KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI

COLLEGE OF SCIENCE

DEPARTMENT OF THEORETICAL AND APPLIED BIOLOGY

OCUPATIONAL HEALTH AND SAFETY AUDIT OF FUEL FILLING STATIONS IN THE AGONA NKWANTA, INCHABAN AND SEKONDI- TAKORADI METROPOLIS IN GHANA

BY

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DECLARATION

I, George Yirenkyi hereby declare that this submission is my own work towards the MSc Environmental Science and that, to the best of my knowledge it contains no material previously published by another nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

This research work is wholeheartedly dedicated to my beloved wife, Joyce Yirenkyi, son, Deanyameahyirano Kwaku Ompong Yirenkyi and ever supportive brother and father, Vasco Ompng.

May the good Lord richly shower His blessings upon you them.

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ABSTRACT

Fuel Filling Stations are an indispensable part of modern technological society, but they also pose numerous risks and threats to employees and the environment. The outburst of flames at Fuel Filling Stations (FFSs), especially the June 3, 2015 catastrophic explosion at GOIL filling station at Kwame Nkrumah Circle, Accra in which 160 lives were lost has raised a lot of concern among stakeholders. Hence, the need to assess the prevailing safety practices and level of awareness of employees on health and safety at the FFS, and determine the compliance of these FFSs to require standards set by the Environmental Protection Agency of Ghana. A mixed methodological approach including: field measurement, Geographical Positioning System (GPS) data capturing on locations of FFSs, field survey, questionnaire administration, structured and face-to-face interviews were employed in gathering data for the study which took place at Agona Nkwanta, Inchaban and SekondiTakoradi metropolis. A total of 80 employees in 40 FFSs were involved in the study and data analyzed with Statistical Product for Service Solutions Software (SPSS Version 20.0) and Excel. The study revealed that though 78.5% of employees were aware of safety measures, the scope was narrow. The ANOVA showed that the Multinational Oil Marketing Companies (OMC's) outperformed the State Owned and Individual Private Owned OMCs. It was revealed that 90% and 42.5% of FFSs did not meet the required standard ($\geq$ 30 m) of set-back from road and distance from residential areas respectively. Though the respondents claimed they have knowledge of safety measures at their respective work places, yet that did not determine the success of the OMCs in health and safety management because of observed narrow scope. Adequate training on regular basis should be given to employees especially those at the Individual private owned OMCs while research on the effects of volatile organic compounds from petrol fumes on fuel pump attendants in Ghana had to be carried out.

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LIST OF ABBREVIATIONS AND ACRONYMS

CNS Central Nervous System

EHS Environmental Health and Sanitation

EPA Environmental Protection Agency

FFS Fuel Filling Stations

GPS Global Positioning System

HSE Health and Safety Executive

ILO International Labour Organisation

MMDA Municipal Metropolitan and District Assemblies

NPA National Petroleum Authority

OHS Occupational Health and Safety

OMC Oil Marketing Companies

PPE Personal Protective Equipment

WHO World Health Organisation

VOC Volatile Organic Compounds

UST Underground Storage Tanks

CHAPTER ONE

INTRODUCTION

1.1 Background

Fuel stations are not only an indispensable in modern technological society, but also lifeblood to modern appliances. However, they pose numerous risks and threats to employees and the environment. Anyone of the petrol stations presents a wide range of challenges to the health and safety of people and their environments (Nieminen, 2005). Obese (2010) argues that, work place safety continues to attract attention for several reasons attributable to the current global technological development, which is constantly introducing chemicals as well as other innovations whose potential hazards, may not be fully appreciated for years.

WHO (2010) indicated that, the growth in urban areas in many parts of the world has outpaced the ability of governments to put up essential infrastructures; enact and enforce the legislation needed to make life in cities safe, rewarding, and healthy. This growth has resulted in an increased use of automobiles, the need for fuelling services and consequently, mushrooming of filling stations. Many of these stations have no requisite safety measures (fire standards, layout, location and waste management) that will enable them to obtain operational licenses from the regulatory bodies (Olusegun, A. T., Folakemi, O. O. & Omotayo, S. K. 2011). Fuel Filling Stations are sited in close proximity to each other and in residential areas as against the guidelines for siting such accident - related facilities.

This practice as observed by Olusegun, *et al*. (2011) presents a dangerous trend, putting the inhabitants of the vicinity at risk. The safety of people and protection of the environment must be major concerns at fuel filling stations. Health, safety and welfare are important to both employers and employees. Employers are required by

law to ensure safety, health and welfare of their employees. In addition, they are interested in reducing the number of working days lost, due to accidents and in reducing employees' personal problems that can affect their quality of work to decrease productivity (Obese, 2010).

The International Labour Organisation (ILO) Occupational Safety and Health Convention 1981 No. 155 provides a reference point for the establishment of national and enterprise-based Occupational Health and Safety (OHS) systems. At the national level, the principles that govern OHS systems include policy setting; regulation and regulations control; promotion and support; education and training. At the industry and institutional level, the importance of OHS is less prominent. This is often illustrated by the delegation of OHS as an additional responsibility to overburdened professionals specialized in other disciplines, rather than making OHS a composite of an organization's policies, and creating full-time positions for OHS practitioners to implement such a policy (ILO, 2001).

Baker, S. P., Conroy, C., & Johnston, J. J. (1992) identified that injuries occurring on the job as a result of unsafe work behaviors remain a serious problem in the United State of America and are a major cause of unnecessary death. In every 24 hours, a total of 36,000 workers are injured and 16 are killed (NIOSH, 1998). In addition, a total of 7,000 to 11,000 employees die yearly with 2.5 to 11.3 million workers suffering non-fatal injuries (Leigh, 1995; Miller, 1997). Injuries relating to work result in 250,000 potential productive years of life lost yearly – more than cancer and cardiovascular disease put together (Baker *et al*., 1992; Leigh, 1995). The total loss of injuries relating to work in 1992 has been estimated at $116 billion (Baker *et al*., 1992).

Owing to poor data collection systems in developing countries such as Ghana, information concerning occupational diseases and injuries is difficult to obtain. Work-related diseases are treated like any other disease at the hospitals without any suspected link to work place causative factors (Obese, 2010). Between 1987 and 1996, records from the Factories Inspectorate Division of the Ministry of Employment and Labour Relations reveal that many cases of accidents that occur in factories go unnoticed by the general public. Data available puts persons who sustained various degree of injuries at 734 with 55 fatalities in 1997 at work places in Ghana with another 898 occupational injuries and 54 morbidity recorded in 1998 and 57 fatalities took place with 1,190 injuries in 1999 (Micah & Aikins, 2002).

1.2 Statement of the Problem

Ghana's emerging oil and gas industry is creating economic opportunities though in its infant stages. Many downstream distribution channels are springing up with one of the main offshoots of the industry being the emergence of filling stations across the country (Baffour, R. A., Offe, A. & Annor, D. L. 2014). With the increase in these filling stations much focus is geared toward the economic benefits other than the health and safety management practices at these filling stations. There is the potential of employees facing health and safety problems, since Ghana Labour Act, 2003 (Act 651) on occupational health and safety has been weak in strengthening employees health and safety at work places with other regulatory agencies; such as Environmental Protection Agency and National Petroleum Authority failing to help ensure compliance of standards at some filling stations.

It is worth noting that frequent exposure to petroleum products is hazardous to workers health (WHO, 2010). Yet, many filling stations have no safety policies to advance the

health needs of attendants and even if they have, are not put into practice for accident free work environment. In a study by Ansah & Mintah (2012), it was identified that 44% of filling station attendants perceive their companies to provide appropriate personal protective equipment (PPE). This shows the lack of commitment of some Oil Marketing Companies in enforcing the use of PPE as the remaining 56% perceive their companies not to provide adequate and appropriate personal protective equipment.

Relevant works conducted in Sekoradi-Takoradi municipality have been on the impact of Filling Stations on the environment (Baffour *et al*., 2014), and safety management at Filling Stations (Ansah & Mintah, 2012). These focused on

responses from filling stations attendants instead of empirical data. There is also, no documented evidence on safety management practices at the filling stations in Ghana (Ansah & Mintah, 2012). There is a short fall in depth and direction of research works that will provide information on: the level of awareness of hazards and safety measures among filling stations; prevailing safety management practices in filling stations; and compliance of filling stations with requirements for their sitings. It is in line with this that the study sought to investigate the health and safety management practices among filling stations in Agona Nkwanta, Inchaban and Sekondi –

Takoradi Metropolis.

1.3 Research Aim and Objectives

1.3.1 Overall Aim of the Study

The aim of this study is to assess the health and safety management practices in Fuel Filling Stations at Agona Nkwanta, Inchaban and Sekondi – Takoradi Metropolis.

1.3.2 Specific Objectives:

The following objectives were used for the study;

1) To determine the level of awareness of hazards and safety measures among fuel filling stations employees in Agona Nkwanta, Inchaban and Sekondi – Takoradi Metropolis;
2) To assess the prevailing safety practices in fuel filling stations in Agona Nkwanta, Inchaban and Sekondi – Takoradi Metropolis; and
3) To determine whether the fuel filling stations in Agona Nkwanta, Inchaban and Sekondi – Takoradi Metropolis were in compliance with environmental and work place standards.

CHAPTER TWO

LITERATURE REVIEW

2.1 The History of Occupational Health and Safety Practices

Occupational health and safety study has been in existence as long as structured work environments dawned (Pettinger, 2000). In the year 1713, Ramazzini documented the adverse effects of work place conditions on the health of employees, and also researched into the injury and morbidity rates of many different occupations. As a result of the social importance of the progress and economical development of these occupations, Ramazzini discussed and put forward preventive strategies for reducing occupational disease and injury (Raouf & Dhillon, 1994; Tayyari & Smith, 1997). Even though engineers in health and safety did not concentrate on mechanisms for realizing work-place free accidents, it ended up being the foundation for current methodologies in reducing work-place accidents and associated illness. As industrial centers grew, there was an increased in the destruction of living conditions and also, the morbidity rate grew (Tayyari & Smith,
1997).

In fact, initial public sector efforts on the part of government in 1933 in England began with federally run factory inspections. There was a tremendous improvement in England's factory conditions as a result of Factory Act of 1844; nevertheless employers did not consider the adverse effects of poorly managed health and safety workplaces. Workers who usually die as a result of work place related illness have insufficient legal backings for families to fight on their behalves. The best an employer can do is to pay for the funeral expenses (Heinrich, H. W., Petersen, D. &

Roos, N. 1980). Employers' Liability Act was passed in 1880 in England which gave the opportunity for workers, or their families to take legal actions against employers for damages. In order for employers to address the safety of the working conditions for employees, this legal act came into force.

For a proper insurance rate between Insurance companies and clients, the insurance companies then created the inspection departments in the early 1900s. The inspectors of the insurance companies would assess the workplace hazards of their clients and accordingly give appropriate evaluation and insurance rate. Heinrich *et al*., (1980) pointed out that as insurance companies in the early days aimed at controlling their own losses, they coincidentally contributed to the reduction in workplace accidents.

2.2 Traditional Safety and Health

Research by Geller (1996) and Wilde (1998) identified engineering, education, and enforcement as being the basis for health and safety practices which have been in existence for centuries. These were focused on: (1) educating and training employees on health and safety management; (2) engineering technologies that will help reduce health related hazards; and (3) Compliance and enforcement of health and safety policies.

2.3 Conceptual and Theoretical Framework

A number of theories have been propounded on occupational health and safety among these are; Behavioural, Risk Analysis, Best Available Technique (BAT), Legislated - Engineering, Voluntaristand Systems Approaches (Obese, 2010). This research discussed the Behavioural, Risk Analysis, BAT and Legislated -

Engineering approaches.

2.3.1 Behavioural approach

Heinrich *et al.* (1980) developed basic theories from industrial accident data and discovered that health and safety hazards at workplace have a direct impact on the cost of operations. The theory relied on 4 points; (1) a potential injury is as a result of an incident, (2) an incident occurs only as a result of a personal unsafe act or hazard, (3) hazards exist only because of the faults of people, and (4) faults of people are as a result of their social environment.

2.3.2 Risk Analysis Approach

Risk Analysis Approach provides an opportunity for discovering the technological solutions for improving and developing environmental protection. Nieminen (2005) pointed out that life cycle assessment of petrol station's equipment and activities are highly vulnerable to error than risk analysis. Risk analysis is both practical and systematic so it is possible to identify the possible release sources. After these release sources had been determined and preventive technical solutions implemented, it leads to reduced accidents.

2.3.3 Best Available Technique (BAT)

The BAT approaches as explained by Nieminen (2005), relates to the situation where there is a rejection of a worse or more dangerous technical solution in favour of an existing better alternative that is economically feasible. Factors such as local conditions, size of location and lifetime must also be taken into account in evaluating BAT. This may even require expensive solutions in certain special environmental circumstances (Nieminen, 2005). No BAT report has been drafted for fuel stations in

Ghana. However, expert advice is given by some regulatory agencies such as EPA on alternative environmental management and health and safety practices.

2.3.4 Legislative-engineering approach

This approach seeks to identify failures in legal structures that are engineering specific in enforcing health and safety management practices among industry. It enforces quality construction works in the establishment of facilities such as filling stations in order to avoid or minimize future accidents at such work places. Facilities are to incorporate into the design stage, health, safety and environment policies. This is geared toward reducing future cost associated with accidents (Obese, 2010).

The approach is therefore, based on the legal instruments of the regulatory agencies compelling industries to adhere to standards in the construction of facilities. In the case of the Oil Marketing Companies, there are several legal instruments regulating the siting of facilities such as filling stations in Ghana. These include; (1) The National Petroleum Authority Act, 2005, (Act 691) which stipulates that the construction or operation of a petroleum product retail station, will only commence with the prior written authorization of the Authority, (2) The Town and Country Planning Department determines whether a proposed activity of a developer is in line with the zoning status of the area, and (3) Further assessments on where and how proponent will be developing the site for the said project is carried out by the Environmental Protection Agency (EPA) and it is based on these findings that the application can be denied permit or undergo further review.

2.4 Health and Safety Management

In designing occupational health and safety policies, the ultimate goal is the health and safety of the employees as well as protecting the environment for a sustainable development. Hence, safety experts and managers make decisions after an assessment and evaluation of prevailing health and safety management systems for better, cost efficient policies geared toward resourcing workers in order to control or prevent occupational hazards and injuries (Lingard & Rowlinson, 2005). According to Channing (2008), the development of Health and Safety practices became imperative after numerous catastrophes and harm to human life in work places and on sites. The 1980's were characterized by series of environmental and social incidents such as the American oil tanker Exxon-Valdez which collided with the

Bligh Reef and causing a major oil spillage in Alaska's Prince William Sound and the explosion on the oil and gas production pipeline near Aberdeen (Peattie, 2008). Dabup, (2012) argues that, the overall aim of Health and Safety practices is to ensure that risks to workers, the general public and the preservation of the environment are properly controlled. Dabup, (2012) further explains that, the results from the effective management of health, safety and environment, that is vital to employee well-being, enhances business reputation, and help business achieve high performance teams and cost benefits. This assertion was supported by Erickson (2011), whose findings suggested that treatment of employees is the most predictive factor of Health and Safety performance.

2.5 Elements of Effective Health, Safety and Environment management Effective health, safety and environment management is not just critical to employee well-being, but also plays a crucial role in giving businesses a human face while facilitating

the achievement of high-performance (HSE, 2000). There are accusations of poor environmental management practices levelled against some filling stations in Ghana with some not adhering to health and safety standards thereby encountering accidents such as fire outbreak. It is therefore, imperative for filling stations to place emphasis on achieving excellence in Health, Safety and Environment management.

Effective health, safety and environment management is not just critical to employee well-being, but also plays a crucial role in giving businesses a human face while facilitating the achievement of high-performance (HSE, 2000). There are accusations of poor environmental management practices levelled against some filling stations in Ghana with some not adhering to health and safety standards thereby encountering accidents such as fire outbreak. It is therefore, imperative for filling stations to place emphasis on achieving excellence in Health, Safety and Environment management. A key outcome of successful Health, Safety and Environment management is that Health, Safety and Environment performance should be able to meet both organizational and statutory requirements and demonstrates commitment to continuous improvement (HSE, 2000).

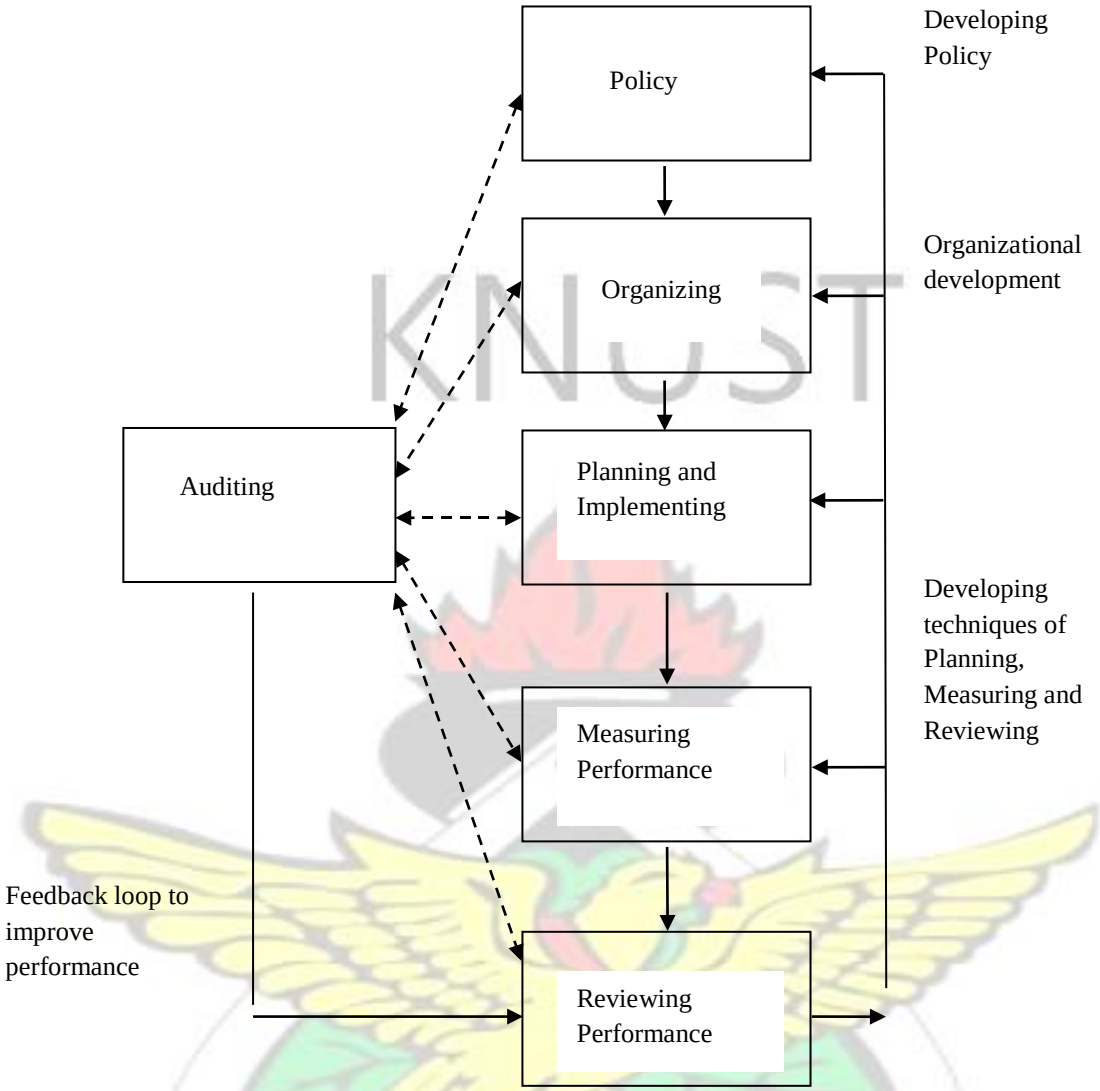


Figure 1: Key elements of successful Health, Safety and Environment management adapted from HSE, 2000.

Management activities for successful occupational health and safety management require clearly a defined policy, well-defined plans incorporating specific objectives, strong management commitment, the provision of sufficient resources, a systematic training program, effective monitoring and reporting of performance and a process for reviewing performance and making improvements (Lingard & Rowlinson, 2005).

2.5.1 Policy

According to HSE (2000), the first step in the occupational health and safety management process is defining corporate health and safety policy. Policy should be established following a detailed analysis of an organization's current situation with regard to occupational health and safety. It is designed in such a way that responsibilities to people and the environment are met in ways which fulfill the spirit and letter of the law (Hughes & Ferrett, 2007). Activities that can cause injuries and illness may also damage property and interrupt production. Dabup (2012) indicated that, health and safety policy should influence the selection of people, equipment and materials, the way work is done, and how goods and services are provided. A written statement on the arrangements for implementing and monitoring policy should show that hazards have been identified and risks assessed, eliminated and controlled (Dabup, 2012). In Ghana, corporate organizations have their codified health and safety policies that guide the activities of their operations but others, do not have. Some multinational organizations in Ghana have their health and safety policies enacted for operational performance of companies at the global level and even at the local level have additional health and safety policies which are designed to fit into the culture and environment of the local people.

2.5.2 Organization

To make a health and safety policy effective, Rwamamara (2007) stated that the next step in the management of health and safety is the creation of an organization in which roles, responsibilities and relationships support the systematic planning and control of health and safety. Various filling stations project stakeholders must get involved and be committed to making it work. This is often referred to as a 'positive health and

safety culture', of which the following five 'C's are the important aspects (Rwamamara, 2007):

- Commitment in being clear about your intent to achieve excellence in health and safety.
- Competence: to ensure that the workforce is competent to fulfill their health and safety responsibilities, the training needs of different groups of employees must be considered.
- Control: monitoring staff knowledge and awareness.
- Consultation: involving the workers in the reviewing of problems and procedures.
- Communication: occupational health and safety information needs to flow effectively within the organization and people outside it.

A well-organized corporate organization will achieve a zero health and safety management if policies are not well planned and implemented to meet the health and safety of the workers with emphasis on environmental management.

2.5.3 Planning and implementation

Planning and implementation is the third step for a successful occupational health and safety management. Planning is the key to ensuring that your health and safety efforts really work. Planning for health and safety involves setting objectives, identifying hazards, assessing risks, implementing standards of performance and developing a positive culture (Rwamamara, 2007). Rwamamara (2007) suggested that planning should provide for:

- Identify hazards and assessing risks, and deciding how they can be eliminated or controlled;

- comply with the health and safety laws that apply to your business;
- agree health and safety targets with managers and supervisors;
- purchase and supply policy which takes health and safety into account;
- design tasks, processes, equipment, products and services, safe systems of work;
- identify procedures to deal with serious and imminent danger;
- co-operate with workers, managers, regulatory agencies such as EPA, NPA, EHS, MMDAs;
- Set standards against which performance can be measured.

As a part of a feasibility study, prior to the commencement of operations, a full assessment of health, safety and environment risk is performed. This would involve having a practical arrangement and logical approach to implementing the health, safety and environment policy in place. The planning process is focused on elimination of or minimizing of risk. It is important for organizations to undertake risk assessment to facilitate the development of control measures (Holt, 2005).

2.5.4 Measuring and Reviewing

A review by Dabup (2012) showed that, conducting performance measures and reviews against a series of specific and attainable standards shows how improvement is required within the health, safety and environment policy and processes. Standards help to build a positive culture and control risks. They set out what people in the organization will do to deliver the policy and control risk. They should identify who does what, when and with what result. These standards should be measurable, achievable and realistic.

In other areas, Rwamamara (2007) observed how important it is to measure health and safety performance to judge success. The fourth step for a successful health and safety management is measuring and monitoring health and safety performance which is a key activity in making sure that the organization is achieving its health and safety policy, objectives and targets (Rwamamara, 2007).The measurement of occupational health and safety performance involves a number of functions (HSE,
2000; Holt, 2005; Lingard & Rowlinson, 2005). These include;

- provision of an indication of how the organization is performing in health and safety;
- identification of problem areas in which improvements are needed;
- providing the ability to track performance over time and evaluate the effectiveness of health and safety improvement strategies; and
- provision of data that can be used in benchmarking or comparative performance assessments, for example between construction projects

2.5.5 Monitoring, Auditing and Reviewing

Monitoring provides the needed information to review activities and decide how to improve performance (Rwamamara, 2007). Auditing by the companies own employees or outsiders, complement monitoring activities by looking to see if the policy, organization and systems are actually achieving the right results. Audits would indicate whether the health and safety policy have been reliable and effective. While reviewing the effectiveness of a health and safety policy, attention needs to be paid to;

- the degree of compliance with health and safety performance standards(including legislation);

  areas where standards are absent or inadequate;

- achievement of stated objectives within given time-scales;
- injury, illness and incident data - analyses of immediate and underlying causes, trends and common features.

Rwamamara (2007) posits that, monitoring have two key components to effective monitoring. These are the active and reactive monitorings. Active monitoring (before things go wrong), involves regular inspection and checking to ensure that your standards are being implemented and management controls are working. Reactive monitoring (after things go wrong), involves learning from your mistakes, whether they have resulted in injuries and illness, property damage or near misses. Information from active and reactive monitoring is used to identify situations that create risks, and do something about them. Priority should be given where risks are greatest, and looking closely at serious events and those with potential for serious harm.

2.6 Filling Station Employees and Risk

Filling station employees are a group of workers exposed daily to hazardous conditions ranging from armed robbery to severe petroleum fuel and or fumes containing carcinogens (WHO, 2010). For example, an American Conference of Government and Industrial Hygienist in 2001 recommended an occupational exposure limit of 23 mg/m^3 for a 10 – hour work day in a 40 – hour work week VOCs for petroleum industry workers fuel service station attendants. Yet in Ghana, fuel attendants are exposed continually to gasoline fumes for more than a typical 40 – hour work week (Udonwa, N. E., Uko, E. K., Ikpeme, B. M., Ibanga, I. A. & Okon, B. O. 2009). Exposure to these compounds poses a potential risk to many illnesses. At low chronic doses, petrol vapour is irritating to the eyes, respiratory tract, skin and neuro-cognitive functioning (Tu *et al.*, 2004). Exposure to higher

concentrations of petroleum vapour containing benzene and other harmful compounds may cause central nervous system (CNS) effects such as staggered gait, slurred speech and confusion or cancer in the long term (WHO, 2010). It could also result in rapid unconsciousness and death due to respiratory failure renal dysfunction, lipid degeneration and other clinical manifestations (Tu, R. H., Mitchell, C. S., Kay, G. G. & Risby, T. H. 2004). Frequent exposure to petroleum products is thus hazardous to workers health (WHO, 2010). Yet many filling stations had no safety policies to advance the health needs of attendants and other employees in general (Ansah & Mintah, 2012).

2.7 Health and Safety Management in Africa

A study by Nwagbaraocha (2011) showed that, prior to the late 2000s, African countries did not have legislation or regulations on health, safety and environment laws. However, this practice has changed in recent times as countries on the continent are making efforts to strengthen their health, safety and environment regulatory frameworks (Nwagbaraocha, 2011). Some of the countries include:

- Ghana which has implemented an environmental rating and disclosure scheme that indicates how companies are meeting environmental commitments with less emphasis on health and safety of workers;
- The Democratic Republic of the Congo's National Assembly passed environmental legislation that would create a national agency for environmental protection and require mandatory environmental impact statements for certain activities;
- Algeria passed a decree establishing rules and conditions for granting wastewater discharge authorizations, and

- ❖
- ❖ Morocco which reached an agreement that would create an institute to monitor H&S conditions in workplaces.

Nwagbaraocha (2011) reported that the reason for this move was attributed to pressure to modernize health, safety and environment regulatory frameworks caused by increased foreign investment in the continent, a desire for transparency within African countries, and foreign pressure from western governments on organizations that operate in Africa.

2.8 Risk Management in Occupational Health and Safety

Two theoretical approaches to health and safety management have been reviewed. These include participative and behavioural approaches. Baker (1990) reviewed the participative methods to management of safety and its effects on performance. These involved unstructured interviews with employees, managers and safety representatives. Two different styles of management were identified by Baker, in his wok; an authoritarian (top down management style) and participative approach to safety management. Moreover the participative style of management facilitates improvement to site safety through health and safety committees, safety training, crew safety plans, health support schemes, employee rehabilitation schemes, job skills training, project safety reviews as well as accident investigation and industrial hygiene approaches.

Before the introduction of participative management style, there was a reactive role in safety management, responding to safety concerns only after incident or accidents, whereas after the adoption of the participative approaches, management sought out opportunities to eliminate unsafe behaviour and conditions generally.

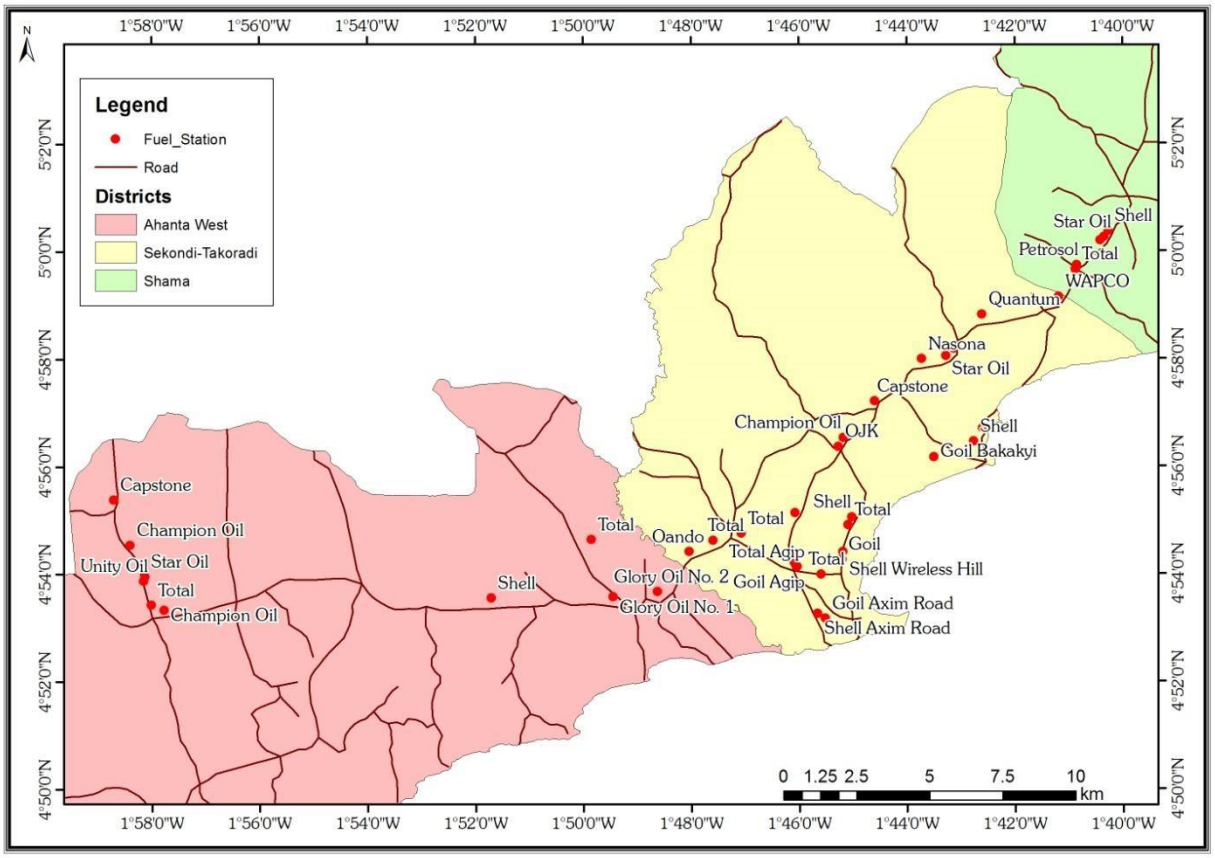
Rowe (2001) argued that, the participative approach used in the implementation resulted in the development of a sustainable approach to risk management. Induction training, continuous improvement of tools and equipment, supported by staff involvement, ongoing periodic observation and safety audits were all aspect of risk management approach.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in Agona Nkwanta, Inchaban and Sekondi-Takoradi Metropolis, which are located in the Western Region of Ghana. About 40 Filling Stations were involved in the study and their locations were captured using Global Positioning System (GPS) device to record their respective coordinates (Map 1).



Map of Filling Stations in Agona Nkwanta, Inchaban and Sekondi-Takoradi Metropolis

3.2 Social Survey

It encompasses an objective and quantitative approach to the study of social processes in a well – defined area at a given time through one or more institutions, by either a schedule, or a questionnaire and the data thus obtained related statistically (Kumekpor, 2002). Thus, is a method of collecting facts by putting questions to people. Social survey can equally be considered as an exploration or investigation into the current or existing social, political, economic and environmental conditions of a place or people (Kumekpor, 2002).

3.3 Types of Data Used

A cross – sectional survey of all Oil Marketing Companies (OMC) within Agona Nkwanta, and along the stretch of Agona Nkwanta to Sekondi – Takoradi and

Inchaban were covered in the study. Both secondary and primary data were used.

3.3.1 Secondary Data

Secondary Data used included data from agencies such as the Environmental Protection Agency (EPA) of Ghana, National Petroleum Authority (NPA) of Ghana, the Ghana National Fire Service, and Ahanta West District Assemblies. These data which included the requirements for setting up fuel stations in Ghana were: minimum setback from road (≥ 30 m); minimum distance from residential facility (≥ 30 m); distance from Under Storage Tank (UST) to dispensing pumps (≥ 10 m); and wall height (≥ 3 m). These data were used as benchmark to determine filling station compliance as compared to what was measured in the field. Other requirements which formed part of the field work included: sand in bucket close to pumps; bollards on

pumps; leakage detection, safety and health displays (such as no smoking) and fire extinguishers located near pumps or dispensers.

3.3.2 Primary data

3.3.2.1 Questionnaire administration

An interviewer administered questionnaire was used to collect data (Appendix A). The questionnaires had questions on:

- Employees demographic characteristics;
- awareness of hazards and safety measures at the filling stations;
- the prevailing safety practices at the filling stations; and
- compliance of filling stations to environmental standards

The exercise started on Friday, 2nd January, 2015 to Thursday, 5th March, 2015. The time for questionnaire administration was in the morning from 6:30 am to evening 8:30 pm. During this time most respondents were found at work including those that were running day and night shifts. On the average it took 30 minutes to interview each respondent. In all 80 respondents were interviewed.

Questionnaire was designed for the collection of the factual information. Some of the questions were prepared to elicit a straightforward "yes" or "no" response in order to avoid ambiguity and minimize the need for speculation in the analysis of the data. Before the administration of the questionnaires, a pilot study interview was undertaken on a small sample group. On the basis of the results of the study, modifications were made to the questionnaire before it was finally administered.

3.3.2.2Observation

By personal observation, it was possible to obtain information immediately and directly associated with the phenomenon being studied (Soininen, 1995). Site visits and walking around were done at specific locations within the facilities such as pump area, filling area, forecourt and security posts to compare specific project processes and the reality of security threats faced by workers. This yielded interesting observations for comparison purposes. These observations support the interviews conducted from an actual versus theoretical perspective.

3.3.2.3Interviews

The management and employees in each of the 40 filling stations under the study were visited and interviewed. Permissions were sought from the managers of the various filling stations before interviews were conducted (with the use of structured questionnaires). The researcher took into consideration the fact that, an individual's ideas on the health and safety management practices at the filling station is representative enough of the other employees' ideas since majority of the questions were straight forward questions requiring exact answers (Appendix A).

3.5 Sampling technique

The target population of this study was the employees of the Oil Marketing Companies in Agona Nkwanta, Inchaban and Sekondi-Takoradi area. Purposive sampling was used for this work. The study took into consideration the fact that the majority of the employees were made up of people who may, for some reasons, not feel disposed to complete the questionnaire themselves. The questionnaire administration thus, took the form of the researcher completing the forms as respondents provided the responses.

3.6 Location of Filling Stations

Using the Garmin high sensitivity hand-held GPS device at a navigation accuracy of 3 m – 4 m, about 120 GPS coordinates of the 40 Filling Stations were captured during the field work (Appendix B). Two weeks was used in the picking of coordinates of the study area.

3.7 Data Processing and Analysis of Variance

Data collected was edited before the analysis was done. The questionnaires retrieved from the respondents were serially numbered to facilitate identification. The responses to the various items were coded. Data were grouped and subjected to statistical analysis by means of some tools of the Statistical Product and Service Solutions software (SPSS Version 20.0). The analyses carried out were for descriptive statistics, measures of association and one-way analysis of variance. The data was presented in the form of Tables, Frequencies and Percentages.

A one – way analysis of variance was used to compare the mean scores of more than two groups (Pallant, 2011) which involve one independent variable with a number of different levels. These levels correspond to the different groups. For example, in comparing the safety practices of three major OMCs through employees' perceived safety scores, there is one factor (safety practice) based on three levels (multinational, state owned and individual private owned OMCs). The dependent variable is a continuous variable (which is the perceived safety scores of employees).

It therefore compares the variability in scores between the different groups with the variability within each of the groups (Pallant, 2011). An F ratio is calculated, representing the variance between the groups divided by the variance within the groups. A large F ratio indicates that there

is more variability between the groups (caused by the independent variable) than there is within each group (Pallant, 2011). A one – way analysis of variance was therefore conducted to explore the differences in the perceived safety management scores of employees at the Fuel Filling Stations in the study area. The respondents were divided into three groups according to the type of Fuel Filling Stations they were working with (Multinational, State Owned, and Private / Individual owned). The dependent measure was a 9 point Likert – type scale questionnaire developed to solicit information on the safety management practices such as provision of personal protective equipment (PPE), safety training, safety policies, safety communication and safety facilities.

The effect size (strength of association) for the various prevailing safety practices was calculated using eta squared given as:

$$\textbf{Eta Squared} = \frac{sum\ of\ squares\ between\ groups}{total\ sum\ of\ squares}$$

This is a set of statistics that indicates the relative magnitude of the differences between means, or the amount of the total variance in the dependent variable that is predictable from knowledge of the levels of the independent variable (Tabachnick & Fidell, 2007).

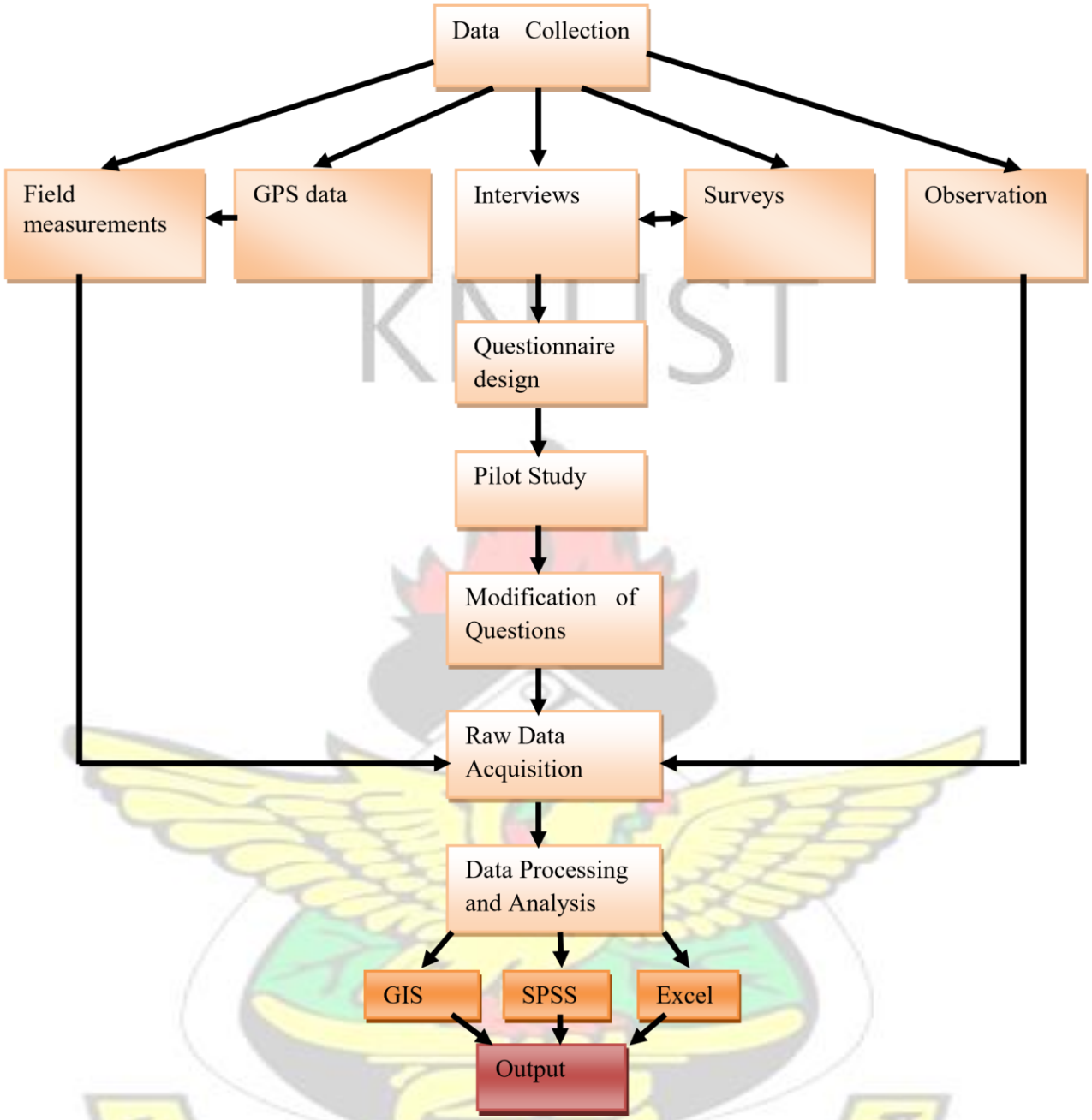


Figure 2: Flow diagram of data collection.

CHAPTER FOUR

RESULTS

4.1 Biographic Data on Respondents

The study showed that out of a total of 80 respondents interviewed at the Fuel Filling Stations, majority (75%) were males whilst 25% were females (Table 1).

Table 1: Sex of respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid **male**	60	75.0	75.0	75.0
female	20	25.0	25.0	100.0
Total	80	100.0	100.0	

But in terms of age, out of a total of 80 respondents, majority (57.5%) of the respondents were between the ages of 18 - 25, 37.5 % between the ages of 26 – 35, and 5% above 35 years (Table 2).

Table 2: Age of respondents

Age Range	Frequency	Percent	Valid Percent	Cumulative Percent
18-25	46	57.5	57.5	57.5
26-35	30	37.5	37.5	95.0
>35	4	5.0	5.0	100.0
Total	80	100.0	100.0	

The educational backgrounds of the 80 respondents working at the various Oil Marketing Companies (OMC's) were identified. It was revealed that the multinational OMCs had 2.5% of respondents with tertiary qualification, 37.5% have secondary education, and 5% have basic education. The individual private owned

OMCs saw a similar trend in terms of the number (percentage) of respondents with tertiary and secondary education but rather had 2.5% of the respondents with basic education. The state owned OMCs had the least respondents with no respondent having tertiary qualification, 10% had secondary education while 2.5% of the respondents had basic education (Figure 3).

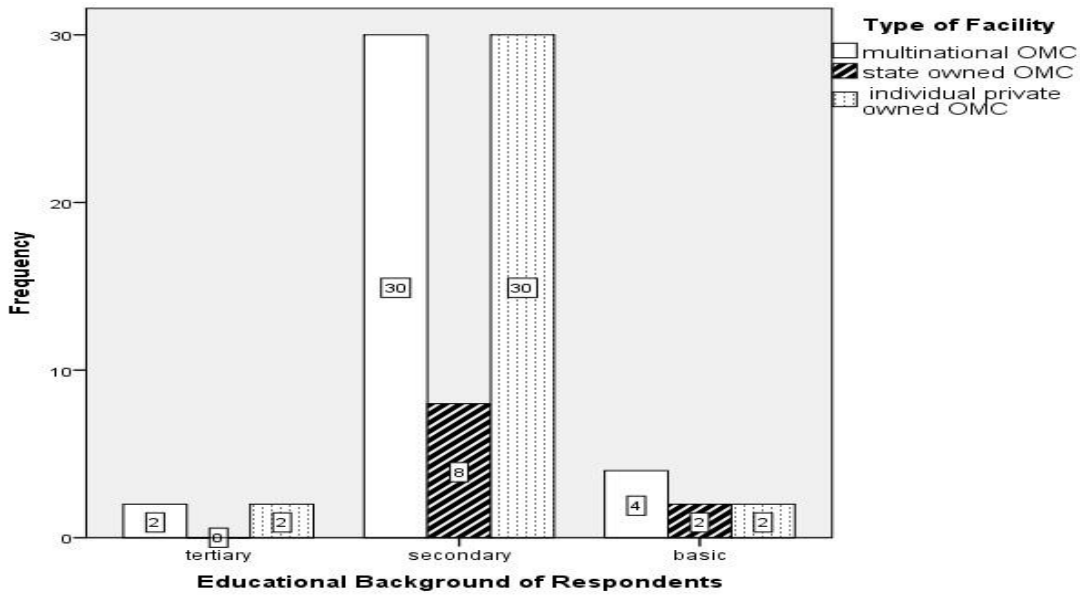


Fig 3: Educational backgrounds of the respondents at the various OMCs.

Majority of the respondents interviewed worked at the multinational companies. The study involved a total of 80 respondents, out of which 45%, 42.5% and 12.5% work at the multinational, individual private owned and state owned OMCs respectively (Figure 4). These respondents were mainly the Fuel Pump Attendants, who were always into contact with petroleum products since the bulk of the Fuel Filling Stations' services such as sale of fuel depended on them.

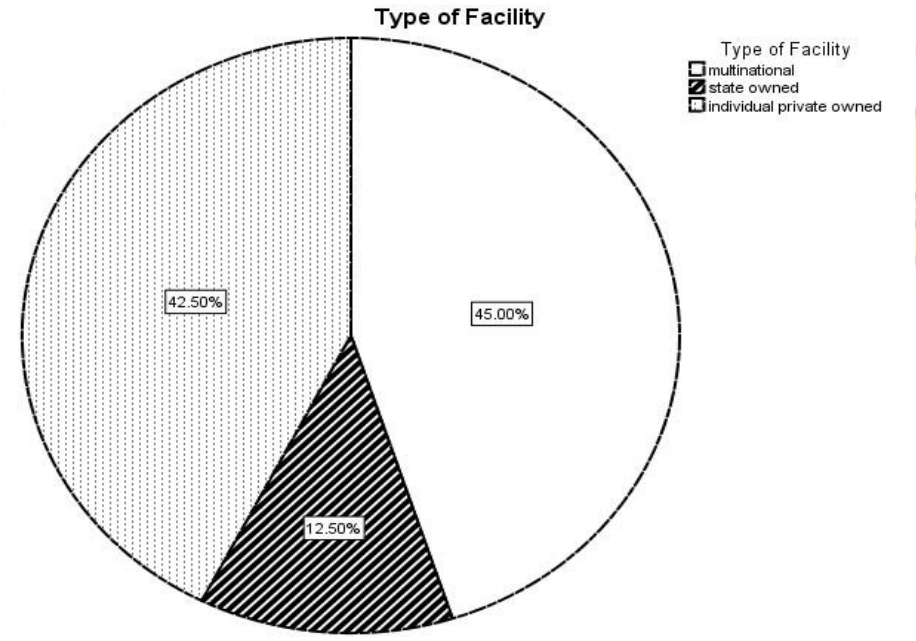


Fig 4: Categories of Oil Marketing Companies in the study area

The respondents interviewed at the Fuel Filling Stations have been working from 1 month to 2 years and above. The study suggested that majority (55%) of the respondents working at the petrol filling stations have served for more than two years while the least (12.5%) worked between 1 – 6 months. Fifteen percent of the respondents have also worked for 6 months – 1 year, while the remaining 17.5% have worked for 1 year – 2 years (Table 3).

Table **3: Length of service of respondents at Fuel Filling Stations**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1month - 6 months	10	12.5	12.5	12.5
	6 months-1 year	12	15.0	15.0	27.5
	1 year-2 years	14	17.5	17.5	45.0
	above 2 years	44	55.0	55.0	100.0
	Total	80	100.0	100.0	

n = 80, where n = the total number of respondents.

4.2 Awareness of Health and Safety Measures of the Respondents at FFS The respondents were asked whether they were aware of safety measures at their work places, 63 of them representing 78.75% agreed that they were aware of some safety measures, 7.5% of them claimed they were not aware of any safety measures whilst 11 (13.75%) of the respondents were unsure (Table 4). Knowledge of fire extinguisher usage saw a large number; 68 of the respondents indicating 85% agreeing to having knowledge on its usage, while 5% could not tell whether they could use or not. The respondents working at the FFSs that did not have knowledge of fire extinguisher

usage were 8, representing 10%. Again, 88.75% of the respondents agreed that they were aware of some practices that pose health hazards at the work place, with 7.5% being unsure and 3.75% not aware of practices that could pose health hazard at the FFS (Table 4).

In times of disaster outbreak, the employees of an organization should be aware of safe assembly point. In this case, 82.5% of the respondents at the FFS suggested they were aware of safe assembly point whilst 15% were not with 2.5% not sure. Volatile organic compounds (VOC's) are associated with petrol fumes which affect lungs of FFS attendants. The study revealed that there was wide gap in terms of lack of knowledge on awareness of the harmful effects of VOCs associated with petrol fumes, on their health as indicated by 47.5% of the respondents with 28.75% of them aware of VOC effects, whilst 23.75% were not sure of VOCs harmful effects on their health (Table 4).

Moreover, 75% of the respondents did not attend periodic medical examination with only 17.5% of them claiming they have been attending periodic medical examination. Nevertheless, majority (81.25%) of respondents were exposed to OHS policies at the work place, whereas 8.75% of them were not, with 10% of them not being sure of their exposure to OHS policy at the work place (Table 4).

Table 4: Level of Awareness on safety practices among FFS employees

Indices	Characteristics							
	Agree		Not sure		Disagree		Total	
	N	Percent	N	Percent	N	Percent	N	Percent
Aware of safety measures	63	78.75	11	13.75	6	7.5	80	100
Knowledge of Fire Extinguisher Usage	68	85	4	5	8	10	80	100

Aware of practices that pose health hazard	71	88.75	6	7.5	3	3.75	80	100
Aware of safe assembly point during fire/disaster outbreak	66	82.5	2	2.5	12	15	80	100
Aware of harmful VOC* associated with petrol fumes	23	28.75	19	23.75	38	47.5	80	100
Exposed to OHS** policies	65	81.25	8	10	7	8.75	80	100
Periodic Medical Examination	14	17.5	5	6.25	60	75	80	100

***** Volatile Organic Compounds, ****** Occupational Health and Safety.

Considering the data gathered on the awareness of the respondents on health and safety practices at the various FFS in the study area, it became imperative to know and assess the prevailing safety practices at the FFS in order to have a better idea on health and safety management systems of the OMCs.

4.3 Prevailing Safety Practices at the FFS

The research categorized the respondents into three groups according to the type of Fuel Filling Stations they were working with; Multinational, State Owned, and Private / Individual owned. The ANOVA results indicated a statistically significant difference at the $p < 0.05$ level among the 5 prevailing safety practices scores for the three groups: for adequate provision of PPEs; with $F = 14.9$, adequate safety training; $F = 13.1$, enforcement of safety policies; $F = 23.2$, adequate safety communication; $F = 9.9$, and adequate safety facilities; $F = 15.4$ (Appendix C).

The eta squared results for adequate provision of PPE was 0.28. In Cohen's (1988) terms, it would be considered as a large effect. Cohen classifies 0.01 as a small effect, 0.06 as a medium effect and 0.14 as a large effect (Cohen, 1988). The analysis revealed that the multinational Oil Marketing Companies (OMCs) (M = 5.97) had the highest provision of PPEs than the State owned with M = 4.00 and private / individual owned with OMCs M = 3.59 (Appendix D).

With a large effect (eta squared = 0.25), the ANOVA showed that Multinational OMCs had M = 6.14, provided adequate safety training for employees than the state owned OMCs (M = 4.40) and private / individual owned OMCs (M = 3.82) (Appendix D). A large effect (eta squared = 0.38) shows that the mean scores for enforcement of safety policies between private / individual owned OMCs (M = 2.15) and state owned OMCs (M = 2.50) was significantly small but both were significantly high against the mean score of multinational OMCs (M = 4.28) indicating high enforcement of safety policies by the multinational OMCs.

The effect size for adequate safety communication calculated using eta squared was 0.21. Also the mean scores of the Multinational OMCs (M = 5.11) with regards to adequate safety communication was significantly high compared to the mean scores of both State owned OMCs (M = 3.80) and private / individual owned OMCs (M = 3.44). But with another large size (eta squared = 0.29), the ANOVA analysis revealed a rather significantly small difference in the mean scores of multinational OMCs (M = 6.94) and state owned OMCs (M = 6.80) for adequate provision of safety facilities but both were significantly high against the mean score for private / individual owned OMCs (M = 4.97) (Appendix D).

A post-hoc comparison was also conducted to explore the differences between each of the groups in relation to the five dependent variables on prevailing safety practices for the study. Tukey Honestly Significant Difference Test (HSD) post-hoc also showed

that the mean scores for the multinational OMCs were statistically significant from the State Owned OMCs and Individual / Private owned OMCs in the five dependent variables on prevailing safety practices (Appendix E).

But further results obtained on other prevailing safety practices at the FFS suggested that, majority (67.5%) of the FFS carry out maintenance on fire extinguishers within every 6 months while 32.5% of them carry out maintenance on fire extinguishers after 6 months and more (Table 5). Ninety-five percent of respondents claimed that they underwent demonstration form of training in which 87.5% of them claimed lasted for more than a week. The remaining 5% claimed they only went through oral training at the work place. Duration of training that was less than 1 week had 12.5% response. Ninety percent of respondents indicated that they have leakage detection system with 45% of respondents claiming they monitor leakage on a daily basis where 12.5%, 30% and 2.5% monitor leakage on weekly, monthly and quarterly basis respectively (Table 5). However, 10% of respondents pointed out that they do not have any leakage detection system in place.

On the issue of emergency stop test, most of the FFSs carry out the emergency stop test on a monthly basis as indicated by the majority 77.5% of the respondents whereas 17.5% of them indicated they test on weekly basis and the rest 5% of the respondents claimed they carry out emergency stop test on daily basis. Also, respondents were interviewed concerning the switching off of motor vehicle engines whenever they were filling fuel. Majority 50% of the respondents claimed vehicle engines are switched off, 12.5% of them also claimed vehicle engines were not switched off and 37.5 of them also indicated that at times vehicle engines were switched off (Table 5).

Table 5: Assessment of other Prevailing Safety measures at FFS

Variable	Characteristics	Frequency	Percent (%)
maintenance of fire extinguishers	< 6 months	54	67.5
	> 6 months	26	32.5
Form of training at work place	Oral	4	5
	Demonstration	76	95
Duration of training	< 1 week	10	12.5
	> 1 week	70	87.5
Availability of leakage detection system	Yes	72	90
	No	8	10
Frequency of leakage monitoring	Daily	36	45
	Weekly	10	12.5
	Monthly	24	30
	Quarterly	2	2.5
	None	8	10
Emergency Stop test	Daily	4	5
	Weekly	14	17.5
	Monthly	62	77.5
Off car engines before filling fuel	Yes	40	50
	No	10	12.5
	Sometimes	30	37.5

n = 80, where n is the total number of respondents involved in the study

4.4 Assessment of Compliance of FFS to Required Standards

Frequency and percentage relating to the characteristics of some compliance indicators at the FFS were calculated to determine the safety management practices. The frequency revealed that, all FFSs complied with the display of no smoking sign and available fire extinguisher (Table 6). Nonetheless, 29 of the FFS indicating 72.5% displayed “IN and EXIT” sign, with 11, not displaying the “IN and EXIT” sign. The

need for bollards near pumps to safeguard pump attendants from vehicular accidents was assessed. It was identified that 80% of the FFS provided bollards within pumps while 20% did not. Similarly, 97.5% of the FFSs provided fire extinguishers near bollards / pumps whereas 2.5% of them kept their fire extinguishers at a distance. In this case, 95%, 2.5%, and 2.5% of FFSs had 1:1, 1:2, and 1:3 extinguishers to dispenser's ratios respectively. Sand in buckets was also available at 87.5% of the FFSs while 12.5% did not provide. Ninety-five percent of the FFSs claimed they never encountered fire outbreaks and 5% of the FFSs indicated they encountered fire outbreaks (Table 6). Ninety percent of FFSs were less than 30 m from the road. Only 5.3% of FFSs met the required standard of ≥ 30 m set back from the road. This is in serious violation of regulations enshrined in the laws of Ghana National Petroleum Authority (NPA) and Environmental Protection

Agency (EPA). The required ≥ 30 m set back from roads is important to reduce vulnerability of PFSs to road side accidents with moving vehicles.

EPA and NPA of Ghana set minimum distance of 10 m between Underground Storage Tanks (UST) and dispensing pumps. Majority 90% of the FFSs met the required standard while 10% did not (Table 7).

EPA and NPA Ghana require that FFSs ≥ 30 m from adjoining residential facilities. But the study revealed that 42.5% of the FFSs are < 30m from residential facilities showing how close FFSs are to the residential facilities and could negatively impact on these facilities in times of fire outbreak, but 57.5% of them met the standard requirement of ≥ 30 m from adjoining residential facilities (Table 7). It was realized that 32.5% of the FFSs have not erected any wall at all but 67.5% of the FFSs rather have walls with heights < 3m (Table 7). But Ghana NPA and EPA standard require a wall height of ≥ 3m.

Table **6: Assessment of some Compliance indicators on safety practices at the FFSs**

Variable	Characteristics	Frequency	Percent (%)
Displayed no smoking sign	Yes	40	100
	No	0	0
Displayed In and Exit sign	Yes	29	72.5
	No	11	27.5
Fire Extinguisher near Bollard/Pumps	Near	39	97.5%
	Far	1	2.5
Sand in Buckets	Available	35	87.5
	Unavailable	5	12.5
Bollards within pumps	no bollard	8	20
	bollard erected	32	80
Fire Extinguisher to dispenser ratio	1:1	38	95
	1:2	1	2.5
	1:3	1	2.5
Availability of fire extinguishers	Yes	40	100
	No	0	0
Experience fire outbreak	Yes	2	5
	No	38	95

n = 40, where n is the total number of FFSs covered in the study.

Table ***7: Physical assessment of FFS to EPA standards***

Variable	Distance/height (m)	Frequency	Percent
	< 30	36	90
	≥ 30	4	10
	< 30	17	42.5
	≥ 30	23	57.5
Distance of UST to dispensing pumps	< 10	4	10
Setback from road			
Distance from residential area			
	≥ 10	36	90
Wall height 27 67.5 no wall 13	< 3		32.5

n = 40, where n is the total number of PFS in the study area, UST = Underground Storage Tanks.

CHAPTER FIVE

DISCUSSION

5.1 Biographic Data Analysis of the Respondents

Majority of the employees working at the petrol filling stations were males. This was evident from the biographic data gathered on the respondents as indicated in Table 1. Although, little use had been made of the background data in analysing responses to the research questions, the data had a purpose. It provided an understanding of the people who participated in the study. The fuel filling stations restrict the age requirement of employees to 18 years and above. The majority of the respondents were found to be between 18 – 25 years, reflecting the age bracket of individuals (youthful and energetic individuals) who work with the FFS. They were observed to have at least completed a basic education.

The multinational Oil Marketing Companies had employees with the highest educational qualification compared to the state and individual private owned oil marketing companies. Better educational background of employees are important because they are able to comprehend technical information, and to make critical

thinking relevant to the health and safety management practices at their work place. In line with the length of employment, the research targeted respondents who have worked at the FFSs for period not less than a month. Majority of the respondents were found to have worked for more than two years while, few had worked for less than 2 years. The staffs were, thus, experienced in the work practices.

5.2 Analysis on Awareness of Health and Safety Measures of Respondents at FFS

From Table 4, it was seen that knowledge on the harmful effects of volatile organic compounds (VOCs) associated with petrol fumes was lacking among the respondents. In fact, without adequate knowledge on the effects of VOC at work places, employees may not be cautious with the use of restricted materials / procedures at their work places. It is therefore, relevant for supervisors and managers at such work places to provide information on the nature and harmful effects of their products and services. Earlier studies have shown that, petrol pump attendants are continuously exposed to organic and inorganic substances in the petrol (Majumdar *et al.*, 2008). These may be numerous, but to name a few, are volatile compounds (including benzene and toluene), along with toxic gases, such as carbon monoxide and traces of soot that are emitted from vehicles. These are known to have deleterious effect on general health, particularly on the respiratory system (Alam *et al.*, 2014).

A study by Majumdar *et al.* (2008) showed that the air at Fuel Filling Stations and their immediate surroundings is disrupted by emissions coming from evaporating vehicle fuels. These include un-burnt fuel from loading and unloading operations, refueling and liquid spillages. Therefore, one can easily deduce the high levels of

aromatic hydrocarbons at the filling station (Alam *et al*., 2008). Airborne organic compounds, such as benzene have been recorded at Filling Stations at levels high above the average levels for urban areas; where traffic is the primary source of emission (Isabel *et al*., 2010; Sergio *et al*., 2012). Alam *et al.* (2014) was of the opinion that road side air pollution was not the only area of concern to ambient environmental management. The average daily exposure of Filling Station Attendants to these air pollutants has been observed to exceed that of non-filling station attendants (Sergio *et al*., 2012).

To make matters worse, most of these respondents who were Filling Station Pump Attendants claimed they were unable to go for periodic medical check-ups at any recognized health centre, either due to inadequate financial status or not seeing the need for the check-up. This was evident in the study as three-quarter of the respondents indicated that they did not go for periodic medical check-ups (Table 4). It is rather contradicting to realize that majority of the respondents were exposed to work place occupational health and safety policies but were not privileged to adequate information on the importance for regular medical check-ups and effects of petrol fumes that they are exposed to. Majority of the respondents claimed they were aware of safety measures, practices that pose health hazard and fire extinguisher usage. In times of disaster outbreak, employees of an organization should also be aware of their safe assembly point. Accordingly, it could be seen that there were such provisions in most of the PFSs covered (Table 4). However, are these assembly points safe enough, and can they not, for instance, be impacted by raging fire considered to be class B fire? The mere provision of assembly point for employees should not be a guarantee for the complete safety of workers. Rather, adequate health and safety practices that would

ensure that disaster do not occur and even if it occurs, should come with minimum damage need to be observed.

5.3 Analysis of Prevailing Health and Safety Practices at the FFSs in the Study Area

The provision of personal protective equipment is very vital to protect workers from exposure to workplace hazards especially, chemicals or fumes (HSE, 2007). This study found that multinational companies provided most personal protective equipment to workers compared to state and private / individual owned companies. Most of the OMCs only provided employees with uniforms and safety boots. But the provision of respiratory protectors, safety glasses and safety vests were not provided in any of Fuel Filling Stations visited. Matthews *et al.* (2008) believed that efforts to eradicate exposures to adverse conditions at work places need to be complemented by increasing the provision of personal protective equipment. Also Matthews and his group observed that the lack of access to safety equipment was a major barrier to their use/work. They concluded that, with the adequate provision of personal protective equipment (PPE) devices, there was 40% increase in use than when it was not available (Matthews *et al.*, 2008). The mean provision of PPEs in (Appendix D) showed that the multinational OMCs performed better than the state and individual private owned OMCs. But the state owned OMCs also, performed better in the provision of PPEs than the individual private owned OMCs. This is in agreement with earlier findings of Olaotse (2010), who observed that, private owned OMCs provided minimal PPE that is a reflection of not complying with safety policies of OMCs. This is in relation to their small sizes hence, have worse and less developed occupational health and safety programmes for their workers. Alli (2001) also suggested that exposed persons should be provided with personal protective equipment and clothing when the degree of safety achieved is considered inadequate. Employers should thus, consult their employees or representatives on

suitable personal protective equipment and clothing, having regard to the type of work and risks involved. Furthermore, with respect to unavoidable hazards, employers should provide and maintain equipment and clothing as are reasonably necessary, without cost to the workers (Alli, 2001). The employer should provide the employees with the appropriate means also, to enable them to use the individual personal protective equipment. The employer as part of his duties is to ensure proper use of the equipment provided.

Safety training in any organization is a key to protecting and improving the health and safety of employees. The employees gain appropriate knowledge, techniques and procedures for taking precautionary measures to reduce occurrence of injury at work (Clark, 2008). In fact, this study showed high mean scores for the various OMCs, thus, indicating how important safety training was considered on their daily agenda.

But there was a vast difference in the mean score among the three categories of OMCs (Appendix D) in that, the multinational OMCs considered health and safety training vital to the success of their operations. They claimed that a very healthy and knowledgeable employee is a successful business entity. The mean score among the three OMCs was lowest for individual private owned OMCs.

Tedesse and Admassu (2006) observed that death rates occurring among workers due to occupational accidents are five to six times higher than those in industrialized countries as a result of poor safety training and education for workers. The issue is largely undocumented due to poor recording system in developing ccountries.

Employees' training is one of the most important duties to be carried out by employers. Alli (2001) agreed that workers as part of their duties, need to know, not only how to execute their jobs but also, how to protect their lives and health, and those of their coworkers at workplace. Managers and supervisors responsible for workers safety at workplaces are supposed to train them adequately. The training offered to workers

must include information on the health and safety aspects of the work, and on ways to prevent or minimize exposure to hazards (Alli, 2001). On a larger scale, employers and organizations should instigate training and information programmes on the prevention and control of hazards, and protection against risks.

Enforcement of safety policies recorded the lowest mean score (Appendix D). Therefore, it could be deduced that the OMCs in Ghana are not adhering to the enforcement of safety policies at their work places. In principle, occupational injuries and diseases are preventable and among the best approaches are; to develop occupational health and safety hazards awareness among workers and employers, assessing the nature and extent of hazards, introducing and maintaining effective control and evaluation measures, and enforcing health and safety policies (Tedesse & Admassu, 2006). Occupational and work-related accidents and injuries to health occur at the individual work places. Preventive and control measures within the enterprise should be planned and initiated jointly by the employer, managers and workers concerned. Measures formulated for the prevention and control of occupational hazards in the work place should be guided by a clear, implementable and well-defined policy at the level of the enterprise (Alli, 2011).

In achieving a successful health and safety management practices at every work place, it is essential to effectively and continuously communicate health and safety policies among employees and employers. This study identified that safety communication was the penultimate health and safety management tactics as perceived by respondents at the various OMCs. It revealed a poor safety communication between supervisors and their subordinates and among workers. The respondents perceived the individual private owned OMCs to have poor safety communication among the three categories of the OMCs. The multinational OMCs were again, perceived by the respondents to

have good safety communication. This could be attributed to their international relations and huge market presence in other countries. They also have separate health and safety management policies from locally enacted ones that fit exactly into the environment in which their operations are carried out. The respondents at some of the individual private owned OMCs even suggested that, they did not have health and safety policy though some regulatory agencies mandate them to have one. They also attributed the poor health and safety management practices at their work places to poor monitoring and supervision on the part of these regulatory bodies. One of the respondents at the individual private owned OMCs had to say this:

''We just work and nothing else. All we do is to sell fuel to customers and have no exposure to health and safety management issues here. If you get hurt while on the job, you just have to get home and treat yourself. No medication or first aid here. So all you need to do is to be very careful''

Adequate provision of safety facilities such as sanitary, good lightening systems, security personnel and waste bins had the highest mean score perceived by the respondents. This total mean score was significantly high ($p < 0.05$) than the total mean scores of the other safety variables under discussion (Appendix D). It was therefore, inferred that employees were provided with adequate sanitary facilities and waste bins. Solid waste management should be properly executed, from source to generation to the final disposal site, is highly required in work places where different kinds of wastes are generated (Tedesse & Admassu, 2006).

5.4 Analyzing Compliance of FFS to Required Standards

With the discovery and exploration of oil and gas in Ghana, Fuel Filling Stations are on the increase, as there is increase in the demand for petroleum consumptions. FFSs

are therefore, springing-up within every stretch of the road and even within residential and institutional areas. In this case, there is no effective evaluation of the environmental conditions of the places where these FFSs are sited by both the companies themselves and regulatory Government Agencies such as EPA and NPA. The study revealed that some of the FFSs were located within wetlands, on stream banks and some share walls with residential and institutional facilities, such as homes and schools. The indiscriminate siting of FFSs in both residential and institutional areas has led to an increase in the hazard levels which can cause disaster at some point in the future.

The study observed that 90% of the FFSs had set backs less than 30 m which is close to the 89% reported in a study by Olusegun *et al.* (2011) among 27 fuel stations in Ile – Ife, South Western Nigeria. Again, the study revealed that 42.5% were sited at a distance less than 30 m from residential and institutional areas (Table 7). This result is however, different from the 66% reported in a study by Ahmed *et al*, (2014) among 50 Fuel Filling Stations in Minna Town, Nigeria. This therefore, makes houses and schools with close proximity to these Fuel Filling Stations vulnerable to fire outbreaks, and increases the probability of accidents cases around the Filling Stations.

Notable incident is the June 3, 2015 multi-hazard disaster that occurred at a GOIL Filling Station near Kwame Nkrumah Circle which resulted in the deaths of over 160 people with several others sustaining different degrees of injuries. Residential and other infrastructural facilities within the GOIL filling station got burnt resulting in economic losses (Daily Graphic, 2015); only 5% of the FFSs claimed that they experienced fire outbreaks in the study as compared to 11% and 0% fire outbreaks reported in earlier works by Olusegun *et al.* (2011) and Ahmed *et al.* (2014) respectively. In view of wall heights, none of the FFSs met the required standard of ≥

3 m, whereas 90% fared well in meeting the required standard of ≥ 10 m of distance between underground storage tanks and dispensing pumps (Table 7). The 10% that did not meet the required distance were the individual private owned OMCs. With the possibility of fire outbreaks, there were 100%, 97.5%, 87.5%, and 95% compliance for the display of no smoking sign, extinguisher near bollard / pumps, sand in buckets and availability of fire extinguishers respectively within the FFSs (Table 6). The multinational and state owned OMCs fared well in the provision of sand in buckets and extinguishers near bollard / pumps than the individual private owned OMCs.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study concludes that though respondents claimed they have knowledge of safety measures at their respective work places, yet that did not determine the success of the OMCs in health and safety management because the scope was narrow. Majority of them were with little knowledge of safety measures and this was not enough for productive work. Workers were exposed to the harmful effects of volatile organic and inorganic compounds from petrol fumes and dust particles, and they were not also attending regular medical checkups. Health issues at work places were not given the needed attention by the respondents and the employers in general.

The multinational OMCs were performing well as compared to the other categories of OMCs in all the health and safety variables such as adequate provision of PPE, adequate safety training, adequate safety facilities and adequate health and safety communication. The OMC's failed in the stringent enforcement of health and safety policies, though most respondents perceived multinational OMC's as performing better than the state and individual private owned OMC's, according to the mean scores. The state owned and the multinational OMC's were found to provide the best safety facilities for their workers than the individual private owned OMC's. Workers were given pre-job and on-the-job trainings to prepare them for the task of executing good health and safety management practices.

The OMC's complied with the display of no smoking sign, provision of fire extinguisher, placement of fire extinguisher near bollards / pumps though few of them did not comply with the display of "In and Exit" sign, provision of sand in buckets, and erection of bollards bills. Most of the OMC's violated the siting policies of PFS as most were less than 30 m of the set back from the road as against the recommended distance.

6.2 Recommendations

The following recommendations have been proposed:

- The oil marketing companies, especially the individual and state owned companies should increase the provision of personal protective equipment such as respiratory protectors (nose and mouth guards), safety vests, safety glasses and gloves for the station attendants;
- Workers should be adequately trained on health and safety issues, especially in the individual private owned OMC's.

- Government of Ghana through the appropriate agencies should enact national health and safety policies that would be used to regulate activities of the OMC's with a provision for follow up on regular basis'
- There should be proper documentation on occupational health and safety related disaster cases at work places by the assigned agencies or bodies in Ghana to facilitate easy access and policy planning;
- Petrol filling stations should not be sited in residential and institutional areas, in order to prevent mass disaster;
- The reason for non-compliance should be investigated in future study to ascertain the reality on the ground.
- Regulatory agencies should strengthen their policy implementation as these individual private owned OMCs are falling short of required standards in several aspects of health, safety and environment indicators.

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APPENDICES

Appendix A: Questionnaire on Health and Safety Practices in Petrol Filling Stations at Agona, Shama and Sekondi-Takoradi.

Please complete this form. **Tick your choices**. All information will be handled with confidentiality.

1. Age of respondents (yrs) : 18-25 [ ] 26-35 [ ] above 35 [ ]
2. Sex of respondents : Male [ ] Female [ ] 3. Educational background :
   a) Tertiary [ ]
   b) Senior Secondary School [ ]
   c) Basic /Middle School [ ]
4. Name of Petrol filling station…….
5. Type of Petrol filling station
   a) Multinational company [ ]
   b) Individual private owned [ ]
   c) State owned
6. For how long have you been working with this Petrol Filling Station?
   a) 1 day – 6 months [ ]
   b) 6 months – 1 year [ ]
   c) 1 year – 2 years [ ]
   d) above 2 years [ ]

7. Please kindly score the following variables on awareness of safety measures at your work place using strongly agree, agree, unsure, disagree or strongly disagree.

Variable	Strongly agree	agree	unsure	disagree	Strongly disagree
Aware of safety measures					
Knowledge of Fire Extinguisher Usage					
Aware of practices that pose health hazard					
Aware of safe assembly point during fire/disaster outbreak					

Aware of harmful VOC* associated with petrol fumes					
Exposed to OHS** policies					
Periodic Medical Examination					

8. Displayed NO SMOKING sign. YES [ ] NO [ ]
9. Displayed IN and EXIT signs. YES [ ] NO [ ]
10. Do you have fire extinguisher(s)? YES [ ] NO [ ]
11. Do you know how to operate them? YES [ ] NO [ ]
12. Fire Extinguisher to DISPENSER 1: 1, 1: 2, 1: 3 OR 1: Whole
13. Maintenance of Fire Extinguisher. < 6 months [ ] > 6 months [ ]
14. Have ever experience any form of work place disaster such as fire outbreak. YES [ ] NO [ ]
15. Form of training at the workplace. Oral [ ] Demonstration [ ] None [ ]
16. Duration of Training: Less than 1wk [ ] Greater than 1 wk [ ] No training [ ]
17. Training before job placement: YES [ ] NO [ ]
18. Availability of leakage detection system: YES [ ] NO []
19. Duration of checking of leakage. (a) daily [ ] (b) weekly [ ] (c) monthly [ ] d) quarterly e) none [ ]
20. Please score the following prevailing safety management practices at your work place using 1 = very strongly disagree 2 = strongly disagree 3 = disagree 4 = weakly disagree 5 = no idea 6 = weakly agree 7= agree 8 = strongly agree 9 = very strongly agree

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Adequate provision of PPE									
Adequate safety training									
Enforcement of safety policies									
Adequate safety communication									

Adequate safety facilities									

21.How often do you check your emergency test stop?

a) daily [ ]

b) weekly [ ]

c) monthly [ ]

22. Do the vehicles off their engines before filling the fuel? a) yes [ ] b) no [ ]

23. Any other comment or suggestions that have not been captured in this study which you will like this research to address?

……
……
……
……

Field Measurement / Work

1. Wall height at filling stations < 3 m [ ] ≥ 3 m [ ] None [ ]
2. Setback from the road <30m [ ]≥30m [ ]
3. Distance from residential area <30m [ ]≥30m [ ]
4. Distance of UST to dispensing pumps < 10 m [ ] ≥ 10 m [ ]

Field Observations

1. Sand in bucks: a) available [ ] b) not available [ ]

2. Extinguisher near Bollard/Pumps: a) near [ ] b) far [ ] 3. Bollards within pumps: a) no bollard b) erected [ ] **Appendix B: GPS Coordinates of filling stations within Agona Nkwanta, Shama and Sekondi – Takoradi Area.**

Name of Filling Station: Capstone- Agona Nkwanta T1

N: 04° 55.388	04°55.373	04°55.393
W:001°58.710	001°58.703	001°58.695

E:165 187 190

Name of Filling Station: Champion Oil – Agona Nkwanta T2

N: 04° 54.544 04°54.533 04°54.549

W:001°58.405 001°58.392 001°58.369

E:160 160 156

Name of Filling Station: Star Oil- Agona Nkwanta T3

N: 04° 53.955 04°53.969 04°53.946

W:001°58.129 001°58.118 001°58.115

E: 144 146 143

Name of Filling Station: Unity Oil- Agona Nkwanta T4

N: 04° 53.875 04°53.858 04°53.875

W:001°58.151 001°58.139 001°58.125

E: 134 131 134

Name of Filling Station: Total – Agona Nkwanta T5

N: 04° 53.427 04°53.421 04°53.428

W:001°58.009 001°58.014 001°58.001

E: 144 146 144

Name of Filling Station: Champion Oil – Agona Nkwanta T6

N: 04° 53.335 04°53.337 04°53.317

W:001°57.779 001°57.781 001°57.789

E: 160 158 158

Name of Filling Station: Shell – BokroT7

N: 04° 53.554 04°53.558 04°53.566

W:001°51.710 001°51.724 001°51.714

E: 133 133 130

Name of Filling Station: Total - BeahuT8

N: 04° 54.638 04°53.635 04°53.626

W:001°49.859 001°49.838 001°49.851

E: 65 66 65

Name of Filling Station: Glory Oil No. 1– ApowaT9

N: 04° 53.577 04°53.590 04°53.599

W:001°49.459 001°49.468 001°49.474

E: 92 93 96

Name of Filling Station: Glory Oil No. 2-ApowaT10

N: 04° 53.665 04°53.672 04°53.663

W:001°48.628 001°48.610 001°48.612

E: 56 56 57

Name of Filling Station: Oando-ApremdoT11

N: 04° 54.410 04°54.403 04°54.420

W:001°48.041 001°48.025 001°48.024

E: 41 40 40

Name of Filling Station: Total-ApremdoT12

N: 04° 54.622 04°54.632 04°54.626

W:001°47.604 001°47.582 001°47.593

E: 44 45 46

Name of Filling Station: Total- KwesimintimT13

N: 04° 54.751 04°54.763 04°54.761

W:001°47.080 001°47.080 001°47.090

E: 54 53 53 Name of Filling Station: Shell Axim Road-Takoradi T14

N: 04° 53.257 04°53.246 04°53.254

W:001°45.662 001°45.654 001°45.641

E: 45 45 43

Name of Filling Station: Goil Axim Road- TakoradiT15

N: 04° 53.169	04°53.165	04°53.171
W:001°45.521	001°45.509	001°45.498
E: 46	48	47

Name of Filling Station: Shell Agip- TakoradiT16

N: 04° 54.131	04°54.116	04°53.171
W:001°46.039	001°46.032	001°46.035
E: 64	64	66

Name of Filling Station: Total Agip- TakoradiT17

N: 04° 54.128	04°54.113	04°54.086
W:001°46.048	001°46.053	001°46.048
E: 64	62	62

Name of Filling Station: Goil Agip- TakoradiT18

N: 04° 54.208	04°54.212	04°54.229
W:001°46.101	001°46.117	001°45.108
E: 67	71	70

Name of Filling Station: Nasona TTI- TakoradiT19

N: 04° 55.132	04°55.133	04°55.119
W:001°46.080	001°46.093	001°46.089
E: 83	85	84

Name of Filling Station: O J K Fijai Junction T20

N: 04° 56.364	04°56.355	04°56.329
W:001°45.275	001°45.262	001°45.258
E: 132	130	133

Name of Filling Station: Champion Oil Fijai T21

N: 04° 56.531	04°56.534	04°56.530
W:001°45.183	001°45.195	001°45.205
E: 153	155	151

Name of Filling Station: Capstone Nkroful Junction T22

N: 04° 57.210	04°57.211	04°57.210
W:001°44.601	001°44.612	001°44.620
E: 149	150	148

Name of Filling Station: Nasona Kojokrom T23

N: 04° 57.991	04°57.981	04°57.974
W:001°43.733	001°43.740	001°43.745
E: 127	131	133

Name of Filling Station: Star Oil Kojokrom T24

N: 04° 58.052	04°58.045	04°58.040
W:001°43.282	001°43.280	001°45.276
E: 122	121	119

Name of Filling Station: Champion Oil Kojokrom T25

N: 04° 58.186	04°58.178	04°58.172
W:001°43.139	001°43.135	001°43.124
E: 131	130	130

Name of Filling Station: Quantum Kojokrom T26

N: 04° 58.818	04°58.828	04°58.842
W:001°42.612	001°42.614	001°42.613
E: 187	187	188

Name of Filling Station: Wapco Sekco Junction T27

N: 04° 59.146	04°59.143	04°59.130
W:001°41.186	001°41.177	001°41.178
E: 103	104	104

Name of Filling Station: Total Inchaban T28

N: 04° 59.659	04°59.661	04°59.670

W:001°40.881 001°40.874 001°40.878

E: 82 82 82

Name of Filling Station: Petrosol Inchaban T29

N: 04° 59.737 04°59.743 04°59.747

W:001°40.855 001°40.863 001°40.871

E: 80 79 77

Name of Filling Station: Kan Royal Inchaban T30

N: 05° 00.196 05°00.186 05°00.182

W:001°40.418 001°40.406 001°40.399

E: 76 75 75

Name of Filling Station: Star Oil Inchaban T31

N: 05° 00.255 05°00.248 05°00.244

W:001°40.347 001°40.337 001°40.329

E: 79 77 72

Name of Filling Station: Shell Inchaban T32

N: 05° 00.371 05°00.385 05°00.390

W:001°40.264 001°40.266 001°40.269

E: 75 77 74

Name of Filling Station: Old Shama Road- Sekondi T33

N: 04° 56.709 04°56.700 04°56.702

W:001°42.599 001°42.606 001°42.607

E: 128 128 126 Name of Filling Station: Shell Esikado T34

N: 04° 56.457 04°56.460 04°56.465

W:001°42.765 001°42.767 001°42.767

E: 82 81 81

Name of Filling Station: Goil Bakakyi- Sekondi T35

N: 04° 56.167 04°56.171 04°56.185

W:001°43.502 001°43.504 001°43.510

E: 60 60 58

Name of Filling Station: Shell Sekondi Road T36

N: 04° 55.054 04°55.056 04°55.054

W:001°45.027 001°45.035 001°45.038

E: 65 65 63

Name of Filling Station: Total Sekondi Road T37

N: 04° 54.910 04°54.902 04°54.895

W:001°45.101 001°45.096 001°45.090

E: 58 55 53

Name of Filling Station: Shell Wireless Hill- Sekondi T38

N: 04° 54.411 04°54.418 04°54.414

W:001°45.194 001°45.192 001°45.187

Name of Filling Station: Goil Sekondi Road T39

N: 04° 54.269 04°54.263 04°54.253

W:001°45.215 001°45.213 001°45.207

E: 77 79 78

Name of Filling Station: Total Market Circle T40

N: 04° 53.990 04°53.985 04°53.972

W:001°45.601 001°45.606 001°45.611

E: 61 61 60 **Appendix C:** ANOVA on Prevailing Safety Practices among OMCs in the Study area

Prevailing Safety Measures		Sum of Squares	df	Mean Square	F	Sig.
Adequate provision of PPE	Between Groups	105.180	2	52.590	14.931	.000
	Within Groups	271.208	77	3.522		
	Total	376.388	79			
Adequate safety training	Between Groups	97.041	2	48.520	13.079	.000
	Within Groups	285.647	77	3.710		

	Total	382.688	79			
Enforcement of safety policies	Between Groups	84.213	2	42.107	23.161	.000
	Within Groups	139.987	77	1.818		
	Total	224.200	79			
Adequate safety communication	Between Groups	50.950	2	25.475	9.930	.000
	Within Groups	197.538	77	2.565		
	Total	248.487	79			
Adequate safety facilities	Between Groups	73.928	2	36.964	15.949	.000
	Within Groups	178.459	77	2.318		
	Total	252.388	79			

Appendix D: Descriptive Statistics for Prevailing Safety Practices among OMCs in the Study area

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Adequate provision of PPE	multinational	36	5.97	1.748	.291	5.38	6.56	5.31	2	9
	state owned	10	4.00	1.826	.577	2.69	4.29		0	6
	individual private owned	34	3.59	2.017	.346	2.88			0	8
	Total	80	4.71	2.183	.244	4.23	5.20		0	9

Adequate safety training	multinational	36	6.14	1.693	.282	5.57	6.71		2	9
	state owned	10	4.40	2.459	.777	2.64	6.16		0	8
	individual private owned	34	3.82	1.992	.342	3.13	4.52		1	8
	Total	80	4.94	2.201	.246	4.45	5.43		0	9
Enforcement of safety policies	multinational	36	4.28	1.256	.209	3.85	4.70	3.63	2	7
	state owned	10	2.50	1.581	.500	1.37	2.63		0	5
	individual private owned	34	2.15	1.374	.236	1.67			0	5
	Total	80	3.15	1.685	.188	2.78	3.52		0	7
Adequate safety communication	multinational	36	5.11	1.369	.228	4.65	5.57	5.10	2	8
	state owned	10	3.80	1.814	.573	2.50	4.06		2	6
	individual private owned	34	3.44	1.761	.302	2.83			1	8
	Total	80	4.24	1.774	.198	3.84	4.63		1	8
Adequate safety facilities	multinational	36	6.94	1.413	.236	6.47	7.42	7.36	4	9
	state owned	10	6.80	.789	.249	6.24	5.59		6	8
	individual private owned	34	4.97	1.766	.303	4.35			1	7
	Total	80	6.09	1.787	.200	5.69	6.49		1	9

Appendix E: Post-hoc test for Prevailing Safety Practices among OMCs in the Study area using Tukey HSD

Dependent Variable	(I) Type of Facility	(J) Type of Facility	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound

Adequate provision of PPE	multinational	state owned	1.972*	.671	.012	.37	3.58
		individual private owned	2.384*	.449	.000	1.31	3.46
	state owned	multinational	-1.972*	.412	.671	.012	-3.58
		individual private owned	-2.384*		.675	.815	-1.20
	individual private owned	multinational state owned	-.412		.449	.000	-3.46
			1.739*		.675	.815	-2.03
Adequate safety training	multinational	state owned	2.315*		.688	.036	.09
		individual private owned	-1.739*	.576	.461	.000	1.21
	state owned	multinational	-2.315*		.688	.036	-3.38
		individual private owned	-.576		.693	.684	-1.08
	individual private owned	multinational state owned	1.778*	2.131*	.461	.000	-3.42
			2.131*		.693	.684	-2.23
Enforcement of safety policies	multinational	state owned	-1.778*	.353	.482	.001	.63
		individual private owned	-2.131*		.322	.000	1.36
	state owned	multinational	-.353		.482	.001	-2.93 -
		individual private owned	1.311		.485	.748	.81
	individual private owned	multinational state owned	1.670*		.322	.000	-2.90
			-1.311		.485	.748	-1.51
Adequate safety communication	multinational state owned	individual private owned	.359		.573	.063	-.06
		multinational state owned			.383	.000	.75
		individual private owned			.573	.063	-2.68
		multinational individual private owned			.576	.808	-1.02

	individual private owned	multinational	-1.670*	-.359	.383	.000	-2.59	-.75
		state owned			.576	.808	-1.74	1.02
Adequate safety facilities	multinational	state owned individual private owned	.144		.544	.962	-1.16	1.44
			1.974*		.364	.000	1.10	2.84
	state owned	multinational	-.144		.544	.962	-1.44	1.16
		individual private owned	1.829*		.548	.004	.52	3.14
	individual private owned	multinational	-1.974*		.364	.000	-2.84	-1.10
		state owned	-1.829*		.548	.004	-3.14	-.52

*. The mean difference is significant at the 0.05 level.

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The Regional Director,

Environmental Protection Agency,

P.M.B

Sekondi-Takoradi, W/R.

Dear Sir/Madam,

REQUEST FOR ASSISTANCE

This is to introduce to you Mr./Miss/Mrs. George Tirenkyi,

a second year/third year/fourth year undergraduate/postgraduate student(s) of the Department of Environmental Science, Kwame Nkrumah University of Science and Technology, Kumasi.

They are/He is/She is currently working on a project entitled: Health and Safety Practices among Petrol filling stations in Agona Shaha and Sekondi-Takoradi and require(s) the under mentioned assistance from your outfit.

To use facilities in your laboratory	[ ]	To obtain information	[✓]
To obtain chemical(s)	[ ]	To collect data	[✓]
To test sample(s)	[ ]	To collect samples(s)	[ ]

Name of Facility/Chemical/Sample(s).....

The Department will be most grateful if they/he/she can receive all the assistance they/he/she need(s) to achieve this goal. Student Phone No.....0249705364...
Name of Supervisor.....Mr. Martin Arkoh.
Supervisor's Phone No...0201215676.

Yours faithfully,

DR. I. K. TETTEH
HEAD OF DEPARTMENT