Accordingly, these theories call for more compliance promotion in the form of assistance, incentives and other activities.

The rationalist and normative models represent opposite ends of the spectrum and each provides useful insights into the types of behavior that lead to compliance. Regulated communities everywhere generally can be divided into three general categories: (1) those who will not comply at all unless they are forced to; (2) those who are "impressionable," and might comply if presented with incentives, knowledge, or capacity to do so; and (3) those who will cooperate in all circumstances. Which one of these categories predominates will vary from country-to-country and can help inform individual country decisions about what mix of compliance promotion and enforcement activities to stress in efforts to promote the rule of law and the protection of public health and the environment (INECE 2009).

2.4 INNOVATIVE AND COST-EFFECTIVE APPROACHES TO EMP

In order to attain a higher level of environmental protection in light of the scarce resources of enforcement agencies, it is crucial to identify and apply approaches susceptible to reducing the administrative costs of monitoring and enforcement. Whereas high fines coupled with a low inspection probability appear, on first sight, to be an attractive option for ensuring deterrence and keeping administrative enforcement costs low, an arbitrary increase in fines is not always feasible (due to external, *e.g.* regulatory limits or affordability) or not desirable (when taking account of risk aversion) (Global Forum on Sustainable Development{GFSD}, 2004). High fines may even be counterproductive, as they may induce the regulatees to spend resources on evading liability through, for example, falsification of monitoring reports, hiding of pollution incidences, challenging of enforcement decisions in court, or attempts to bribe officials (Cohen, 1999).

2.4.1 Links between Government Compliance Monitoring and Self-Monitoring by Businesses and Filling Stations

Targeting non-compliant firms is one option for reducing enforcement costs suggested by economic theory. It follows the idea that the intensity of monitoring of a polluter may be based on

the firm's prior compliance history (Cohen, 1999). By introducing compliance dependent compliance monitoring and enforcement, firms previously complying might be monitored less frequently (Harrington, 1988 and Harford, 1991). They can also be fined less if found non-compliant than firms previously violating legislation. The threat of being placed in the "more frequently monitored" and "more severely punished" group serves as an incentive to comply. Empirical examples of targeting firms with a greater risk of non-compliance and using higher penalties for repeat-offenders were found in the US EPA's enforcement approach. Unlike the empirical examples, Harrington's (1988) approach suggested not monitoring firms with the highest compliance costs because this would need over-proportionally high enforcement resources. This strategy, however, does not take account of damage costs.

The introduction of self-monitoring and self -reporting schemes as a complement to state monitoring has been considered as a possible means of substituting government compliance monitoring efforts by passing some of the monitoring responsibility and cost on to the firm without decreasing deterrence (Cohen, 1999). It is obvious that this may help save administrative enforcement costs to the extent that the firm's self-monitoring and reports replace monitoring activity and detection by the government. This approach also assumes that related cost reductions would not be over-compensated by costs for processing the reports and by the potentially increased frequency of imposition of fines.

As an additional incentive for firms to report correctly, it has been suggested that a combination of self-reporting schemes with differential penalties be implemented. The idea is to impose lower penalties on correctly reported violations or pollution than on violations that have gone unreported and that have been detected by the authority (Cohen, 1991, Swierzbinski, 1994, Heyes, 1996, Heyes, 2000). In reality, environmental legislation (for example in the EU)

frequently requires the regulated agents to install monitoring equipment, to report emissions and to report violations of the regulations (e.g. in cases of malfunction of abatement equipment). Furthermore, the US EPA Audit Policy is an example where positive incentives are granted for self-monitoring and correctly self-reported non-compliance. The quality of monitoring data delivered by operators and regulated processes may also be furthered by monitoring certification schemes as used in the UK. In non-OECD (Organization for Economic Cooperation and Development) countries, enterprises frequently lack the necessary monitoring equipment and self-monitoring is hence much less developed (GSFD 2009).

2.4.2 Personal Liability for Non-Compliance

The previously suggested approaches treated the regulated industry uniformly, not distinguishing the various actors. However, it is known that pollution releases may often depend on the individual behaviour of employees (principal-agent relationship between the firm management and employees). Therefore, the question arises as to how sanctions could be best allocated between the firm and the employee. Economists argue that the actors who are in a position to magnify the risk of pollution should have sufficient incentives to reduce this risk. When the hierarchical control of the employees is limited or when specific allocations allow them to evade the burden (for example because the penalty is too high to be recovered from wage reductions), corporate fines are not perfect substitutes. In these cases the allocation of penalties matters, *i.e.* the employee should be penalised rather than the firm and/or imprisonment rather than financial sanctions may be considered (Cohen 1999 and Heyes, 2000).

2.4.3 The Role of the Public, the Courts and Market Forces in Compliance

There are generally two principal enforcement channels: The administrative enforcement channel and a legally-based channel (private litigation). Legally-based enforcement is an important

instrument as it can allow citizens to bring polluters before a court for damage caused by their non-compliance with regulation. A recent text discusses the desirability of this way of so-called "private" enforcement. The advantages of private involvement in enforcement are, amongst other things, the direct impact that has been made on private agents, which may allow them to be better judges of polluting behaviour (due to, for example, proximity of their communities) than enforcement agencies. Private enforcement might also improve enforcement towards certain firm/industry types, such as government-owned polluters, where public enforcers might lack the will to enforce. Private enforcement can also provide the possibility to save government monitoring costs and allows the limited public enforcement means to be better targeted (Cohen, 1991). A disadvantage, however, may be associated with the possibility that private enforcement may lead to over-enforcement and thus to over-deterrence.

2.5 Benefits of Compliance and Enforcement

Over the past forty years, environmental law has been central to government efforts to implement a wide range of environmental programs designed to protect air, water, natural resources, wildlife and public health (INECE 2009). A compliance and enforcement program that is effective and part of a larger environmental management effort will bring a broad range of benefits to society. A well designed environmental compliance and enforcement program will create both public and private value (INECE 2009).

Compliance creates "public value" when it promotes the rule of law and good governance, ensures fairness and strengthens the credibility of environmental requirements, protects the goods and services provided to a society by a well-functioning ecosystem; and protects public health. Compliance creates private value when it increases investor confidence by reducing business risks;

stimulates innovation and increased competitiveness; and creates new jobs and markets (GFSD 2004).

2.6 FACTORS AFFECTING THE IMPLEMENTATION OF EMP

Any step involving the achievement of good environmental quality, inevitably involves some costs (Famiyeh, Kuttu & Anarfo 2013). There are two costs, the cost of implementation and the cost of maintenance of the EMP. The implementation costs include costs incurred from activities a company undertakes to comply with the EMP which involves planning, identifying impacts and develop management plans, training and awareness, communication, documentation and document control, environmental functional reviews, miscellaneous and the registration process. The maintenance costs however comprises the cost incurred in monitoring the EMP, records related to the EMP, auditing and the cost involved in reviewing the EMP to enable continual improvement. Human rather than financial resources are the major barriers impeding EMP implementation, (Goodchild, 1998; Poole, Coombs, & Van Gool, 1999).

Apart from the costs involved, the institutional arrangements and policies can in some ways affects the number of organizations implementing an EMP. In the global market place companies consider institutions and public policies to be critical elements of the business environment. The institutional environment which creates the rules of the game among economic agents influences an agent's ability to efficiently contract with other agents (Williamson, 1996). This in most cases put constraints on industrial organizations, the market in which they operate and the way firms responds to this institutions.

In the environmental arena, the institutional environment is an essential influencing factor for industry because it creates not only the rules of the game, but also the market for environmental products and services. Uncertainty in the institutional environment, such as the behaviour of

environmental regulatory agencies could prevent industries from seeking certification after implementation. For example, regulatory violations by an EMP applicant station might be revealed or disclosed during its environmental certification process and if such violations are used by regulatory agencies or other third parties against the applicant industry, then such legal proceedings would result in additional cost of certification to the applicant station (Famiyeh, Kuttu & Anarfo 2013).

Furthermore, the process of environmental monitoring of filling stations and certification of filling stations may inadvertently lead to the discovery of non-compliance with applicable environmental regulations. Companies forcing to be in compliance with environmental laws and regulations always think of the identification of violations during the implementation phase, self or third-party audits can lead to real liabilities to the industry.

2.7 PROBLEMS ASSOCIATED WITH THE OPERATION OF FILLING STATIONS IN NIGERIA

The EMP provides solution to the generally identified environmental impact associated with the operation of filling stations which include:

i. Spills arising from the sales of petroleum products as a result of overfilling of fuel tanks of automobiles and boats;
ii. Used engine oil (automobile drain oil or waste oil) generated from automobile services;
iii. Leaks from underground storage tanks due to corrosion, accident to the vehicle tanker during product discharge, oil spillage and usage of inferior construction material;
iv. Sanitary wastes;
v. Drainages from car wash and storm water and;
vi. Refuse (EGASPIN 2002)

Licensees/operators of retail outlets are to institute planned and integrated environmental management practices, aimed at ensuring that unforeseen, identified and unidentified environmental issues are contained and brought to an acceptable minimum (EGASPIN 2002).

2.8 LAWS AND REGULATIONS RELATING TO THE OPERATION OF FILLING STATIONS IN KADUNA.

In Nigeria, there are Federal and State Statutory Regulations that have been enacted to regulate the activities of the downstream sector of petroleum with the aim of protecting the environment in the interest of all stakeholders. Several regulations, in the form of acts, edicts, bylaws, ratification of conventions, guidelines etc. have been put in place to cater for environmental and social compliance by filling stations. The compliance with these regulations is equally important for sustainable management and environmental protection. Among these regulations which are specifically targeted to operation of filling stations in Kaduna and Nigeria are examined.

i. Petroleum Act 1969 (Cap.P.10 Laws of the Federation of Nigeria, 2004);
ii. Mineral Oils (Safety) Regulation, Act 1997,
iii. Harmful Waste (Special Criminal Provisions) Act (Cap H1, LFN, 2004);
iv. Environmental Impact Assessment (EIA) Act of 1992 (CAP E12, LFN, 2004);
v. National Environmental Standards and Regulations Enforcement Agency (NESREA) Act of 2007;
vi. National Emergency Management Agency NEMA (Establishment) Act 1999
vii. Oil in Navigable Waters Act 1968 (Cap 06, LFN 2004);
viii. National Oil Spill Detection and Response Agency (NOSDRA) Act 15 of 2006;

ix. Environmental Guidelines and Standards in the Petroleum Industry in Nigeria (EGASPIN) 2002.

x. Kaduna State environmental Protection Authority, (KEPA Law) Edict No.1 of 1998.

The Petroleum Act is the main legislation on the exploration, production, refining and distribution of petroleum resources in Nigeria and contains provisions with respect to safety and environmental protection. Section 8(1) (f), (g) and (h) also confers on the minister the power to suspend any operations which are not being conducted in accordance with "good oil field practice". This wider provision can arguably be applied more broadly to all aspects of pollution. Although this regulation does not define "good oil field practice" the phrase is defined in the Mineral Oils (safety) Regulations as that which is in accordance with the appropriate Institute of Petroleum Safety Code, the American Petroleum Institute Codes, or the American Society of Mechanical Engineering Codes (Emeseh, 2006).

These codes are believed to adopt practices or engineering techniques recognized as being the most effective and practical means to develop the resource, while minimizing adverse environmental and other negative effects (Architecture, Engineering, Construction, Operations and Management {AECOM, 2009}). It is therefore clear that the aim of the Act is to maintain best international standards of operations in terms of health, safety and good environmental practice in Nigeria. However, in light of the evidence of pollution and lack of safety in the industry, it is highly debatable that best filling station practices are being adopted even with provisions of serious sanctions in case of breach of these provisions in Section 6 of the Act. In the UK, the Petroleum Act (1998) vests that all rights to the nation's petroleum resources in the Crown, but the

government can grant licenses that confer exclusive rights to search and bore for and get petroleum. Each of these confers such rights over a limited area and for a limited period.

The oil minerals (safety) regulation 1997 which amends the Oil Minerals safety regulation of 1963 also makes provisions for filling stations operation. The regulation made recommendations in the area of providing clear, comprehensive, safe and practical operational procedures and guidelines, ensuring that every personal protective equipment is judiciously used and maintained in serviceable conditions at all times. The regulation further maintained suitable fire precautions methods and storage tanks inspections requirements.

The Harmful Waste (Special Criminal Provisions) Act prohibits the carrying, dumping or depositing of harmful waste without lawful authority in the air, land or waters of Nigeria. According to the Act, a harmful waste means "any injurious, poisonous, toxic or noxious substance that can subject any person to the risk of death, fatal injury or incurable impairment of physical and mental health".

Furthermore, Environmental impact assessment is a preventative regulatory tool which systematically investigates the long and short term impacts (both positive and negative) of proposed development projects on the natural and human environment (Eneh, 2011). An EIA ensures that potential impacts are assessed, identified and mitigation measures implemented where possible. In appropriate cases, the regulator may refuse permission for the project on environmental and safety grounds. Nigeria introduced this tool through enactment of the EIA Act in1992. Responsibilities under the Act were originally vested in the now moribund FEPA and some of its function (including responsibilities for EIA decisions) now subsumed under the Federal Ministry of Environment (FME).

Under the EIA Guidelines, petrol station projects fall within categories of projects that require an EIA under class A. It can therefore be said that the Act provides a framework to ensure prevention of negative environmental consequences from downstream project development.

The National Environmental Standards and Regulations Enforcement Agency (NESREA), which has responsibility for enforcing compliance with the provisions of international agreements, protocols, conventions and treaties on the environment. NESREA Act of 2007 establishes NESREA as the main environmental regulatory body, (NESREA Act, 2007). While Section 7 provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitory and regulatory measures. Section 8 (1)(K) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution and sanitation (Environmental Law Research Institute {ELRI} 2011).

In general, it is a successor to the now repealed Federal Environmental Protection Agency (FEPA) Decree of 1988 which established the then FEPA as the main environmental regulator. Although there are some variations, on the whole, the two laws are substantially quite similar. **National Effluent Limitation Regulations under NESREA** requires industry facilities to have anti-pollution equipment for the treatment of effluent. The regulation also prohibits the release of hazardous substances into the air, land or water of Nigeria beyond approved limits set by the Agency.

The NEMA Act establishes a National Emergency Management Agency charged with responsibility for Disaster Management in Nigeria. Section 6 of the Act defines disaster as natural or other disaster which includes any disaster arising from any crisis, epidemic, drought, flood earthquake, storm, train, road, aircraft, oil spillage or other accidents and mass deportation or

repatriation of Nigeria from any other country. The inclusion of disaster from road and train transport gives NEMA jurisdiction in an accident scene that is or could lead to potential disaster. This may include accidents involving hazardous material such as petroleum products. Importantly, the Act recognizes the need for integration of national policies via collaboration with state governments. Thus, Section 8 establishes a State Emergency Management Committee (SEMC) in each of the 36 states of the federation. The state SEMCs are to respond to any disaster within the State and may seek assistance from the Agency if it deems fit in any circumstance.

In order to perform their statutory obligation, the agency developed a National Contingency Plan which integrates hazard risks scenario and planning assumptions; objective strategies and guiding principles (NEMA Act). This legislation is seen as establishing a potentially effective structure for disaster management. However, again it suffers from implementation deficits largely due to lack of adequate funding (Ambituuni, Amezaga & Emeseh 2013)

Oil in Navigable Waters Act is another legislation that was passed after the discovery of oil to address environmental problem in this country. The Act, unlike the Petroleum Act, has direct impact on environmental protection by prohibiting the discharge of oil into the sea and navigable waters. The Act under review prohibits the discharge of certain oils into prohibited sea areas and territorial waters of Nigeria. It imposes obligation on ship owners to install anti – pollution equipment. It prescribes penalties for violations. Under the Act, it is an offence punishable by imprisonment to dump oil into the Nigerian territorial waters. The power to enforce the provisions of the Act is vested in the Minister of Transport.

Another relevant legislation is the National Oil Spill Detection and Response Agency (NOSDRA) which was established in 2006 as part of the FME in pursuance of the country's obligations as a party to the International Convention on Oil Pollution Preparedness, Response

and Cooperation (1990), which requires states parties to prepare a National Oil Spill Contingency Plans. The Agency is primarily responsible for coordination and implementation of the blueprint/manual for checking oil spill through, containment, recovery, and remediation/restoration (NOSDRA, 2012) as provided in the National Oil Spill Contingency Plan. However, although spills from filling stations activities can be included in the interpretation of oil spills, the agency appears to focus only on spills from the upstream sector. Possibly, this could be because the NOSDRA Act did not specifically state that the agency should also be involved in downstream oil spill clean-up.

The Department of Petroleum Resources (DPR) has responsibility for enforcing safety and environmental regulations and ensuring that filling stations operations conform to national and international best industry practices and standards (Agha, Irrechukwu and Ziga 2004). It is against this backdrop that the DPR has developed various Environmental Guidelines and Standards in the Petroleum Industry in Nigeria (EGASPIN) covering all aspects of oil and gas operations since 1981, with the current one being in 2002.

According to Agha, Irrechukwu and Ziga (2004) the guidelines were developed to enhance environmental control of the petroleum industry taking into consideration existing local conditions, international practice, available technology, and monitoring programmes. Arguably, the guidelines can be said to have covered most of the regulatory aspects of the petrol stations safety and environmental management of retail outlets including; effluent limitations, standards and monitoring, spill prevention and counter measures plan, management of hazardous waste disposal operations, EIA procedure, and hazard, safety/risk assessment integration. However, even with the inclusion of monitoring programmes, implementation has proven to be essentially in

effectual considering evidence of magnitude of filling stations safety and environmental issues in the country (Fadeyibia et al., 2011).

The Kaduna State Environmental Protection Authority (KEPA) was established by edict of 1994 and later revised in 1998. The regulation (KEPA law) was established to address all environmental problems in the state from all point and non point sources such as filling stations, industries, domestic, commercial, institutional facilities etc, and to change people's negative attitudes towards environmental management for sustainable development. The authority is charged with the responsibility of addressing all environmental problems in the State including but not limited to organizing programmes aim at changing people's negative attitudes towards environmental management for sustainable development.

From the above discussions, it is clear that there is an established regulatory framework, which provides some protection for environmental and safety issues arising from filling stations operations. The question however, is whether these provisions are sufficiently comprehensive, adequate and effective. The analysis so far indicates very limited range of sanctions, clear areas of oversight, lack of specificity in references to international codes, and institutional overlaps and duplication of responsibilities. Most of the relevant state and local environmental laws essentially replicate federal laws. While acknowledging wider enforcement challenges (Emeseh, 2012), there are obviously challenges in the laws which need to be addressed in order to ensure better protection for the environment and citizens.

Conflict exist between the Federal and State agencies over competency with regard to environmental damage arising from oil activities (Emeseh, 2012) due to unclear definition of regulatory jurisdiction. This leads to rivalries and jealousies (Eneh, 2011) resulting in top–down legislation having limited applicability and effect within the downstream context. Again, this is a

further illustration of the way in which lack of comprehensiveness of the regulatory framework affects enforcement. The implication of such overlapping regulatory functions is explained by Eneh (2011) as too expensive, very bureaucratic and time wasting. Consequently, this results in conflicting responsibilities for monitoring and enforcement, and discordant, inconsistent inter–intra organizational relationship (UNEP, 2011). For example, UNEP (2011) found DPR and NOSDRA have differing interpretations of EGASPIN. This has enabled oil industry actors to discontinue remediation processes in oil spill contaminated sites before they have been fully restored to an adequate environmental status.

The institutional environment is an essential influencing factor because it creates not only the rules of the game, but also the market for environmental products and services (As seen in chapter 2 of this work {2.6}). Uncertainty in the institutional environment, such as the behavior of environmental regulatory agencies could prevent industries from seeking certification. This affects enforcement of laws in various sectors of the economy (filling stations included) owing to obstruction and manipulation of the system by actors who are beneficiaries of the dysfunctional system which enables the perpetuation of rent seeking and other underhand practices (Amundsen, 2010). This system is perpetuated through corruption and weakening of the very institutions and structures tasked with ensuring the justice, accountability and the rule of law (Usman and Okolie, 2013).

Poor enforcement of these laws and regulation can also be attributed to inadequate funding of the regulatory agencies by depriving them of the resources required (such as adequate numbers of appropriately trained staff, necessary facilities and equipment, and national coverage of offices) to effectively discharge their regulatory function (Ebigo, 2008). For instance, most issues relating to petrol stations environmental pollution and poor safety operations are particularly visible at state

and local level. However, the main enforcement agencies do not have a sufficiently wide national coverage and concentrate mainly in the capital cities. This limits the agency's ability to monitor and respond to petrol stations related environmental and safety issues in the 36 states in the country. This is not to imply that these agencies are necessarily efficient in the areas where they have a presence. They are unduly dependent on industry players to provide facilities, resources and equipment for monitoring activities. This result in a situation where the opinion of industry players influences the regulators application of policy and reporting of data (Eneh, 2011). This is further complicated within the filling station sector in light of the relationship between the regulators on the one hand and their relations with the government. For example Amundsen (2010) reports a situation where DPR (the main industry regulator) was treated like another arm of the NNPC subject to directives and pressure from the NNPC and the presidency. As a result, DPR often fails to discharge its functions effectively (Osayande, 2008).

In a nut shell, effective monitoring and enforcement by the regulators is crucial to the effectiveness of this laws and regulations, and this is facilitated by the laws being sufficiently robust, comprehensive and consistent; provision of innovative and cost-effective approaches (chapter 2 {2.6}); appropriate institutional capacity and necessary resources to undertake enforcement action; and a conducive wider socio-political and governance environment for effective enforcement (Ogbodo, 2009).

In general, an EMP is the therefore the tool which filling stations use to voluntarily implement these laws and regulations. The EMP consists of a number of these interrelated regulations that function together to help the filling stations manage, measure and improves the environmental aspect of its operations. Compliance with the EMP by the filling stations is

consonant to compliance to environmental regulation. This research work will further expand on the extent of compliance to the EMP by filling stations in the Kaduna.

CHAPTER THREE

3.0 STUDY AREA AND METHODOLOGY

This chapter examines the study area with specific reference to the location, geology and relief, climate, soil and vegetation collectively known as physical features. The human features include the population, commerce and industries. It also discusses the methodology adopted for the study as well as analytical techniques.

3.1 DESCRIPTION OF THE STUDY AREA

3.1.1 Location and Size

Kaduna Metropolis is located between latitudes $10^{\circ}25^{1}$ N and $10^{\circ}36^{1}$ N and longitudes $7^{\circ}23^{1}$ E and $7^{\circ}29^{1}$ E), as shown in Figure 3.1. It shares common boundaries with Igabi Local Government to the northwest and northeast, and Chikun Local Government to the South East. Kaduna Metropolis consists of two LGAs (Kaduna North and South) and parts of other two LGAs Chikun and Igabi. The city was founded by Sir Frederick Lugard in the colonial era as a strategic military and administrative base from what was initially a cluster of villages (Lock, 1968).

Kaduna, the capital of Kaduna State, is one of the most important political, industrial and economic centres in Nigeria. It is also one of the most populous millennium cities and serves as the most important trade and transportation centre in the northern Nigeria. Kaduna is a city characterized by rapid urbanization, rising numbers of cars, filling stations and degradation of local environmental assets. The DPR is responsible for the environmental monitoring of filling stations within the metropolis and environs. It shares this responsibility with Kaduna Environmental Protection Agency (KEPA) and the Fire Service of the four LGAs.

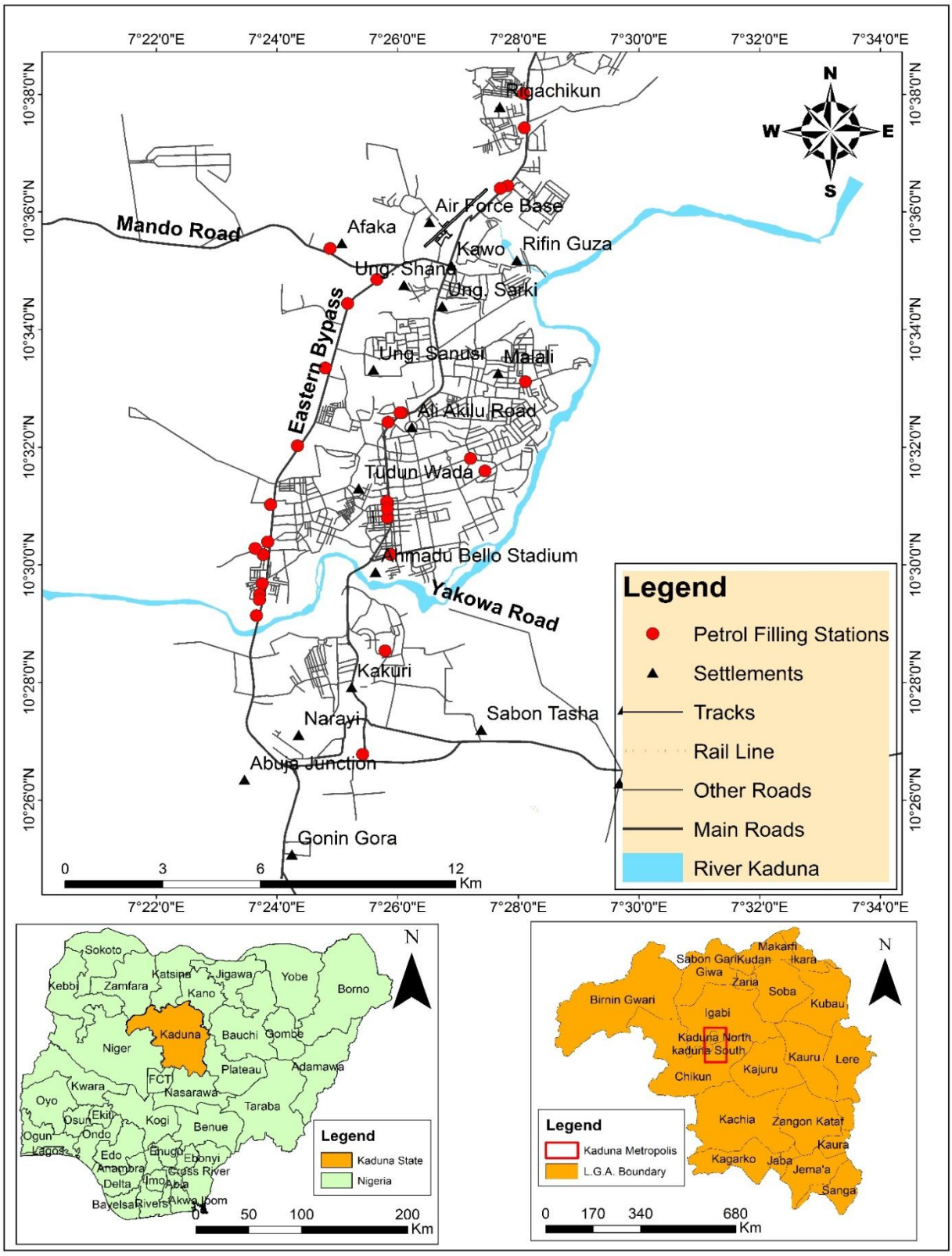


Figure 3.1: Kaduna showing the study area and the sampled stations
Source: Quickbird Image, 2014.

3.1.2 Geology and Relief.

Kaduna is underlain by Precambrian Basement Complex Rock. The bedrock geology is predominantly metamorphic rock of the Nigerian basement complex consisting of biotite, gneisses and older granite. The plains of which Kaduna is situated are part of the vast gently undulating plains scenery to Lake Chad and beyond and from south of Kaduna to the Tigueddi Scarp near Agedes (Mortimore, 1970).

The Land gradually slopes down towards the west and south in west and is drained by Kaduna River which flows for about 210 Kilometer from the Jos Plateau where it obtains it source through sparsely vegetated and populated regions before reaching Kaduna town (Beecrof, 2009). During construction of filling stations, the land is being exposed for burial of underground storage tanks (USTs), the beauty of the landscape is distorted, seepage of oil into the soil and influent of waste water into the soil or drainage may occur during operation of filling stations. With the geology and relief setting of the study area, it is of paramount importance for filling stations to ascertain full compliance with the EMP in order to avoid water and land pollution from petroleum resources.

3.1.3 Climate

The state lies in the northern Guinea Savannah of Central Nigeria and has two distinct seasons – the dry and the wet. The dry season extends from November to March and encompasses dust laden harmattan wind, which is dry and cold in the early months and dry and hot towards the end of the season. During the rainy season, which begins in the month of April and ends in October (Lock, *1968,* Kaduna State government official site, 2010), all petroleum products that have split on the environment will be washed down to the underground aquifer or moved to another area posing threat away from source. An annual average rainfall of 1016mm is recorded for the state

which is high compared to the Sahel savannah zones of the extreme north defined by 600mm of rainfall (Lock, 1968). Highest temperatures, usually in the month of April, are within 35.0° C to 40.6°C and lowest in January within 7.2° to 12.8° where most VOCs evaporate into the atmosphere (Lock, *1968*). When temperature is high, little spark can ignite fire, the location of filling stations has a lot to do with the prevailing winds, if the direction of the filling station is not ideal i.e., the filling station facing east will worsen fire explosion where as when the filling station is facing west will reduce fire due to the direction of the wind.

3.1.4 Soil and Vegetation

The soils and vegetation are typical red brown to red yellow tropical ferruginous soils and savannah grassland with scattered trees and woody shrubs. The soils in the upland areas are rich in red clay and sand but poor in organic matter. However, soil within the "fadama" areas is richer in kaolinitic clay and organic matter, very heavy and poorly drained, characteristic of vertisols. Fringe forests ("*kurm*i in hausa language") in some localities, are presently at the mercies of increasing demands for fuel wood in the fast growing town and urban centers (Bello 2000). Filling stations brings about land use change, desertification and unstable soil. Compliance to EMP by filling stations in Kaduna will help to restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere and to preserve biological diversity and the principle of optimum sustainability in the use of natural resources and ecosystems.

3.1.5 Population

Kaduna, the capital of Kaduna state, is one of the largest cities in northern Nigeria ranked as the fourth most populous and important political, industrial and economic centres in Nigeria. As at 1991, the population of Kaduna metropolis was 1,098,013. In view of differences and errors in population figure, exponential method was used to project for the population of Kaduna

metropolis for 2016. Using the state growth rate (3.8%) which put the value at 2,839, 143. The metropolis is made up of different ethnic groups including, the Hausa, Jarawa, and the Gwari.

3.1.6 Commerce and Industries

There are six distant institutions and departments in the government machinery which are traffic related and describe the frequent usage of filling stations. These include the personnel, agriculture, health, finance, works and educational developments. It is not astonishing that there are over 400 primary and secondary schools spread around the nook and crannies of the metropolis, over 13 financial institutions with many branches such as First Bank of Nigeria and United Bank of Africa (UBA) PLC, many government health facilities and private ones too, industries and transportation, among others. All these situated within the study area describes the high demand for road transportation for the flow of commuters within the institutions and residential areas. In fact, the commercial activities of one of the L.G.A centre mainly on markets and transport (Zazzau Emirate Development Association [ZEMDA] 2015). The influx of migrants into the study area also increases the number of vehicles that will operate within these areas and also the frequency of the utilization of the filling stations viz-a-viz the rationale for the mass/proliferation of new filling stations within the study area.

Other facilities that require the use of petroleum products includes farm machineries, owing to the fact that some parts in the study area engage in commercial food production (ZEMDA 2015). Some commercial activities such as shops, hotels, restaurant and laboratories also use generators to aid their businesses. These machineries however use petroleum product to function which therefore determines petrol demand and consumption rate within the study area.

Currently there are three categories of owners and managers of filling stations in the study area namely;

3.1.6.1 Major oil marketers

Major oil marketers are multinationals with local oil and gas retail outlets and have been in the business for much longer than the independent marketers. The companies in this group belong to a trade association called the Major Oil Marketers Association of Nigeria (MOMAN). These multinationals usually construct filling stations and appoint dealers to manage them under their supervision. These filling stations are licensed and supervised by DPR and generally required to operate with the Regulations and Guidelines of the Oil and Gas Industry in Nigeria.

Six major marketers are listed in the Nigerian Stock Exchange. They are: Africa Petroleum Plc (now Forte Oil), Conoil Plc, Mobil Oil Nigeria Plc, Oando Plc, Total Nigeria Plc e.t.c.

3.1.6.2 Independent Marketers

Independent marketers are private retailers of oil and gas products. Their existence became necessary due to limitations of major marketers in concentrating their business in the most profitable locations. They include Edijen Company Nigeria ltd, Royal arms Petroleum and Co ltd, Yan biyu Petroleum Ltd, Akon petroleum ltd, and Afdin Petroleum Sevice ltd. DPR and other relevant regulatory agencies are responsible for approving the construction and monitoring of Independent filling station and to ensure they comply with existing Regulations and Guidelines.

3.1.6.3 NNPC Retail Outlets

NNPC Retail Limited established strategic retail outlets in different part of the nation for safe, reliable and profitable retailing of petroleum products. It is a subsidiary of the NNPC, it is responsible for handling the retail of petroleum products. The Mega Stations are categorized as follows; Super Mega Stations, Mega Stations, Floating Mega Stations, Affiliate Stations and Standard Stations. This categorization is based on size and facilities of each station. NNPC currently maintain 37 Mega Stations, 12 Floating Stations and over 500 Affiliate Stations across

the country. The number of affiliate's stations is frequently reviewed based on local demands (NNPC 2015).

3.2 RESEARCH METHODOLOGY

This section discusses the methods employed in generating data for the study. The section focuses on the types of data, the sources of data, the sampling design and the methods of data analysis.

3.2.1 Reconnaissance Survey

A reconnaissance survey of the selected filling stations was carried out in the study area. The DPR (zonal office Kaduna) provided the list of all licensed filling stations in Kaduna. This enabled the determination of the sampling techniques and in designing research instrument. The fillings stations were visited so as to be sure they were not decommissioned. Information on the laws and regulation relating to operation of filling stations in Nigeria and Kaduna were obtained from National Environmental Standard and Regulation Enforcement Agency (NESREA), National Oil Spill Detection and Regulation Agency (NOSDRA), Federal Fire Service (FFS) and Kaduna State Environmental Protection Agency (KEPA).

3.2.2 Types of Data

The types of data needed to achieve the objectives of this research work include:

1. Data on the extent of compliance to EMP by NNPC, major and independent managed stations such as the general housekeeping practice, Leak and Spill detection technique, fire control mechanism among others.
2. Data on the capacity of the EMP in environmental management of problems associated with the operation of filling stations

3. Data on the constraints to compliance with EMP by filling stations such as availability of unit that ensures EMP implementation, reports, certification record keeping among others.

3.2.3 Sources of Data

3.2.3.1 Primary Sources of Data

The researcher employed the use of questionnaire to the managers of filling stations to gather responses on compliance level to EMP by filling stations in Kaduna as well as unstructured interview with agencies namely; DPR, Federal Fire Service (FFS) and Kaduna KEPA.

3.2.3.2 Secondary Sources of Data

These include relevant information obtained from documents from the filling stations, DPR, KEPA, and FFS Office. Others include published and unpublished sources such as relevant textbooks, internet materials, journals and related literatures.

3.2.4 Sample Size and Techniques

The sampling frame for this study is the management staff of the filling stations. Information from DPR shows that there are 290 filling stations within the nook and crannies of the metropolis (26 mega stations, 58 major marketers and 206 independent marketers). However, having determined the sample frame, stratified sampling was used in selecting the filling stations for this study. The filling stations were divided into three strata based on the ownership, which were NNPC managed stations, major and independent marketers. In each of the stratum, a random sampling technique was used for the selection of filling stations where stations were sampled, altogether 10% of each of the stratum was randomly selected which gave a total of 3, 6 and 21 accordingly. Hence, this study will base on 30 filling stations as a representative of the entire petrol stations in the study area.

3.2.5 Sampling Design

In administering the questionnaire, a purposive sampling technique was used to identify the targeted respondent from each of the filling station. In this case operational managers of the filling stations were sampled. This was made possible by asking the respondents their post before giving them the questionnaire, such that only those within the target filled the questionnaire. However, since the filling stations have one operational manager per station, one questionnaire was admitted to each filling station which gives a number of 30 questionnaire. The checklist was rated on 5-point scale Likert of Excellent (5), Very Good (4), Good (3), Fair (2) and Poor (1) (see Appendix II)

3.2.6 Method of Data Analysis

Specific method used in the analysis is as indicated in the objectives. The objectives of the research were achieved as follows:

Objective 1: Assess the extent of compliance to EMP by NNPC, major and independent managed stations in Kaduna metropolis

Extent of compliance was from the questionnaires to management of the stations and examination of records by the stations. Data were analyzed using descriptive statistic and presented in form of tables and graphs.

Objective 2: compare the compliance level of the three categories of filling stations in Kaduna metropolis.

Check list on EMP requirement such as protective clothing, warning signs, firefighting and prevention equipment was made among the filling stations. The result from the three (3) categories of the filling stations was used to determine which one comply more and why. Data were analyzed

using descriptive statistic and presented in form of tables. Kruskal walli H test was used to test for hypothesis on the assumption that "there is and there is no significant difference in the compliance level to EMP by NNPC, major and independently managed filling stations in the study area. This will be tested at 0.05 level of significance.

Objective 3: Examine the potentials of EMP in the management of the environment in the vicinity of the filling stations

Potentials of the EMP were determined from responses of the operators of the filling stations, on the ability of the EMP to mitigate the environmental hazards of filling stations. The objective was achieved descriptively using frequency tables, charts, and percentages.

Objective 4: Examine the major constraining factors to EMP implementation in Kaduna

Major constraining factors to EMP implementation was also from the questionnaires to management of the stations, therefore, the objective was achieved descriptively using frequency tables charts, and percentages, indicating the major constraints to EMP implementation.

The criteria for the description of the EMP, extent and level of compliance, assessment of the potentials and constraining factors to EMP were drawn from regulations and laid down principles for EMP of filling stations in Nigeria.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

This Chapter deals with the presentation and analysis of data which were collected from both primary and secondary sources. This chapter is divided into four sections, section one covers issues concerning EMP implementation in the filling stations in Kaduna metropolis, section two covers analysis of the differences in the level of compliance among the three categories of filling stations, section three explores the potentials of EMP in the management of the environment in the vicinity of the filling stations whereas section four document the major constraining factors to EMP.

4.1 EXTENT OF COMPLIANCE: HOUSEKEEPING PRACTICE

4.1.1 Types of Waste Generated in the Filling Stations

Waste from the filling station is categorized into two – solid and liquid (effluent) waste. Solid which mostly are mixed wastes such as cans, polythene, plastics, or used vehicle parts from workshops while the liquid form waste water, used oil, oil or grease used etc. Table 4.1 gives the type of waste generated by the filling stations

Table 4.1 Types of Waste Generated

Waste Types	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Solid	1	-	4	16
Liquid	-	2	6	27
Both	2	4	11	57
Total	3	6	21	100

Source: Field work 2016

Based on the field survey, 16% of the filling stations generate only solid waste, 27% generate liquid waste while 57% generates both solid and liquid waste. Waste forms an integral part of filling stations operation, this waste when not properly handle emits greenhouse gases, toxic

fumes, and VOCs which are detrimental to the environment. How these wastes are managed is therefore important.

4.1.2 Method of Solid Waste Treatment/Disposal.

Table 4.2 shows the method of solid waste treatment/disposal by the filling stations.

Table 4.2 Method of Solid Waste Treatment/Disposal

Method	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Segregation before collection	1	1	3	17
Treatment before disposal	-	1	2	10
Collection by waste contractors	2	4	16	73
Burning	-	-	-	-
Total	3	6	21	100

Source: Field work 2016

The result shows that 17% of the filling stations segregate their waste before being disposed, 10% treat the waste before disposal and 73% of the filling stations maintained that refuse is being collected by waste contractors. The percentage of filling stations that segregate and treat waste before disposal is therefore below average. Waste such as used rags or any oily materials or containers are supposed to be segregated and treated before disposal. How these wastes are disposed is important because they are mostly of chemical sources (petroleum products), as such, are toxic or harmful to both human and the environment if not properly disposed-of.

This observation was in agreement with Cointreau, (1982) who pointed out that in most developing countries such as Nigeria, waste generally are indiscriminately disposed closed to residential houses, markets, farms, road sides and drainage channels constituting threat to

human/aquatic lives and environmental safety. Olurunfemi and Odika, (1998) equally affirmed this as they stated that waste generated by industries and commercial centers such as chemicals, paints, pesticides, grease and oil sludge reduce the aesthetic value of the environment. Most filling stations studied dump their waste at the backyard without waste receptacle and further collected by waste contractors is in contravention to EGASPIN (2002) and KEPA Law (1998).

4.1.3 Effluent Generation at the Lube Bay or During Tank Cleaning

Table 4.3 provides the analysis of effluent generation at the lube bay or during tank cleaning

Table 4.3 Effluent Generation at the Lube Bay or During Tank Cleaning

Effluent Generation	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Generated	1	4	12	57
Not Generated	2	2	9	43
Total	3	6	21	100

Source: Field work 2016

The field survey shows that 57% of the filling stations generate effluent at the lube bay and during tank cleaning while 43% mentioned not generating effluent. Effluent generating stations mentioned that the waste oil is being collected in containers or receptacle and sold elsewhere; whereas any other liquid waste or effluent is channeled into main drainage present in front of the forecourts. Cleaning of open chassis, not encased engines, gear boxes and hydraulic equipment e.g. like dumper, excavators, communal machines, agricultural and forestry equipment result in heavy polluted wash water as compared to closed chassis like passenger cars, buses etc (Raad, Margane and Saade, 2011).

Data collected shows one of the tanks from a sampled station being occupied with water to a certain level and the method of evacuating the effluent waste was discharge via pipe into the

main drainage present in front of the forecourt. Based on EGASPIN (2002) under effluent limitations, Standard and Monitoring, effluents should not be discharged directly to the highway or public sewers. These effluents (oily waste water, solid waste and lubricants) shall pass through an efficiently operated oil/water separator. KEPA law also states that "any person who generates liquid waste shall be required to provide suitable holding tanks, from which the waste shall be carried for disposal. This therefore connotes the lack of compliance to EMP provisions by filling stations. It is often mentioned that petroleum product as flammable liquid can float on water surface over a considerable distance therefore posing danger away from source.

Also, none of the filling stations studied when inquired could produce a copy of permit for discharge point sources of oily or spent lubricant. A permit is required for the discharge of produce water and all existing point sources of produced water have to be registered with DPR. Also, the discharge of effluent waste without a permit is in non-compliance with the KEPA edict which states that "no industry or facility shall release effluent with constituents beyond permissible limits into the public drains, rivers, lakes, pools surface or underground injection without a waste Discharge/disposal permit issued by the authority or any organization designated by the authority.

The National Effluent Limitation Regulation under NESREA, require facilities such as filling stations to have anti pollution equipment for the treatment of effluent, still under NESREA, the harmful waste act and oil in navigable water act, prohibits the release of hazardous substance into land, air and water bodies.

4.1.3 Spillage Cases in the Filling Stations

The occurrence of spillage cases in the filling stations is analyzed in Table 4.4

Table 4.4 Spillage Cases in the Filling Stations

Spillage Cases	NNPC Managed Stations	Major Marketers	Independent marketers	Percentage
Spillage Cases	2	-	18	67
No Spillage	1	6	3	33
Total	3	6	21	100

Source: Field survey 2016

Table 4.4 shows that 67% of the responding filling stations have experienced oil spillage while only 33% have not experience spillage. Oil spill occur in filling stations due to the activities carried out within the stations. Oil spill refers to the release of liquid petroleum hydrocarbon into the natural environment as a result human activities (Bello and Anobeme 2015). Accidental release of fuel from filling stations may occur due to: leaks from storage tanks and connecting pipe work arising from damage, aging or improper installation; small spills during unloading or vehicle filling which are not cleaned up; failure or absence of oil/water separators on drainage systems; failure to control rainwater run-off by appropriate drainage; failure to drain tanks and pipe work adequately prior to maintenance and repair work and major spill, such as a tank failure or overfilling. Evidence in plate I shows oil spill during operation in one of the filling station.



Plate I: Oil Spill in one of the visited stations

When oil spill occurs, the effluent will either dry up, move directly into the main drainage instead of oil water separator, or washed away during rainy season. A major spill also occurred in one of the filling stations under study; the adaptor was not properly fixed which spilled up to about 5000 litres of fuel that flowed to the main drainage in front of the forecourt. The ignition source was one of the motorist whom were queued up to buy the product closed to the drainage, started the vehicle which ignited the fire. Plate II shows the burning filling station as a result of major spill which occurred during offloading of premium motor spirit (PMS).



Plate II: Fire outbreak due to major oil spill in one of the studied NNPC managed station (24th April, 2016)

Officials of the F.F.S Kaduna attributed this fire incident to lack of effective mitigation measures, and compliance to safety requirement for the operation of filling stations. The official further mentioned that a unit is to be on standby with concentrated foam water and delivery horses once petrol is being offloaded in to Underground Storage Tanks (USTs) to avoid such incidence from occurring as the requirement provides. This shows that there is a lack of compliance to EMP implementation by the filling stations. Plate III shows the NNPC filling station burnt down due to major spill whereas plate IV is the affected nearby filling station that shares boundary with the affected station also half burnt and according to DPR guidelines for approval to construct and

operate petroleum products filling station, the distance between two stations will not be less than 400 metres.





Plate III: Burnt NNPC Filling Station (24th Apri l, 2016) **Plate IV: Affected nearby station (24th April, 2016)**

4.1.5 Cleaning Spill during Offloading and Unloading

Table 4.5 shows the method employed by the filling stations in cleaning spill.

Table 4.5 Cleaning Spill during Offloading and Unloading

Methods	NNPC Managed Stations	Major Marketers	Independent marketers	Percentage
Allowed to dry	-	-	7	23
Use of sand	2	2	5	30

Use of water and detergent	1	4	9	47
Total	**3**	**6**	**21**	**100**

Source: Field survey 2016

Close examination of Table 4.5 shows that 23% of the filling stations allow fuel from spillage to dry, 30% use sand to absorb the fuel while 47% use water and detergent. However, when fuel is allowed to dry, the hydrocarbon in it evaporate into the atmosphere and once inhaled, causes different diseases such as cancer (Raad, Margane and Saade 2012) water and detergent was the common method used (47%) even though some do not add detergent.

Also, in the case of using sand for cleaning, throwing the sand at the backyard appears to be the cheapest method of disposal, (when compared to treating) majorly used by the operators (83%), while 27% throw it into the drainage, none of the filling stations treat this sand before disposing. This substance is later washed during rainy season into the environment. In the real sense, material used to clean up spills is contaminated and therefore disposed safely, if necessary by a hazardous waste disposal specialist.

4.1.6 Leakage Cases from the Filling Stations

Table 4.6 provides the analysis of filling stations with occurrence of leakage in the study area.

Table 4.6 Leakage Case from the Filling Stations

Leakage Cases	NNPC Managed Stations	Major Marketers	Independent marketers	Percentage

Leakage cases	1	1	3	10
No leakage cases	2	5	18	90
Total	**3**	**6**	**21**	**100**

Source: field survey 2016.

Field investigation revealed that 90% of the filling stations claimed that there have not been leakage cases while 10% have experienced incidence of leakages. The leakages were said to have come from connecting pipe network and storage tanks. Michigan (1995) noted that even a small drop of gasoline leak of one drop per second can result in the release of about 1500 litres of petrol into the ground water in one year, since one drop of fuel can contaminate about 300cm of water, even a few quarts of gasoline in the groundwater may be enough to severely pollute water resources. At low levels of contaminations, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health.

It is widely proven that one of the major sources of contamination of soil, air, underground and surface water has been related to fuel tank leak, processed chemical product and diluted rejects (Moschini et al, 2005). As at 1985, fuel underground storage tanks became a priority in the United States, leading to the regulation by the European Protection Authority (EPA) of prevention, detection and fixing of leaking tanks as well as to the creation of a specific agency (Office of USTs) to supervise these aspects (EPA 1984).

More so, data collected from the field identified 2 filling stations with their USTs leaking and each using inappropriate method of solving the problem, information from DPR shows that those cases were not reported to the authority; this could be attributed to the fear of the cost of cleaning or follow up measures by the service providers and the DPR not doing intent routine monitoring.



Plate V: Effluent from a leaking tank in the filling station.



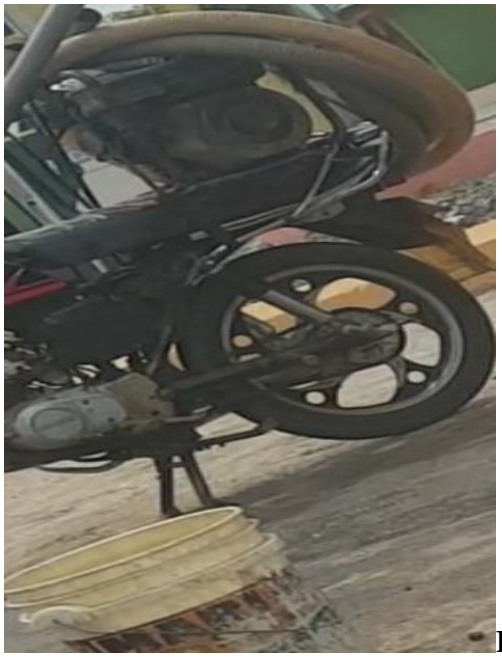


Plate VI: Local Contractor within the Filling Station.

Plate VII: Effluent discharged into the soil

Plate V shows the activities carried out in one the sampled filling stations with an UST leakage. One and half drum of effluent was discharged into the drainage and on the soil surface within the filling station and the remaining fuel separated from water (plate V). The remaining

effluent from the tank was being separated from water using drum and bucket, the effluent was discharged from the USTs via generator and pipe (plate VI) where as plate VII shows evident area where the unwanted fuel was disposed within the station premises. This shows clear evidence of leakages cases and lack of compliance with the EMP.

4.1.7 Method of Detecting Leakage in the Filling Stations

Leak detection system and monitoring wells are part of the measures to monitoring pollution in filling stations. Most filling stations lack these safety measures of preventing, detecting and controlling leaks and spill as stipulated in EGASPIN 2002. Table 4.7 identifies the filling stations with and without leak detection technique.

Table 4.7: Method of Detecting Leakage in the Filling Stations

Methods	**NNPC Managed Stations**	**Major Marketers**	**Independent marketers**	**Percentage**
Leak detection system	-	2	1	10
Monitoring wells	-	2	3	17
None	3	2	17	73
Total	**3**	**6**	**21**	**100**

Source: field survey 2016

Analysis on Table 4.7 shows that, majority (73%) of the respondents neither employs the leak detection system or monitoring wells, only 10% uses the leak detection machine, while 17% uses monitoring wells, a rationale for leakage cases being on the average (table 4.5). This means that even if there are leakages anywhere at the filling stations, there is no way of detecting and this a serious environmental threat. There have been several instances where filling stations especially in the United States have been fined for not attending to leakage cases properly. Monitoring wells

in addition to leakage detection system are critical in the prevention of soil and water pollution by leaking underground fuel storage tanks.

Filling stations are potential sources of pollutants and contaminants of ground water resource. In a country where access to portable water is limited even in a rapidly urbanizing city such as Kaduna, appropriate mitigations of this potential risk ought to be in place for the prevention and management of ground water pollution. Monitoring wells in addition to leakage detection system are critical in the prevention of soil and water pollution by leaking underground fuel storage tanks.

More so, cleaning may be needed regularly in order to prepare a tank for re-lining or to remove built up solid and liquid residues. Majority of the operators (68%) maintain they did not have solid or liquid residue in their tanks, while others (32%) claimed that tanks are cleaned only when solid or liquid is found within the tank. This is in contrast with what is contained in Mineral Oil (Safety) Regulation which states that the storage tank shall be opened for internal inspection at intervals of not more than 60 calendar months.

4.1.8 Hazard Communication Channels

The types of hazard communication channels use by the stations is as shown in Table 4.8

Table 4.8 Hazard Communication Channels

H.C.C	NNPC Managed stations	Major Marketers	Independent marketers	Percentage
Use of Posters	-	2	6	27
Bulletins	-	-	-	
Slogans	-	-	-	
Jingles	-	-	-	
No Smoking signs	3	4	15	73
Total	**3**	**6**	**21**	**100**

Source: field survey, 2016

The use of conspicuous and easily understood notices can help safety of operations at the filling stations and the effective action necessary in the event of a fire or other emergencies. Close examination of the Table 4.8 shows that 27% of the filling stations use posters to communicate hazards to workers as well as the customers. There are therefore clear advantages in following the basic safety signs and colour system for notices/hazard communication channels whether or not they are or include pictorial symbol. In view of possibility of fire accidents, there was 73% compliance by filling stations, on display of "No SMOKING" sign within their premises.

Based on information obtained and presented in table 4.1 to 4.8, a general overview was that filling stations in Kaduna show reluctance in compliance with the EMP during their operational activities. Most EMP requirements were not strictly adhered to, their activities were therefore detrimental to the environment i.e., effluent discharged directly into drainages, spilt oil allowed to dry and so on. However, major marketers show higher level of compliance to the EMP than NNPC and independently managed stations in Kaduna. This is in accordance with the work of Ahmed et al (2014) and Afolabi, Olajide and Omotayo (2011) who asserted that petrol stations

own/run by conglomerates (major and NNPC managed stations) had better standards than those run by independent petroleum marketers (IPMs) in Minna town and Ile-Ife respectively.

4.2 ANALYSIS OF THE COMPLIANCE LEVEL AMONG THE THREE CATEGORIES OF FILLING STATIONS

4.2.1 Checklist for the Compliance to EMP by Filling Stations

Table 4.9 shows a checklist on the compliance level to EMP across the different categories of filling stations in Kaduna Metropolis.

Table 4.9: Checklist of the Compliance to EMP by Filling Stations

Checklist	NNPC Managed Stations	Major Marketers	Independent Marketers
Fire extinguishers	4	5	1
Sand buckets	2	5	1
Practices of attendant during dispensing	3	4	2
Use of protective wears by attendants	3	4	1
Leakage monitoring wells	1	3	1
EMP on display	1	2	1
Documented Accidents and vandalism	1	1	1
Onsite first aid box	3	4	2
Fire/heat/smoke sensors	1	1	1
leak detection systems	1	3	1
contingency plans for spills and fires	2	3	2

means of escape and fire alarms/detection	2	3	1

Source: Field survey, 2016

Table 4.9 shows variables which are to be adequate during the operational phase of filling stations. This was analyzed based on likert scale of Excellent (5), Very Good (4), Good (3), Fair (2) and Poor (1). The Table (4.9) shows low level of compliance to EMP in filling stations owned by independent marketers than the mega stations. This indicates that filling stations managed by major marketers comply more with EMP requirements than the NNPC and independent marketers consecutively. This is believed to be due to higher standards, higher level of enlightenment and awareness programme and greater compliance with existing relevant laws and regulation. The appalling non compliance to EMP observed in filling stations managed by independent marketers was attributed to ignorance, profit maximization and the absence of a functional environmental monitoring and evaluation.

4.2.2 Hypotheses

Table 4.10 shows a kruskal walli H test of the mean response of compliance level among the three categories of the filling stations.

Table 4.10: Distribution of H-Test on the compliance level among the three categories of filling stations

NNPC		**Major Marketers**		**NNPC**	
Variables	**Rank**	**Variables**	**Rank**	**Variables**	**Rank**
1	8.5	1	8.5	1	8.5
2	20	2	20	2	20
3	27	3	27		
4	32.5	4	32.5		
$R_A = 88$		$R_B = 123.5$		$R_C = 28.5$	
$n_A=4$		$n_B=5$		$n_C=2$	

Summary of H-test

H	375.82
Ranks	428.04

P	5.268
Critical value	0.05

Interpretation

Statistics in table 4.10 reveals a significant difference in the compliance level of the three categories of filling stations; H = 375.8 greater than P (5.27). Thus, the null hypothesis that postulated no significant difference in the level of compliance to EMP by NNPC, major and independently managed filling stations is thereby rejected. The conclusion is that there is significant difference in the level of compliance to EMP by NNPC, major and independently managed filling stations in the study area. This implies that the level of compliance to EMP by the three (3) categories of filling stations in Kaduna varies significantly. The test result therefore is line with findings in table 4.1 to 4.8 which shows higher level of compliance to EMP requirements in the major marketers than in NNPC and independent marketers.

4.3 POTENTIALS OF EMP IN THE MANAGEMENT OF THE ENVIRONMENT IN THE VICINITY OF THE FILLING STATIONS

4.3.1 Quality of EMP in environmental management based on laid down procedure by DPR

Table 4.11 shows the respondents assessment on the quality of the EMP in environmental management of filling stations based on the laid down procedure by the DPR.

Table 4.11 Quality of EMP in environmental management

Quality	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage

Excellent	3	3	16	73
Very good		2	3	17
Good		1	2	10
Fair				
Poor				
Total	3	6	21	100

Source: Field Survey 2016

As shown in Table 4.11, 73% of the respondents admit that the EMP has excellent capacity and standard that would ensure effective environmental management of filling stations activities based on the laid down procedure by DPR. While 17% posit that the quality of the EMP is very good, 10% also succumb to the effectiveness of the subject matter. A properly developed EMP therefore is a key element in the sound management of environmental pollution (Peterson and Diss-Torrarance, 2012). A debate on the positive and negative effect of EMP suggests that implementing effective EMP can be expected to improve environmental performance (Alvarez et al 2001). The findings revealed that all the filling stations agreed that the EMP based on the laid down procedure has the potentials of reducing environmental impact arising from the operations of the filling stations and can enhance environmental management.

In a study conducted by Makalene (2015) on the impact of EMPs on firms compliance with governmental regulations and environmental performance, a case study of two manufacturing firms (public and private) in South Africa reveals that after implementing the EMP for 6 months or in the second quarter of implementing and monitoring the EMP, both firms had improved their compliance levels from 25% and 30% to at least 60%. After 12 months of EMP implementation and monitoring, the compliance levels in both firms moved from 25% and 30% to almost 100%. This shows that when EMPs are well implemented and monitored, has the quality to manage

environmental hazards arising from any facility operations and also improve overall operational management of the vicinity of the filling stations.

4.3.2 Level of implementation of the EMP in the filling stations

The level of implementation of the EMP varies considerably across the three categories of the filling stations. Some filling stations do just enough to implement the EMP, some do less and others do not implement at all. Table 4.12 is the distribution of the level of implementation of the EMP in the filling stations

Table 4.12 Level of implementation of the EMP in the filling stations

EMP implementation	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Strongly Implemented		2		7
Implemented	1	3	2	20
Fairly Implemented	2	1	5	27
Not implemented			4	13
Strongly not Implemented			10	33
Total	3	6	21	100

Source: Field Survey 2016

The Table (4.12) reveals that only 7% of the filling stations absolutely implement the EMP into their operational activities, 33% confirmed that EMP is strongly not implemented in the filling stations. This is closely followed by the 27% and 20% of the filling stations who maintained that there is strong level of implementation of the EMP by the filling stations. However, 13% indicated that EMP is not well implemented. EMP implementation is required to mitigate and manage environmental risk. An implemented EMP has the potential to manage the identified impacts associated with various operations in the filling stations under study. The finding also agrees with

the work of Walker, Redmond and Goeft, (2007) that reported only 26% of industries in Australia implemented environmental management plan.

The EMP has increasingly become part of the conditions for the approval of environmental compliance (Makalene 2015). Owing to the consideration that, in any facility operation, implementation of the EMP must be 100%, implies that filling stations in kaduna averagely implement the EMP even though their activities and mode of operations do not imply average compliance. This is in line with the work of Makalene 2015 on the findings on the level of compliance to EMP by two manufacturing company (public and private) in South Africa which reveals that private firm implement the EMP only to 25% while the public firm implement to 30% which therefore is less than average.

4.3.3 Assessment of the potentials of the EMP in reducing leakages

The potentials of the EMP in management of leakage is thus examined in Table 4.13

Table 4.13 Assessment of the potentials of the EMP to reduce leakages

EMP implementation	**NNPC Managed Stations**	**Major Marketers**	**Independent Marketers**	**Percentage**
Strongly reduce the impact	3	5	19	90
Reduce the impact		1	1	7
Fairly reduce the impact				
Not reducing the impact				
Strongly Not reducing the impact			1	3
Total	3	6	21	100

Source: Field Survey 2016

The analysis of result in Table 4.13 reveals that 90% of the filling stations strongly agree that; consistent, accurate monitoring of petrol delivered, stored and dispensed should be carried out at the filling stations to detect leaks from each underground tank and connected pipeline system, placement of monitoring well at each corner of the excavation for each underground tank prior to backfilling. Regular monitoring (at least every 3 months) of the monitoring wells must be undertaken to prevent pollution. Records of monitoring must be kept and made available to the legal authority on request. The filling stations strongly agree that leak detectors must be onsite and regularly tested and records kept. All machinery must be maintained in good working order so as to prevent soil or water pollution from oil, fuel or other leaks. At least once during each working day an inventory check and record should be made has the potentials of reducing leakages. This is followed by 7% who reasonably agree that the aforementioned measures when implemented and monitored can reduce leakages to an acceptable level, while 3% of the respondents remain indifferent on the subject matter.

One of the operators confirmed that when the filling stations employed all these measure into their activities, it was easier for the operators to indicate any leaking tank or pipe. Other stations affirmed that leakages is detected only when customers complain of mixture of the fuel with water or when the litres of fuel sold is low compared to the expected litres available in the tank.

4.3.4 Assessment of the potentials of the EMP to reduce spillages

In all situations, a properly equipped and clearly marked spill kit is kept in a handy location; all staff are trained in emergency spill procedures and know where the spill kit is kept. A spill management plan should be written to ensure effective response to spills. Staffers should be familiar with the EMP and it is regularly updated. Any spills should be removed promptly from

petrol interceptors and drainage channels, if necessary by a waste disposal specialist. Table 4.14 provides the degree of acceptance of the EMP as a tool for spill control.

Table 4.14 Assessment of the potentials of the EMP to reduce spillage

EMP implementation	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Strongly agree	3	4	13	67
Agree		1	5	20
Fairly agree				
Disagree				
Strongly disagree		1	3	13
Total	3	6	21	100

Source: Field Survey 2016

Field investigations revealed that 87% of the respondents affirmed the aforementioned mitigation measures as essential element in controlling oil spill in the filling stations while 13% strongly disagree that the mitigation measures has the potentials of reducing oil spill in the vicinity of the filling stations. Distribution on table 4.14 shows that 67% of the respondents strongly agree with the spill mitigation measures as effective management measures followed by 20% that agreed that the spill mitigation measures are very good in controlling and reducing oil spill.

The respondents affirmed that oil spill pollute the environment resulting in product and financial losses, reputation damage and set people and assets at risk. To reduce the extent of the damage whenever spill occur or to respond to or avoid spill from occurring, there is need to employ the leak detection system and other spill control measures. However based on baseline information from the field, 67% of the fillings stations experience oil spills in their day to day activities with a very low remedial action yet strongly agree with the measures of the EMP in mitigating oil spill.

4.3.5 Assessment of the effluent management measures in reducing environmental impact

Table 4.15 addresses the degree of the acceptance of the respondents on whether the EMP has the potential of reducing and mitigating impact of the effluent from the filling stations.

Table 4.15 Level of acceptance of effluent management measures in reducing environmental impact

Effluent management measures	**NNPC Managed Stations**	**Major Marketers**	**Independent Marketers**	**Percentage**
Strongly agree	3	6	16	83
Agree			2	7
Strongly disagree				
Disagree				
Silent			3	10
Total	3	6	21	100

Source: Field Survey 2016

Close examination of Table 4.15 shows that 83% of the respondents strongly agree with the potentials of effluent management measures in reducing its impact on the environment. Close to 7% also agree with the notion while 10% were silent as to whether the measures have the capacity to manage effluent or not. It is statutorily required that effluent from filling stations should not be discharged directly to the highway or public sewers. This effluent shall pass through an efficient oil water separator (EGASPIN 2002). The agreement with the Authority to handle additional sewage and effluent from the filling stations must be in place. Clean and dirty water systems must be separated to prevent contaminated run-off from entering the surface and groundwater and soil. Effluent from the filling station must not flow to the street, or into watercourses or into storm water systems without first passing through a separator. Yet the seemingly agreed respondents do not comply with the EMP to reduce the impact (Table 4.3).

4.3.6 Assessment of the potentials of EMP in fire hazard control.

Figure 4.1 shows the respondents degree of acceptance of the potential of EMP in managing fire hazard

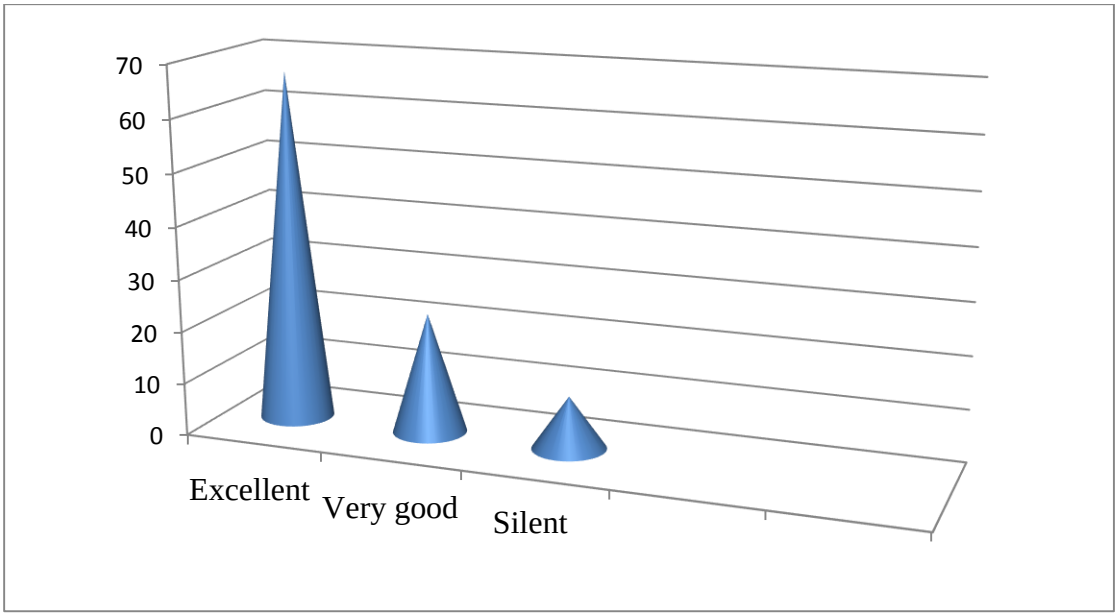


Figure 4.1: Assessment of the potentials of EMP in fire control hazard.

As shown in Figure 4.1, 67% of the filling stations strongly agree with the potential of EMP requirements in the management of fire hazard, such that the six (6) delivery horses with instantaneous coupling hand control branches and foam making branches is used to engulf the fire and disallow oxygen supply which will therefore make the fire subside. Other measures include fire extinguishers as well as sand bucket which should be placed beside every pump. Training should be provided to the staff members on the use of the appropriate firefighting equipment. All emergency equipment should be kept readily available and in a condition ready for immediate use as well as warning and information notices or signs should be on un-obscured display. From the study, 23% also agree while 10% were silent on the subject matter.

4.3.7 Assessment of potential of the EMP in general housekeeping

Respondents view on the potential of the EMP requirement in housekeeping practices is thus analyzed in table 4.16.

Table 4.16 Assessment of potential of the EMP in general housekeeping

EMP implementation	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
Excellent	3	5	17	83
Very good			2	7
Good		1	2	10
Fair				
Poor				
Total	3	6	21	100

Source: Field Survey 2016

Part of the EMP requirement for general housekeeping practice include provision of refuse containers for the recovery of oily rags, empty oil cans, etc. and disposed in accordance with public health and sanitation procedures, satisfactory to the DPR, waste management services; resource recovery; waste management plan; waste management equipment should be available on-site, number of waste bin should be adequate; cost of maintenance and waste collection frequency. The field survey reveals that 83% of the filling stations agree that the EMP when implemented and monitored provide excellent measures on general housekeeping. Appropriately, 7% and 10% of the filling stations also agree that the measures are very good and good respectively.

4.4 CONSTRAINING FACTORS TO IMPLEMENTATION OF EMP IN KADUNA

4.4.1 Availability of EMP in the Filling Station

Table 4.17 presents the details of the analysis of the availability of EMP as a tool in managing operations in the filling stations.

Table 4.17: Availability of EMP in the Filling Station

EMP	NNPC Managed Stations	Major Marketers	Independent Marketers	Percentage
EMP Available	-	2	4	20
No EMP	3	4	17	80
Total	**3**	**6**	**21**	**100**

Source: Field Survey 2016.

As shown in Table 4.17, 80% of the filling stations indicated not having an EMP, only 20% indicated that they have. Availability of EMP in filling stations will make environmental management easier and more natural for everyone who is involved in it at the station. When made available attendants appreciates that the EMP spells out exactly what is expected of them. Majority of the managers lack awareness of the EMP as a tool for guiding filling stations operation. The EMP will provide a framework to ensure that operations in the station are in compliance with environmental regulation. However, Table 4.17 shows the percentages of the filling stations with their EMP physically on site. The proportion of the defaulters is unacceptably high. It is part of the EGASPIN (2002) requirement that operators whose activities affect the environment shall have an EMP. It further required the establishment and maintenance of documented procedures for periodically evaluation of compliance with relevant environmental legislation and regulations.

The system manual shall document and describe a management system with organizational structure, policy, responsibility, objectives/targets, practices, procedures, processes and resources for the implementation of all environmental management issues peculiar to the organization.

4.4.2 Availability of unit that ensure implementation of mitigation measures

For a functional EMP in filling stations, roles, responsibility and authorities should be defined, documented and communicated in order to facilitate effective environmental management. A specific management representative should be appointed to ensure the EMP is established and implemented. Table 4.18 shows the availability of units that ensures implementation of mitigation measures in the filling stations.

Table 4.18: Availability of units that ensure implementation of mitigation measures

Unit	**NNPC Managed stations**	**Major Marketers**	**Independent marketers**	**Percentage**
Unit	1	6	3	33
No Unit	-	-	14	47
Silent	2	-	4	20
Total	**3**	**6**	**21**	**100**

Source: Field survey 2016.

Consequently, 33% of the filling stations have units that ensure the implementation of mitigation measures, 47% admitted that they don't have while 20% were indifferent on the issue. With respect to the percentage of representatives of the filling stations who asserted that there are units that ensure implementation of EMP (33%) is indeed, below average and can be judged as poor implementation of EMP within filling stations in the study area. This serves as a constraining factor to EMP and therefore hinders EMP implementation. EGASPIN 2002 states that a specific management representative shall be appointed to ensure the environmental management system established and implemented.

4.4.3 Training Programmes for Workers

Training programmes is essential in order to ensure regular knowledge update to keep all staff abreast on environmental issues and work efficiency. The availability of training programs for workers is illustrated in figure 4.2

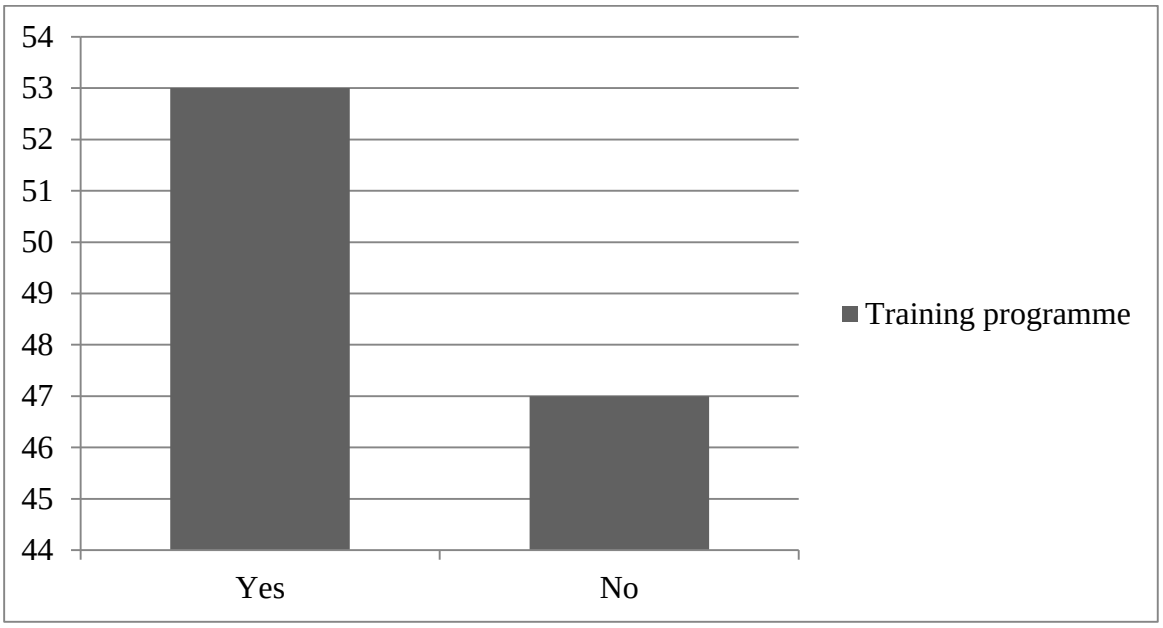


Figure 4.2: Availability of Training Programmes for Workers
Source: field survey 2016

Based on the survey, 53% of the filling stations have training programs for their workers where as 47% lack this requisite requirement. This is found to be a constraint to EMP implementation since training and enlightenment is crucial in raising environmental protection and safety in filling stations. This is in conformity with EFOA, (1999) that safety of people and protection of the environment should at all time be the major concerns at petrol stations because they are potentials for accident especially where the general public has unrestricted access.

Also, based on the distribution of the 53% of the filling stations that have training programmes for workers, 25% give training yearly, 38% monthly while 6% give training weekly. However, 31% give training prior to employment. Inconsistency in the training field could reduce the implementation of the EMP. Training or operational education is a continuous process

throughout the project life cycle in order to ensure compliance to EMP and to safeguard human health.

4.4.4 Recording of Reports, Injuries, Accidents, Diseases and dangerous Occurrences

Good records are very important to the filling stations to show that procedures have been followed. Figure 4.3 shows the percentages of filling stations that records reports, Injuries, Accidents, Diseases and dangerous Occurrences.

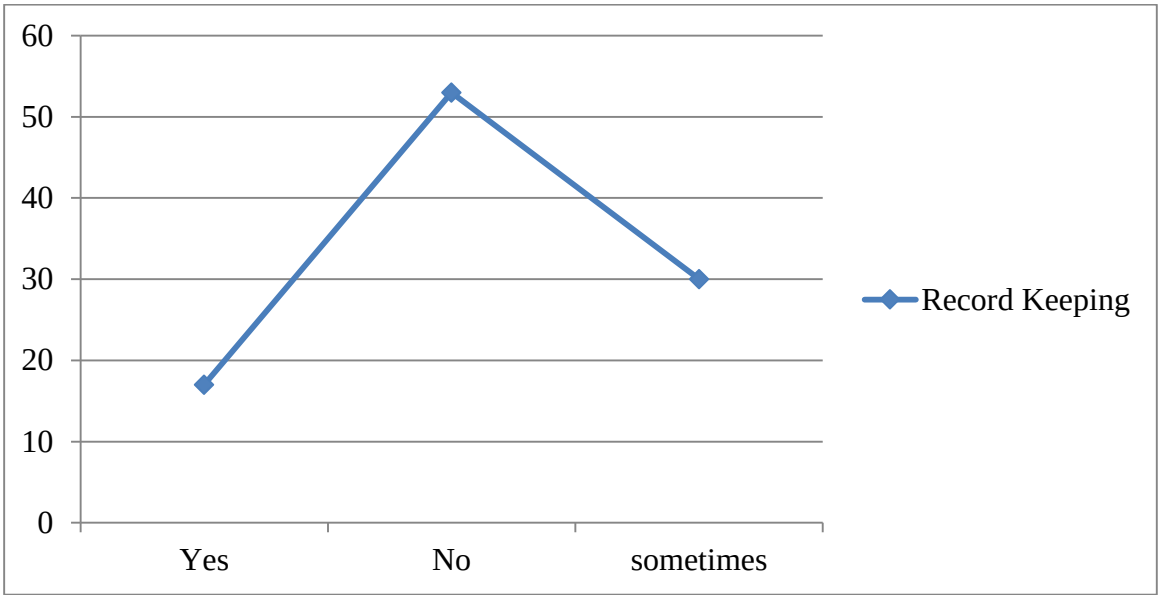


Figure 4.3: Recording of Reports, Injuries, Accidents, Diseases and dangerous Occurrences
Source: field survey 2016

Based on the data on Figure 4.3, only 17% of the filling stations keep record of reports, injuries, accidents, diseases and dangerous occurrences, 30% sometimes keep record, while 53% don't keep record at all. Several activities and occurrence in filling station require keeping of record as stipulated in the regulation. These low rates of record keeping are also against standard health, safety and environmental protocols and an absence of environmental monitoring and best practices and serves as a constraint to EMP implementation. Maintaining up-do-date written procedures and occurrences is good management practice which is therefore mandatory for all operators to engage in.

In one of the sampled filling stations that experienced a leakage case with one of the USTs, neither the filling stations nor DPR have record of the occurrence in addition to using inappropriate method of solving the problem. This is against the standard for operation of filling station since all cases of leaks are to be reported to DPR thereafter the affected USTs should be repaired or replaced. Based on this finding therefore, it appears that the lack of recording and reporting could be attributed to the fear of the cost of cleaning or follow-up measures by the service providers. It was reported that the implementation and maintenance cost together with too much paper work happens to be parts of the major constraining factor to EMP implementation (Famiyeh, Kuttu and Anarfo, 2013).

This indeed is a constraining factor to implementing EMP and therefore hinders environmental management. Filling stations needs to ensure that accident, injuries, diseases and other dangerous occurrences must be recorded. This is as stipulated in EGASPIN 2002 that the organization shall establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristic of its operations and activities that can have significant impact on the environment. This shall include the recording of information to track performance, relevant operational controls and conformance with organization's environmental objectives and targets.

4.4.5 Current Fire Service Certificate in the Filling Stations

Fire Service Certificate is one of the criteria that shows the compliance to EMP in filling station, the certificate must be renewed or updated with the Federal Fire Service every year.

Table 4.19: Current Fire Service Certificate in the Filling Stations

Certificate	NNPC Managed Stations	Major Marketers	Independent marketers	Percentage
Updated Certificate	2	6	4	40
No Updated Certificate	1	-	17	60
Total	**3**	**6**	**21**	**100**

Source; field survey 2016

Table 4.19 shows that 60% of the filling stations do not have an updated certificate while 40% does. However, based on the safety requirement in petroleum tank farm, several requirements such as "boreholes water storage tank of at least 500,000 litres capacity should be installed for firefighting purpose, Six (6) delivery horses with instantaneous coupling hand control branches and foam making branches, all be kept in metal cabinet at strategic locations within the stations, two drums of foam concentrate 200 litres capacity in each should be provided (FFS safety requirements for filling stations operations)

More so, automatic fire alarm system should be installed at strategic locations within the premises, smoke, heat and flame detectors to be installed at strategic location within the stations" must be met in all filling stations before the issuance of such certificate by the service board. Based on the researcher's survey across all forecourts of the filling stations under study, none of the filling stations fully satisfied the requirements, this cut-across even those with the updated certificates (FFS safety requirements for filling stations operations).

An exclusive interview with one of the officials of Federal Fire Service revealed that most filling stations obtain this certificate illegally and that the controller is licensed to revoke such certificates. This affirmed a statement from one of the station managers that, certifications are done prior to regulators inspection. In the real sense, filling stations must be monitored and inspected to ensure that all requirements are in place before certification.

Consequently, the method of obtaining certification shows that cost of compliance is a therefore a constraining factor to EMP implementation by filling stations. This is in line with the work of Femiyeh, Kuttu and Anarfo (2013) which revealed that implementation cost is a major factor that hinders the implementation of EMP in Ghanian firms. Also, during the process of certification uncertainty in the institutional environment, such as the behavior of environmental regulatory agencies could prevent filling stations from seeking certification after implementation. For example, regulatory violations by an EMP applicant station might be revealed or disclosed during its environmental certification process and if such violations are used by regulatory agencies or other third parties against the applicant filling station, then such legal proceedings would result in additional cost of certification to the applicant station and therefore affect the process of EMP implementation.

4.4.6 Regularity of service Line Check for Leak Detection

How regularly filling stations check service line for leakage is illustrated in Table 4.20.

Table 4.20: Regularity of service Line Check for Leak Detection

Regularity	NNPC Managed Stations	Major Marketers	Independent marketers	Percentage
Weekly	-	-	2	7
Monthly	2	3	1	20
Yearly	-	3	4	23
We don't check	1	-	14	50
Total	**3**	**6**	**21**	**100**

Source: Field survey 2016

Table 4.20 shows that 7% of the filling stations check there service line for leak detection weekly, 20% monthly and 23% check yearly whereas 50% confirmed that they don't check. It is therefore not surprising that there are no much leakage cases in the filling stations (Table 4.6) since

the method (Table 4.7) and regularity of leak detection is minimal. This means that environmental monitoring of filling stations operation by the service providers is generally low and this will affect the implementation of the EMP.

In figures contained in a North South Wales (NSW) Auditor-General Report, released late 2011, shows that 770 service stations and 176 other petroleum sites were actually or potentially contaminated with many leaking tanks. In the two most of the worst confirmed cases, high levels of the cancer- causing agent benzene leaked from a Brighton-le-Sands petrol station and were detected beneath a water front pack and elevated concentrations of a toxic chemical mix were recorded inside a home near a service station at Roseberry. More than 300 NSW sites were found to be significantly contaminated, the largest number of which were petrol stations. In several cases, contamination had travelled to nearby homes. A leak from a Sutherland was migrating to an adjacent Sydney water reservoir site (Sydney Morning Herald 2011).

However, this occurs in places where leak detection measures are not fully employed. The effects lack adherence to operational regulations of the filling stations, a range of measures to prevent leakage (leak detection measures/systems) such as leak detection systems, regular monitoring and infrastructural upgrades, hence an effective EMP implementation.

4.4.7 Bottom Plate of every tank being equipped with cathodic protection device

Figure 4.4 shows the number of filling stations having their UST equipped with cathodic protection device

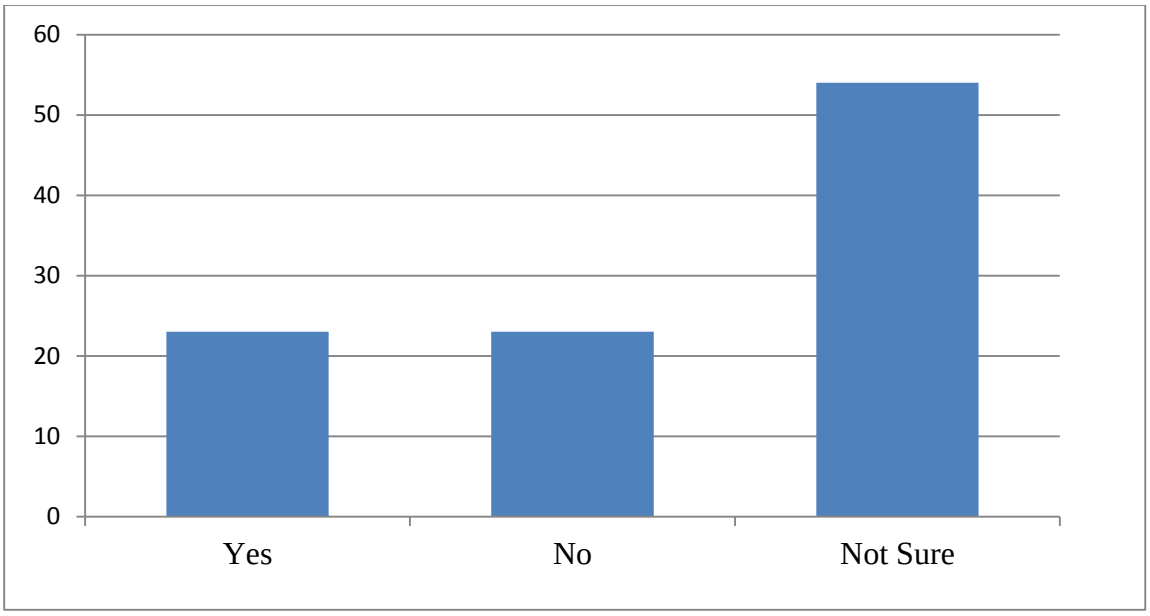


Figure 4.4: Number of filling station with tank being equipped with cathodic protection device
Source: Field survey 2016

The result in Figure 4.4 shows that 23% have their tanks equipped with cathodic protection device with the same proportion not having this device, 54% of the operators are not sure if this is available. Unless protective measures are taken, buried steel storage tanks and other metallic components of fuel storage system corrode (rust) and leak product into the environment. This is the rationale behind the device. The Mineral Oil Safety Regulation (1997) under storage tank regulation makes it mandatory for every tank to be equipped with the device.

The regulation also makes it mandatory for the regular monitoring and maintenance of the device in order to ensure effective working condition of the device. However, with the proportion of the stations operators not having and not sure whether the device is available shows that monitoring and maintenance will be at the lowest level and therefore affects implementation of the EMP. It was mentioned that old steel tanks without proper protection are generally believed to present the greatest risk of developing leaks (Raad, Margane and Saade 2011).

4.4.8 Availability of DPR Inspection Log Book in the filling stations

As part of the requirements in the DPR guidelines for approval to construct and operate petroleum products filling station, a DPR inspection log book must be available where entries will be made and kept onsite for inspectors to obtain baseline information essential to the effective performance of their functions. The result shows that none of the sampled stations have the DPR inspection log book in their stations. This is in contrast with the DPR guidelines for approval to construct and operate petroleum products which states that DPR inspection Log book must be available in the station. It therefore means there is uncertainty on the part of the government in ensuring compliance and serves as a constraint to EMP implementation. When asked how often DPR officials come for inspection the response was they come when there is fuel available for sale and the major aspect of their inspection evolve around meter readings, status of the fuel, rest rooms, and solid waste. However, there are more to DPR official's visit to filling stations especially to measure and check the compliance with EMP and regulations relating to the operations of filling stations than the aforementioned inspection.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter comprises of summary of the key findings of the study, conclusion and recommendations. The recommendations were based on the major findings as guided by the research objectives.

5.1 SUMMARY OF THE FINDINGS

The aim of this study is to appraise the compliance level to EMP by filling stations in Kaduna. The objectives are to; assessment of the extent and level of compliance to EMP by NNPC, major and Independent managed stations in Kaduna, examining the potentials of EMP in the management of the environment in the vicinity of the filling stations and examining of the constraining factors to EMP implementation in Kaduna.

Based on this research guide, the study establishes that filling stations managed by major marketers comply more with EMP requirements than the NNPC and independent marketers consecutively. This was believed to be due to higher standards, higher level of enlightenment and awareness programme and greater compliance with existing relevant laws and regulation of the major marketers. The appalling non compliance to EMP observed in filling stations managed by independent marketers was attributed to ignorance, profit maximization and the absence of a functional Environmental Monitoring and Evaluation.

Statistically, since the calculated value (375.8) is higher than the tabulated value (5.27), the null hypothesis was rejected The conclusion was that there is significant difference in the level of compliance to EMP by NNPC, major and independently managed filling stations in the study area. This implies that the level of compliance to EMP by the three (3) categories of filling stations in Kaduna varies significantly. The test result therefore is line with findings in table 4.1 to 4.8 which

shows higher level of compliance to EMP requirements in the major marketers than in NNPC and independent marketers

More so, the findings further revealed that the EMP followed by a successful implementation and monitoring will improve filling stations level of compliance with environmental laws and regulations to a level of compliance reaching almost 100%, and can reduce the identified impacts to insignificant level.

Furthermore, the study also indicated that, the major constraining factors to EMP implementation in filling station in Kaduna are; Ignorance and lack of knowledge on the EMP as a tool for environmental management, cost of implementation and maintenance, follow-up process, lack keeping record, inadequate training and enlightenment programmes, uncertainty with the regulatory bodies, poor governance and lack of adequate routine environmental monitoring.

5.2 CONCLUSION

Environmental Management Plan (EMP) addresses the management of environmental impacts related to the operation of a filling station. The EMP has the potentials of managing, mitigating and monitoring the environmental impacts associated with the operational phase of the filling stations. The general conclusions drawn from this study vis-à-vis the objectives are that the level of compliance to EMP is below average especially among NNPC managed stations and independent marketers. Various areas which shows lack of compliance to the EMP which at the end result in environmental damage have been identified and are linked to the activities of the filling stations within the area such as lack of leak and spill detection measures, inadequate fire extinguishers, sand buckets, and lack of oil water separator among others. This was attributed to constraints such as profit maximization, cost of implementation and maintenance, inadequate

training and enlightenment programmes and ignorance on the lack of knowledge on the significance of the EMP.

This study provides a foundation on which to improve compliance to EMP by filling stations in the country. It is clear that the filling stations are aware of the potentials of EMP in ensuring environmental management of their activities. Therefore, the filing stations will comply more to environmental laws and regulations if the agencies saddled with the responsibility of ensuring environmental compliance can use the EMP to monitor their compliance

5.3 RECOMMENDATIONS

This study provides baseline information on the extent of compliance to EMP by filling stations in Kaduna and the major containing factors to EMP implementation in the filling station. This could be useful for future research on assessment of environmental compliance to EMP and enforcement in Kaduna and Kaduna state at large. Based on the findings, the following recommendations have been advanced.

There is need to reassure the filling stations operators that environmental legislation and EMP requirements are not punitive, but guidelines to help conserve the environment and that improving the environmental performance of fuel stations is important as they are part of the business society that can potentially contribute to sustainable development through improved environmental performance, resulting in significant economic benefits in the long and short term.

At the institutional level, there needs to be more coherence and clarity of regulatory functions. The regulatory bodies should ensure fairness and strengthens the credibility of regulatory requirements: a consistent and effective compliance and enforcement mechanism by making both penalties and the probability of detection high enough that it will becomes unprofitable and therefore irrational for regulated filling stations to violate the law. Without an

effective compliance assurance program, stations that violate environmental requirements may benefit compared to those that choose to comply. Ultimately, complied stations will be more unlikely to comply if they perceived that it placed them at a competitive disadvantage with non-compliance stations. This at a long run will reduce the level of compliance if not properly handled.

It is important for the respective regulatory agencies to device a way of reducing the cost as well as the paper work involved. In order to reduce the cost associated with EMP implementation, it would be important for the agencies responsible to encourage environmental management benchmarking to allow similar sectors to collaborate in developing EMP. In addition to benchmarking strategy, it would be important for the regulatory body to encourage EMP implementation by involving some of their officers to assist in filling stations to implement the plan or during the review after implementation.

Also, to improve filling stations compliance with the EMP and to encourage them to avoid government penalties, environmental authorities should prioritize targeted awareness programs to ensure that the filling station and their employees are aware of the EMP. Meanwhile, government can incentivize good behavior by presenting awards for compliance with the EMP.

The process of establishing EMPs within filling stations should be transparent and serve as a working tool to improve levels of compliance and commitment across the management structure. The workforce is the most important element for success. Filling stations facing strong competition or regulatory pressure may benefit from good environmental performance.

The regulatory agencies should harmonize and establish clear self-monitoring requirements and integrate self-reporting. Even though it is difficult to rely fully on self-monitoring, application of it could help to improve relations between governmental institutions and filling stations. In order for self-monitoring to be effective, all environmental reporting should

be integrated into one form and the deadlines for reporting on impacts on different media should be harmonized. Self-monitoring would also need to be combined with more effective inspection activities.

Also the regulatory agencies in collaboration should facilitate capacity building initiatives for the operators. This can be done by supporting research organizations, institutions of higher learning and other private bodies in setting up awareness raising and training programmes for the operators on the need for compliance and implementation of the EMP. Training programmes preferably consisting of a series of training sessions and practical work in filling stations for development and implementation of EMP that are in line with international best practices. To ensure follow-up of such initiatives, dissemination of results should be ensured.

REFERENCES

Afolabi, O.T., Olajide F.O., and Omotayo, S.K. (2011). Assessment of Safety Practices in Filling

Stations in Ile-Ife, South Western Nigeria. Journal *of Community Medicine and Primary Health Car*e, 23: 1-2.

Agha, G.U., Irrechukwu, D.O. and Ziga, M.M. (2004). *The development of environmental guideline and standard for the petroleum industry in Nigeria: a systematic approach and future challenges.* In: Proceedings of the 7th Society for Petroleum Engineers International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production: SPE Conference Paper 88640-MS.

Ahmed, S., AbdulRahman, A.S., Kovo, A.S., Ibrahim, S. Okor, E.O. and Agbo, A.A. (2014) Health, Risk and Safety of Petrol Stations in Minna Town: An over View. *World Applied Sciences Journal* 32(4): 655-660.

Ahmed, A. E., Ghauri, B, and Bazmi G.R., (2013). Assessment of the Current State of Health, Safety and Environmental Standards and Activities on Fuel Filling Stations in Pakistan. *Journal of Sustainable Development*, (7)1: 107-114.

Allan, I. and Chilenye, N. (2014). Environmental Impact Assessment Process for Oil, Gas and Mining Projects in Nigeria: A Critical Analysis. *Law, Environment and Development Journal*, 10(1): 35.

Alvarez, M. J., de Burgos, J. and Cespedes, J. J. (2001). An Analysis of Environmental Management, Organizational Context and Performance of Spanish Hotels. *Omega*, 29: 457-471.

Architecture, Engineering, Construction, Operations and Management (AECOM). (2009). Considerations in Developing Oil and Gas Industry Best Practices in the North. Environmental Studies Research Funds Report no. 175.

Ambituuni, A., Amezaga, J. and Emeseh, E. (2013). Analysis of safety and environmental regulations for downstream petroleum industry operations in Nigeria: Problems and prospects. *Environmental Development.*

Amundsen, I. (2010). *Good Governance in Nigeria: A Study in Political Economy and Donor Support. Norwegian Agency for Development Cooperation,* Oslo, Norway.

Andrews, R.N.L., Darnall, N. and Gallagher, D.R. (1999). Environmental Management Systems: A sustainable Strategy for a Sustainable World? *Proceedings of the 8th International Conference of the Greening of Industry Network*, "Sustainability: Ways of Knowing, Ways of Acting", Nov. 14-17, University of North Carolina at Chapel Hill, North Carolina, 1-15.

Ayirebi-Dansoh, J. A. and Amoah, P. (2012). Barriers to implementation of EMS in construction industry in Ghana. *International Journal of Engineering Science, 2*(4): 37-45.

Ayres, I. and Braithwaite, J. (1992). Responsive Regulation. Oxford University Press. Oxford.

Bansal, P., and Hunter, T. (2003). Strategic explanations for the early adoption of ISO 14001. *Journal of Business Ethics*, *46*(3): 289-99.

Beeby, R. (2008). Defence wants free rein on training. In: Wang, X.H. and Wu, W. (2013). A Review of Environmental Management Systems in Global Defence Sectors. *American Journal of Environmental Science,* 9(2): 164-181.

Becker, S.G. (1979). The Economic Approach to Human Behaviour, Chicago and London. University of Chicago Press.3-14

Becker, S.G. (1968). Crime and Punishment: An Economic Approach. *Journal of Political Economy*, 76(2): 169

Beecroft, G.A. (1990). Water Quality Monitoring in river Systems. Development of Chemical Enginneering A.B.U Press Ltd, Zaria.

Bello, A.L. (2000). *Kaduna State.* In Mamman A.B., Oyebanji, J.O., Peters S.W (eds) Nigeria People United, A future Assured. Survey of States. Calabar. Gabumo Press. 2: 249-256.

Bello, O.S. and Anobeme, S. (2015).The Effects of Oil Spillage on the Properties of Soil and Environment around the Marketing Outlets of some Petroleum Marketing Companies in Calabar, Cross River State, Nigeria. *Mayfair Journals*, 1(1): 1-14.

Bennett, S., Kemp, S., & Hudson, M. D. (2016). Stakeholder perceptions of Environmental Management Plans as an environmental protection tool for major developments in the UK. *Environmental Impact Assessment Review, 56*. 60-71.

Chika, O. and Ugochukwu P.C. (2009). Issues and Responses in Contemporary Law and Practice Hudso-Jude Nigeria No.24 Royce Owerri.

Cohen, M.A. (1999), "Monitoring and enforcement of environmental policy", in H. Folmer and T. Tietenberg (eds.), *The International Yearbook of Environmental and Resource Economics 1999/2000. A Survey of Current Issues*,Edward Elgar, Cheltenham/UK, Northampton/MA/USA.

Cointreau, S. J. (1982). Environmental Management of Urban Solid Wastes in Development: A Project Guide. Urban Development Department, World Bank. http://www.worldbank.org/html/fpd/urban/solid-wm/trechpaper5.pdf

Environmental Impact Assessment (EIA) Act of 1992 CAP E12, LFN, 2004.

Ebigo, P.O. (2008). *Appraising the Impact of Economic Reform Programme On Micro, Small and Medium Scales Enterprises*. In: Proceedings of the 19th Enugu International Trade Fair Colloquium.

Emeseh, E. (2012). Main streaming enforcement for the victims of environmental pollution: towards effective allocation of legislative competence under a Federal Constitution. *Environmental Law Revision*, 14: 184–198.

Emilsson, S. and Hjelm, O. (2002). Implementation of Standardized Environmental Management Systems in Swedish Local Authorities: Reasons, expectations and outcomes. *Environmental Science Policy*, 5: 443-448.

Eneh, C.O. (2011). Managing Nigeria's environment: the unresolved issues. *Journal of Environmental Science and Technology*, 4(3): 250–263.

Environmental Law Research Institute [ELRI] (2011). **A Synopsis oof Laws and Regulations on the Environment in Nigeria. In** http://www.elri-ng.org/newsandrelease2.html **Assessed 23th August, 2015.**

Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) 2002.

European Fuel Oxygenates Association [E.F.O.A](1999). European Fuel Oxygenates Association: Guidance for the Design APEA/IP. www.efoa.org. 5 – 9.

Environmental Protection Agency (1984): Underground Tank Corrective Action Technologies. Hazardous Waste Engineering Research Laboratory-Office of Solid Waste and Emergency Response, Washington.

European Environmental Agency (1994). General Guide to the Prevention of Pollution, Controlled Waters And Fuelling Stations: Construction And Operation. European Directive. In: *Guidance for the Design, Construction, Modification and Maintenance of Petrol Filling Stations (1999).* APEA/IP .

Environmental Protection Agency (2003). Environmental Risk Management at Retail Fuel Outlets Victoria, Austrialia.

Environmental Protection Agency (2005). Marina Environmental Management Plan. A Workbook for Marinas, Boatyards & Yacht Clubs in New England. United States Environmental Protection Agency New England.

Fadeyibia, I. O., Jewob, P. I., Opoolaa, P., Babalolaa, O .S., Ugburoc, A., Ademiluyia, S. A. (2011). Burn sand fire disaster from leaking petroleum pipes in Lagos, Nigeria: an 8years-experience. *Burns* 37: 145–152.

Federal Ministry of Environment (FME),2013.Mandate of the Ministry. In http://environment.gov.ng/about-moe/profile/ Accessed 31.06.2016).

Famiyeh, S., Kuttu, S. and Anarfo E. B, (2013). Challenges of Environmental Management Systems Implementation in Ghanaian Firms. *Journal of Sustainable Development*, (7)1: 107-114.

Fubara T.O. (1998). Law of Environmental Protection: Materials and Text Caltop Publications (Nigeria) Limited.

Harmful Waste (Special Criminal Provisions) Act Cap H1, LFN 2004.

Harford, J.D. (1991). Measurement Error and State-Dependent Pollution Control Enforcement, *Journal of Environmental Economics and Management*, 21: 67-81.

Harrington, W. (1988). Enforcement Leverage when Penalties are Restricted, *Journal of Public Economics*, 37: 29-53.

GFSD, (2004).*Conference on Economic Aspects of Environmental Compliance Assurance*. Global Forum on Sustainable Development: Paris, France.

Goodchild, E. (1998). *The Business Benefits of EMS Approaches*, PhD, Salford University, Salford.

Hillary, R. (1997a). *The Eco-management and Audit Scheme: Analysis of the Regulation, Implementation and Support*. Imperial College, University of London.

Hillary, R. (1998). *An Assessment of the Implementation Status of Council Regulation (No 1836/93) Eco-management and Audit Scheme (EMAS) in the European Union Member States (AIMS-EMAS)*. London, UK Imperial College.

Heyes, A. (1996). Cutting environmental penalties to protect the environment, *Journal of Public Economics*, 60: 251-265.

Heyes, A. (2000), Implementing Environmental Regulation: Enforcement and Compliance, *Journal of Regulatory Economics*, 17 (2): 107-129.

Ibrahim, A. (2014). Assessment of the Legal and Institutional Framework for the Prevention of Environmental Degradation by Oil and Gas Companies in Nigeria. Faculty Of Law, Ahmadu Bello University, Zaria Nigeria.

INECE, (2009). Principles of Environmental Compliance and Enforcement Handbook. *International Network for Environmental Compliance and Enforcement*, http://www.inece.org/principles.

International Organization for Standardization (1996). Environmental Management System. Technical Committee ISO/TC 207, *Environmental management*, Subcommittee SC 1, *Environmental management systems*.

Kaduna State. (2010). Kaduna State Government Official site. Kaduna Mega City Plots

Allocated: all For Grasp (Kaduna South) from http://www.nairaland.com/nigeria/topic-167200.0.html

Kaduna State Environmental Protection Authority Law 2010. Law No. 7 of 2010.

Kanyi, J. (2014). *Factors Affecting Environmental Best Practice Compliance among Retail Fuel Service Stations in Thika East Sub-Country Kenya.* Environmental Planning and Management, University of Nairobi, Kenya.

Kemabonta, K.A. and Aderemi, A. O. (2014). Post Environmental Impact Assessment and Toxicological Evaluation of Major Emissions on Selected Fauna of the AP filling Station, University of Lagos, Lagos. Nigeria, *Production Agriculture and Technolog.*10 (1): 1-16

Lee, N. (2000). Integrating Appraisals and Decision Making, in Lee, N. and George C. eds, *Environmental Assessment in Developing and Transitional Countries: Principles, Methods and Practice*, Chichester: John Wiley & Sons.

Lochner, P. (2005). Guidelines for Environmental Management Plans. CSIR Report No ENV-S-C 2005-053 H.

Lock, M. (1968). Kaduna, 1917, 1967, 2017*:* A Survey and Plan of the Capital Territory For The Government of Northern Nigeria. Praeger.

Makalene, H. (2016). The Impact of Environmental Management Plans on Firms' Compliance with Governmental Regulations and Environmental Laws. *Environmental Management and Sustainable Development*, 5(1)

Martin O. M (1987). Nigerian Petroleum Law and Practice. Fountain Books Limited, Lagos, Nigeria.

Michigan State University (1995). Assessing the Risk of Groundwater Contamination from Petroleum Product Storage. Extension Service. Michigan, USA.

Mineral Oils (Safety) Regulation, 1997,

Mohammed, M.U., Musa, I.J. & Jeb, D.N. 2007.GIS-Based Analysis of the Location of Filling Stations in Metropolitan Kano against the Physical Planning Standards. *American Journal of Engineering Research,* 3:147-158.

Morales I.M., Miñarro M.D., Ferradas E.G., Caracena A.B. and Rico J.B. (2010).Assessing the impact of petrol stations on their immediate surroundings. *Journal of Environmental Management*, 91: 2754-2764

Mostek, S. M. (1998). Limited Privilege and Immunity for Self-Evaluative Environmental Audits in Nebraska. *Moving Environmental Performance to the Next Level, 32: 545.*

Mortimore, M.J. (1997). *Zaria and Its Region. A Nigerian Savannah City and its Environ.*

Occasional Paper No 4, Department of Geography, A.B.U Zaria

Mshelia, A.M., John, A., Abdullahi , J. and Dawha, E.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,* 20: 1- 8.

Moschini, L..E et al (2005). Environmental Diagnosis of Risk Areas Related to Gas Stations, Brazilian archives of Biology and Technology, *an international Journal*, 48(4): 657-666.

Morrow, D. and Rondinelli, D. (2002). Adopting Corporate Environmental Management Systems: Motivations and Results of ISO14001 and EMAS certification. *Journal of European Management,* 20: 159-171.

Namakonzi R. and Inanga E.L (2014). Environmental Management Accounting and Environmental Management in Manufacturing Industries in Uganda.*Maastricht School of Management*, Uganda.

Nawrocka, D. and Parker, T. (2009). Finding the connection: Environmental management systems and environmental performance. *Cleaner Production*, 17: 601-607.

National Environmental Standards and Regulations Enforcement Agency (NESREA) (Establishment) Act No. 25, 2007.

National Oil Spill Detection and Response Agency (NOSDRA) Act 15, 2006.

National Oil Spill Detection and Response Agency (Amendment) Draft Bill, 2012.

NEMA. (2003) Summary- State of Environmental (SoE) Report for Kenya, Public Copy.

NEMA. (2004) Summary- State of Environmental (SoE) Report for Kenya, Public Copy.

National Emergency Management Agency NEMA (Establishment) Act, 1999. Section 6.

Ogbodo, S.G. (2009). Environmental Protection in Nigeria: Two Decades after the Koko Incidence, *Annual Survey of International and Comparative Law: Vol. 15.*

Ogola, P. F. A. (2007).Environmental Impact Assessment General Procedures. Presented at Short Course II on Surface Exploration for Geothermal Resources, organized by UNU-GTP and KenGen, at Lake Naivasha, Kenya,

Oil in Navigable Waters Act, Cap 06, LFN, 2004.

Olurunfemi, J. F. and Odika, C. O. (1998). Canal Use and Solid Waste Generation in Ilorin, Kwara State. *The Environmentalist*, 18:75

Osayande, P.B.O. (2008). *Factors inhabiting police performance in Nigeria*. Occasion of the

Retreat with the Theme. Understanding the Mandate and Operations of the Police Service Commission in Context of the Rule of Law.

Peterson, K. and Diss-Torrance, A. (2012). Motivation for compliance with environmental Regulations related to forest health. *Journal of Environmental Management. 112*: 104-19.

Petroleum Act (CAP350) (1969) as amended, 1990. Section 9,8.

Poole, M., Coombs, J. & Van Gool, K. (1999). *The Environmental Needs of the Micro company Sector and the Development of a tool to meet those Needs*. Payback Business Environmental Association for the Southwest, Plymouth.

Prepra Nig Ltd (2015). Environmental Monitoring Plan for Larrabee Enterprises Ltd. A Report Submitted To National Environmental Standards And Regulations Enforcement Agency (Nesrea).

Raad R., Margane A. and Saade E. (2011). Environmental Risk Assessment of fuel stations in Jeita Spring Catchment in Lebanon. Report No 14.

Rashed, I.M., Hasaneen, E.A.S., Edward, M. and Dwagi, E.A. (2008). Environmental Management System as a tool for improving the environmental performance. *Journal of Applied Science and Resources,* 4: 383-390.

REMS, (2010).*Environmental Audit Report of Dhaka Terminal and Mongla Plan*t. Resources and Environmental Management Services, Bangladesh.

Rizzolo, J. 2006. Environmental Management. Code of Practice for the Building and Construction Industry. Ballymun Regeneration Ltd. - Health & Safety Management Unit. Document No: 3-Po-CSM. Issue 1.0, Pp 78.

Sajima, B. (2011). Approach in Developing Environmental Management Plan (EMP). *2nd International Conference on Environmental Engineering and Application.* 17.

Sergio, M.C. (2012). Atmospheric Pollution. *Research,* 3:163-169.

Swierzbinski, J.E. (1994). Guilty until Proven Innocent - Regulation with Costly aLimited Enforcement. *Journal of Environmental Economics and Management*, 27: 127-146.

Sydney Morning Herald 2011. North South Wales (NSW) Auditor-General Report. In www.smh.com.au Accessed in 12th July, 2016.

United Nations Environment Programme (UNEP) (2011). Environmental Assessment of Ogoni Land. United Nations Environment Programme, Nairobi, Kenya.

Usman, E. and Okolie, I. (2013). Police/NSCDC clash: Jonathan directs DSS to takeover investigation. In http://www.vanguardngr.com accessed 08.05.016.

Walker, B., Redmond, J., and Goeft, U. (2007).*Bellevue Sustainable Industry Project*. Final Report to the Swan Catchment Council, August 2007.

Welch, E.W., Mori Y. and Aoyagi-Usui, M. (2002). Voluntary adoption of ISO 14001 in Japan: Mechanisms, Stages and Effects. *Business Strategy and Environment*, 11: 43-62.

Welford R., 1996: *Corporate Environmental Management*, Earthscan, London.

Williamson, O. E. (1996). *The Mechanisms of Governance*. New York, Oxford: Oxford University Press.

World Bank (1999) *Environmental Performance Monitoring and Supervision*. Update. Environmental Assessment Sourcebook. World Bank, Washington, DC.

World Health organization (2004). Safe Piped Water: Managing Microbial Water Quality in Piped Distribution Systems by Richard Ainsworth.

Yusuf, R. O, Agarry S.E & Durojaiye, A.O. (2007). Environmental Impact Assessment Challenge in Nigeria. *Journal of Environmental Science & Technology*, 75-78.

Zailani S. and Wahid, N.A. (2006). A Study on the Impact of Environmental Management System (EMS) Certification towards Firms Performance in Malaysia. *Environmental Quality Management.* 17: 73-93.

Zutshi, A., Sohal, A.S. and Adams, C. 2008. Environmental management system adoption by government department/agencies. International Journal of Public Sector Management, 21: 525-539.

Zazzau Emirate Development Association. In: http://zemda.org.ng/index.php/about-us/2-uncategorised/29-sabon-gari-local-government-sharia accessed 19th. Oct, 2015.

APPENDIX I

DEPAERMENT OF GEOGRAPHY
FACULTY OF SCIENCES
AHMADU BELLO UNIVERSITY ZARIA

TITLE: APPRAISAL OF THE COMPLIANCE LEVEL TO ENVIRONMENTAL MANAGEMENT PLAN BY FILLING STATIONS IN KADUNA METROPOLIS, NIGERIA

QUESTIONNAIRE TO THE MANAGEMENT STAFF OF THE FILLING STATION

Dear Sir/Ma,

This questionnaire is designed to help in assessing of the compliance level to evironmental management plan by petrol filling station in Kaduna metropolis. The research is meant only for academic purpose and all information will be used for that purpose. Your sincere response is appreciated.

Location……

1. Types of waste generated solid [ ] liquid [ ] effluent [ ] All [ ]
2. How are the wastes treated/dispose? Segregating before collection [ ] treatment before disposal [ ] collection by waste contractors [ ], burning [ ] others specify**……..**
3. Is effluent generated at the lube bay or during tank cleaning? Yes [ ] No [ ]
4. If yes, please list discharge point**…….**
5. Kindly provide a copy of the permit for discharged points sources of oily water, solid waste and spent lubricant issued to the filling station**……**
6. Have there been spillage cases from the filling station? Yes [ ] No [ ]
7. When there is spill during offloading, what is been used to clean the spill over? Allow it to dry[ ] Use of sand [ ] Use of absorbent substance [ ] Use of water and detergent[ ]
8. In the case of sand or absorbent substance, how do you treat the sand? Throw it at the backyard [ ] throw it into drainage [ ] treat it
9. Have there been leakage cases from the filling station? Yes [ ] No [ ]
10. How do you detect if there is leakage anywhere in the station? Via leak detection system [ ] through monitoring well [ ] none of the above [ ] others specify**……..**
11. How often are the underground tanks cleaned to remove solid and liquid residue? **……**

12. Do storage tanks of the petrol stations undergo inspection? Yes [ ] No [ ] If yes at what interval? Every 5 years [ ] Every 10 years [ ] none [ ]
13. Indicate the hazard communication channels used? Use of posters [ ] Bulletins [ ] Slogans [ ] Jingles [ ] No smoking [ ] others specify**……**
14. Is there a framework that contains written procedures for normal and emergency operation (EMP) available in the filling station? Yes [ ] No [ ]
15. Are there units that ensure the implementation of the identified mitigation measures? Yes [ ] No [ ].
16. Are there units that ensure the implementation of the identified mitigation measures? Yes [ ] No [ ].
17. Do you have any training programme for workers on environmental protection and safety to ensure that he/she fully understand the hazardous characteristics of petrol, the operational and emergency procedures at the filling station? Yes [ ] No [ ] If yes, how often? Weekly [ ] Monthly [ ] Yearly [ ]
18. Do you record, report, injuries, accidents, diseases and other dangerous occurrences? Yes [ ] No [ ] Sometimes [ ]
19. Is there a current fire certificate or fire service report in the filing station? Yes [ ] No [ ]
20. How regularly are the service lines checked for leak? Weekly [ ] Monthly [ ] Yearly [ ] we don't check [ ]
21. Is the bottom plates of every tank equipped with cathodic protection device? Yes [ ] No [ ]
22. Do you have the DPR inspection log book in the filling station? Yes [ ] No [ ]
23. How often do they (DPR) come for inspection? **.....**
24. Is there a copy of the Mineral Oil (Safety) regulation 1997 in the filling station? Yes [ ] No [ ]
25. Assess the quality of the Environmental Management Plan based on the laid down procedure by the DPR. Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Silent [ ]
26. What is the level of implementation of EMP in this filling station? Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Silent [ ]
27. EMP is expected to reduce leakage from the filling stations into the environment if strategy such as monitoring wells, leak detection machine and regular inventory check are

employed in the filling station. State your level of acceptance. Strongly agree [ ] Agree [ ] strongly disagree [ ] Disagree [ ] Silent [ ]. Provide reasons for your response…….

28. EMP is also expected to reduce spillages from the filling stations into the environment through measures such as spill contingency plan and availability of spill kit. State your level of acceptance. Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Silent [ ]. Provide reasons for your response ……
29. What is your level of acceptance of the effluent management measures such as presence of oil water separator, separation of clean and dirty water, in reducing environmental impact? Strongly agree [ ] Agree [ ] strongly disagree [ ] Disagree [ ] Silent [ ]. Provide reasons for your response…….
30. EMP has the potential of reducing fire hazard through the availability of fire extinguishers, sand buckets, and delivery horses with foam producing branches. State your level of aceptance. Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Silent [ ]. Provide reasons for your response…….
31. The provision of waste management plan, refuse containers and waste management services among others can improve the general housekeeping of filling stations. State your degree of acceptnce. Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Silent [ ]. Provide reasons for your response…….

APPENDIX II

CHECKLIST
LOCATION OF FILLING STATION……..

Checklist	NNPC Managed Stations	Major Marketers	Independent Marketers
Fire extinguishers			
Sand buckets			
Practices of attendant during dispensing			
Use of protective wears by attendants			
Leakage monitoring wells			
EMP on display			
Documented Accidents and vandalism			
Onsite first aid box			
Fire/heat/smoke sensors			
leak detection systems			
contingency plans for spills and fires			
means of escape and fire alarms/detection			

APPENDIX III

CALCULATION OF H-TEST

$$H = \frac{12}{N(N+1)} \sum \frac{R^2}{n} - 3(N+1)$$

H= Kruskal walli

N=Total number of individuals in all the samples

R=Sum of ranks within the sample

N=Number of individuals in that sample

$$H = \frac{12}{N(12+1)} \sum \frac{82^2}{4} + \frac{123.5^2}{5} + \frac{28.5^2}{2} - 3(12+1)$$

$0.077 (1936 + 3050.45 + 406.125) – 39$

$(0.077 \times 5392.6) – 39$

$414.82 – 39 = 375.82$

Correction of tied ranks

$$1 - \frac{\sum (t^3 - t)}{N^3 - N}$$

t = Number of individuals involved in each set of the ranks

N= Total number of individuals in all samples

$$1 - \frac{\sum (6^3 - 6)}{12^3 - 12} \qquad 1 - \frac{210}{1716} = 0.1224$$

$1 - 0.1224 = 0.878$

$$\therefore H = \frac{375.82}{0.878} = 428.04$$