



ASSESSMENT OF HEALTH AND SAFETY PRACTICES IN OIL AND GAS DOWNSTREAM SECTOR: A CASE STUDY OF 50 FUEL SERVICE STATIONS IN ENUGU STATE

Okolieuwa, Christopher Chikwado

Department of Occupational Health and Safety Management, South American University

Abstract

This research was conducted to assess the health and safety standards, occupational hazards and health problems among pumps attendants in fuel service stations in Enugu metropolis. Data was collected using structured questionnaire and an observation check list. A total of 221 pump attendants and 50 fuel service station managers were randomly sampled from 50 fuel service station in Enugu metropolis. The Fisher's exact test at 5% significance level and binary logistic regression were conducted to test association among study parameters using SPSS. The top three occupation hazards were exposure to extreme weather conditions (99%), inhalation of vehicle exhausts fumes and petrol vapour (98%) and fire outbreak (88%). Common illnesses experienced by pump attendants are all work-related and were dominated by musculoskeletal disorders (MSDs), low-back pain (LBP) headaches and dizziness logistic regression using age, sex and work experience as risk factors for MSDs, LBPs and headaches showed significant association between LBP and age of pump attendants ($P=0.036\%$ $\lambda=0.16-0.94$) whilst MSDs and headaches showed on significant association with the risk factors. Post-employment medical examination habits was poor (22%) among the attendants possibly owing to ignorance of the health risks and the fact that the related costs are self-borne. Although all stations had firefighting equipment, training in their usage was highly associated with work experience of pump attendants.

Keywords *Health and Safety Practices; Occupational Hazards; Downstream Sector; Fuel Service Stations*

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Introduction

Health and safety practices in the oil and gas downstream sector in Enugu state are regulated by various agencies, including the Department of Petroleum Resources (DPR), the Nigerian National Petroleum Corporation (NNPC), and the Nigerian Content Development and Monitoring Board (NCDMB). These agencies have established regulations, guidelines, and standards to ensure that health and safety practices are upheld in the sector. However, despite the existence of regulations and guidelines, there are still significant concerns about the health and safety practices in the oil and gas downstream sector in Enugu state. Studies have shown that there are frequent incidents of oil spills, gas flaring, and other environmental pollution caused by the industry, which can have severe health impacts on local communities (Adisa, 2017).

Furthermore, the oil and gas downstream sector in Enugu State is also associated with a high incidence of occupational injuries and fatalities. Workers in the sector are exposed to various hazards, such as explosions, fires, chemical exposure, and physical hazards, which can result in injuries or fatalities (Oyeyemi et al., 2020). To address these concerns, there is a need for regular and comprehensive assessments of health and safety practices in the oil and gas downstream sector.

The practice of health and safety is an unavoidable facet of the oil and gas industry because health concerns of an employee ought to be valued more than any other thing in an organization. There is an adage that says "health is wealth". All other factors involved in the running of an organization all depends on man, both money, material and machines are to be spent, utilized and controlled by man. It is of great importance to note that the state of health of an employee is directly related to his level of performance, therefore a healthy worker is a productive worker. Goetzl (1999) opined that improving employees Health and Safety practice at work, is directly related to their productivity and profitability of organizations. Oxenburgh et al. (2004) said "the health and safety of all employees is closely linked to the Company's productivity in all workplaces". Muchemedzi and Charamba (2006) define occupational health as a science concerned with health in its relation to work or working environment.

Webb (1989) depicted that a central belief in most of the occupational medicine/health promotion literature is that people perform better when they are physically and emotionally able to work and want to work which in turn leads to higher productivity. More substantial links between the implementation of health and safety programmes and their beneficial impact on a business's productivity and profits are emerging both directly (such as reduced sick pay and compensation claims) and indirectly (for example, reduced absenteeism, improved corporate reputation and reduced staff agitation).

Webb (1989) also studied a workstation change and found out an increase of 1000% in productivity within less than three months. These changes are mechanical and physical, for example a change of postures to reduce physical strain of work and use of appropriate machinery for some tasks. Improving the fit between humans and tools inherently means a more effective match, good design permits more output with less human effort (MacLeod, 1995). Improving the quality of the workplace environment promotes productivity and oil and gas companies need to undertake Occupational Health and Safety practices that achieve this.

A workstation change can increase productivity; however, it is misleading to conclude that this change results in the improvement of occupational health and safety standards. New machinery can also be hazardous to health. For instance, a noisy machine may be replaced by a new machine that is more efficient but produces dust. This shows a mere shift from one hazard to another. A workstation change can cause increased efficiency and productivity leading to an ignorance of the resultant occupational health and safety implications. It is therefore misleading to conclude that a workstation change improves occupational health and safety standards in light of the increased productivity. Some workers experience back, neck, leg or arm pain discomfort. There is now a recognition that safer and healthier workplaces translate into increased productivity, more job satisfaction and stronger bottom-line results in the oil and gas industry.

The oil and gas industry in terms of structure have been broadly divided into: upstream sector, downstream sector and Midstream sector. The upstream sector is characterized by exploration and production (E&P) of crude oil and gas (petroleum operations). The upstream sector includes searching for potential underground or underwater crude oil and natural gas fields, drilling exploratory wells and subsequently drilling and operating the wells that and cruel oil or raw material to the surface. There has been a significant shift toward including unconventional gas as a part of

the upstream sector, and corresponding developments in liquefied natural gas (NLG) processing and transport. The midstream sector involved the transportation (by pipeline, rail, barge, oil tanker or truck) strong and wholesale marketing of crude oil or refined petroleum products. Pipelines and other transport systems can be used to move crude oil from production sites to refineries and deliver the various refined products to downstream distributors. Natural gas pipeline network aggregate gas from natural gas producers and deliver it to downstream customers, such as local utilities. The midstream operations are often taken to include some element of the upstream and downstream sectors for example, the midstream, sector may include natural gas processing plants that purify the raw natural gas as well as removing and producing elemental sulfur and natural gas liquids (NGL) as finished products.

Some service providers including in the midstream sector are the barge companies, Rail road Companies, Trucking and handling companies, pipeline transport companies, logistics and Technology companies, Trans loading companies, etc. The downstream sector is the refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas. The downstream sector reaches consumers through products such as gasoline or petrol kerosene jet fuel, diesel oil, heating oil, fuel oils, lubricant waxes asphalt natural gas and liquefied petroleum gas (LPG) as well as hundreds of petrochemical products. Midstream operations are often included in the downstream category and are considered to be a part of the downstream sector. The oil and gas industry falls well and truly within the category of a high-risk working environment. Few other industries self-regulate more strenuously to continuously improve health and safety. However, some top tips for maintaining a safe working environment are as follows:

1. Maintaining basic safety measures
2. Be aware of all hazards
3. Maintain dialogue with your workforce
4. Never stop learning
5. Get to the root of any issues etc.

The management of most filling stations in Enugu state recognize that the propensity of any organization is intricately linked to its health and safety performance and dependent upon responsible environmental stewardship. They believe in the safety of their people, protection of the environment and assets as their main focus. Most take proactive measures to prevent occurrence of avoidable emergencies and incidents but where they do happen, they respond timely, learn from the incident and improve on their readiness to achieve total loss control.

Statement of the Problem

The human, social and economic costs of occupational accidents, injuries and diseases and major industrial disasters have long been a cause for concern at all levels from the individual workplace to the national and international. Measures and strategies designed to prevent, control, reduce or eliminate occupational hazards and risks have been developed and applied continuously over the years to keep pace with technological and economic changes. Yet, despite continuous if slow improvements, occupational accidents and diseases are still too frequent and their cost in terms of human suffering and economic burden continues to be significant. A recent ILO report estimated that 2 million occupational fatalities occur across the world every year (ILO, 2003), the highest proportions of these deaths being caused by work-related accidents, carelessness on the part of oil and gas workers and inadequate safety equipment. The overall annual rate of occupational accidents, fatal and non-fatal, is estimated at 270 million (Hämäläinen, Takala and Saarela, 2006). Some 160 million workers suffer from work-related accidents and about two-thirds of those are away from work for four working days or longer as a result. After work-related accidents, accidental occupational injuries are also the main cause of work-related fatalities. Recent data from the ILO and from the World Health Organization (WHO, October, 2013) indicate that overall occupational accidents are slowly declining in most industrialized countries (ILO, 2003) but are level or increasing in developing and industrializing countries (Alli, 2008). Poor performance in occupational health and safety (OHS) can take a heavy financial toll on any business, not to mention the human cost of work-related illness, injury, and fatality. This is the primary aim of an effective Occupational Health Safety – Management System (OHS – MS). The implementation of such a system can also help your business to deal with the legal imperatives, ethical concerns, industrial relations considerations relating to workplace safety, and to improve its financial performance.

Objectives of the Study

The broad objective of the study is to assess health and safety practices in oil and gas downstream sector - a case study of 50 Fuel Service Stations in Enugu State. The specific objectives of the study are:

- i. To determine the level of compliance to the health and safety practices and regulations in the oil and gas downstream sector.
- ii. To be aware of all hazard and maintain basic safety measures.
- iii. To reduce as low as reasonably practicable the accident rate recorded in the oil and gas downstream sector.

Review of Related Literature

Conceptual Review

Concept of Health and Safety Practices

The oil and gas industry is a major contributor to Enugu state internally generated revenue and at large to the Nigerian economy, accounting for over 80% of the country's export earnings. However, the sector is also associated with a high risk of work-related accidents and illnesses, particularly in the downstream sector where workers are exposed to hazardous materials and processes. To mitigate these risks, health and safety practices have been implemented in Enugu State oil and gas downstream companies. This review provides an overview of the health and safety practices in the Enugu oil and gas downstream sector, and highlights some of the challenges faced by companies in implementing these practices. The health and safety practices in the oil and gas downstream sector are primarily guided by regulations and standards set by government agencies, such as the Nigerian National Petroleum Corporation (NNPC) and the Department of Petroleum Resources (DPR). These regulations cover a range of areas, including the use of personal protective equipment, emergency response planning, and the implementation of safety management systems.

Personal Protective Equipment (PPE):

PPE is an important aspect of health and safety practices in Enugu state and also in the Nigerian oil and gas downstream sector. Workers are required to wear appropriate PPE, such as gloves, safety glasses, and respiratory protection, when working with hazardous materials and processes. However, studies have shown that the use of PPE is often inadequate in Nigerian oil and gas downstream companies, with workers frequently reporting shortages of PPE or being forced to reuse PPE that is no longer effective (Ezejiofor et al., 2019; Oyeyemi et al., 2021).

Safety Management Systems:

Safety management systems (SMS) are a proactive approach to managing health and safety in the workplace. They involve the identification of hazards and the implementation of controls to eliminate or mitigate those hazards. While SMS have been implemented in some oil and gas downstream companies, there is a lack of comprehensive research on their effectiveness in reducing work-related accidents and illnesses (Aluko et al., 2020).

Emergency Response Planning:

Emergency response planning is another important aspect of health and safety practices in the oil and gas downstream sector. Companies are required to have emergency response plans in place to address potential incidents, such as fires or spills. However, research has shown that emergency response plans in Enugu oil and gas downstream companies are often inadequate, with a lack of training and preparedness among workers and inadequate resources for responding to incidents (Oyeyemi et al., 2021).

Challenges in Implementing Health and Safety Practices in Oil and Gas Downstream

While regulations and standards are in place to guide health and safety practices in Enugu oil and gas downstream companies, there are several challenges faced by these companies in implementing these practices. These challenges include a lack of resources and funding, a lack of awareness and education among workers, and cultural

and social factors that may influence attitudes towards health and safety (Oyeyemi et al., 2021, and Akintayo et al., 2020).

Health and Safety Incidents

The most common types of health and safety incidents occur in the work place. This implies that oil and gas sector is known for high-risk activities, which can lead to severe health and safety incidents (HSIs). These incidents can have significant impacts on workers, the environment, and the economy. It is therefore essential to develop a measure for understanding the causes and prevention strategies for HSIs in the oil and gas sector in Enugu State.

Concept of Occupational Accident

An occupational accident is defined as a fire, explosion or another occurrence at work which may endanger the life or other persons. Filling station offer favorable conditions for occupational accidents. In this place it is problems related to noise favoring irritability of the worker physical stress and decreased hearing acuity among others. Biological agents can result in respiratory infections among others. The inadequate postures, the long working hours standing and repetitive movements may be cause injury and pain in the cervical spine, upper and lower limbs. Please note that the injuries resulting from chemical agents are indicated as a major concern in occupational workplace. Benzene, a constituent of gasoline is associated with skin lesions and intoxication at the airway and lymphoblastic leukemia (NHL). Chemical hazards are recognized in the literature and in different studies as the risk of greater magnitude and also cited with greater potential loss over time, however, it is important to identify the workers perceptions of occupational exposure in order to be able to understand all risk factors in relation to their workday for these reasons, the present study aimed to identify types of occupational accidents involving fuel stations workers and report the development of a socio environment intervention as a tool for risk communication to fuel station workers.

Concept of Occupational Health and Safety Legislation

Occupational health and safety legislation is a means by which the work environment can be controlled to ensure the safety, health and welfare of employees and persons likely to be adversely affected by the work environment are protected.

Muchemedzi and Charamba (2006) define occupational health as a science concerned with health in its relation to work or working environment. According to Webb (1989), a central belief in most of the occupational medicine/health promotion literature is that people perform better when they are physically and emotionally able to work and want to work which in turn leads to higher productivity. More substantial links between the implementation of health and safety programmes and their beneficial impact on a business's productivity and profits are emerging both directly (such as reduced sick pay and compensation claims) and indirectly (for example, reduced absenteeism, improved corporate reputation and reduced staff agitation).

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There is now a recognition that safer and healthier workplaces translate into increased productivity, more job satisfaction and stronger bottom-line results.

There are four factors that explain the link between productivity and employees' overall health and safety as explained by Brandt-Rauf et al., 2001:

1. The need for more innovative ways to reduce the high rates of workplace injury and illness.
2. The pressure to reduce the social and economic costs of injury and illness, particularly compensation costs.
3. The need to improve labour productivity without employees needing to work longer hours and/or taking on more work.
4. The need to offer good working conditions as an enticement to recruit and retain skilled workers in the labour market.

The human resource managers these days are faced with crucial issues of occupational health and safety than before. The reason is that the workers just like any other resources require maintenance and care in order to maximize their productivity (Casio, 1996). It is against this background that health and safety should not be viewed as a separate function or responsibility, but as a broader initiative that aims at improving productivity, profitability and competitiveness of oil and gas firm (Pike, 2000).

Reasons for Occupational Health and Safety

- a. **Moral:** duty of reasonable care; unacceptability of putting health and safety of people at risk; society's attitude to moral obligations; making the moral case to senior management
- b. **Legal:** the preventive (enforcement), punitive (through criminal sanctions), and compensatory effects of law
- c. **Economic:** direct and indirect costs associated with incidents and/or unhealthy workplaces and their impact on the organization (includes insured and un-insured costs).

Identification of Occupational Illness

1. Respiratory diseases
2. Skin disease
3. Upper limb and neck disorder
4. Back problems and lower limb disorder
5. Cancers and malignant blood disease
6. Poisoning
7. Noise induced hearing loss
8. Mental ill-health
9. Other occupational illness, etc.

Hazard in the Oil and Gas Industry

The presence of flammable hydrocarbons is an intrinsic hazard in the oil and gas industry in operational locations and wherever products are transported or used. The related health and safety risk have to be addressed across the industry's activities, which include:

1. Seismic and drilling
2. Projects
3. Facility operations
4. Maintenance
5. Construction
6. Marine and road transport

Management systems have been successful in mitigating health and safety risk and reducing the number of incidents. An important aspect of these systems is continuous improvement that is assessed by monitoring performance using indicators.

Different Risk Factors in the Filling Station Workplace

- a. **Physical Risk Factors:** Physical risk factors to which worker are exposed on filling stations includes noise from vehicles, extreme air temperature (hot or cold) during the seasons.
- b. **Chemical risk factors:** Chemical risk factors include contact with the fuel, more specifically, with the chemical Benzene.
- c. **Biological risk factors:** Biological risk factors including bacteria viruses, fungi etc. which the gas station workers come into contact due to the diversity of clients of the local population and immigrants from other regions characteristics of the eastern region of the study, the lack of hand hygiene of workers and non-use of individual protective devices.
- d. **Physiological risk factors:** They are repetitive movements of the same type, such as those performed by employees of filling stations to supply to vehicles. These factors can create or worsen occupational diseases and accidents, which depend on the nature of risk, the degree of exposure, a lack of protective measure, work conditions and rhythms and the worker's function

The Employees, Visitors, Volunteers and Contractors are required to:

- i. Take reasonable care for their own OHS and act in a manner that does not put other at risk
- ii. Actively contribute to identifying, reporting and reducing occupational health and safety hazards and risk.
- iii. Cooperate with the organization on OHS matters including following laid down procedures and participating in consultation and training.

Accident Control

When an accident occurs, it only shows that something has gone wrong with one or more process of the job or some elements of carelessness on the part of the workers or an employer has created an unsafe condition of work. Therefore, an employer or site supervisor should put in place all necessary prevention or control materials and take control of contributory causes of the accident. The employer or site supervisor should also know the physical and mental state of the workers to be sure of the safety level of the site. In ascertaining a reasonable safety control level, the site supervisor should put into consideration the following:

- a. Supervisor safety analysis
- b. Job hazard analysis
- c. Enforcement of safety rules
- d. Adequate safety knowledge
- e. Promotion of employee participation in safety
- f. Development of safety working condition
- g. Mental condition of worker
- h. Physical condition of worker

Other measures of accident control as explained by Bokinni (2006) are highlighted below:

- a. All floors should be clean, not slippery and free from debris
- b. Stairs, gangways and loading bays should be adequately guarded and maintained
- c. Adequate illumination for workspace
- d. Holes, edges and opening should be adequately protected.
- e. Display of standard warning signs where hazard exists
- f. Materials and components should be stacked correctly
- g. Projecting objects or obstacles should be adequately protected.

Protective Clothing

Provision of protective clothing and equipment are as well important. For safety purpose, workers in oil and gas industry should be adequately protected using the following clothing or \ and equipment

- a. safety helmets
- b. safety boots

- c. welding shields
- d. vision goggles
- e. waist safety belts for ladders
- f. Industrial gloves.
- g. green welder's gauntlet
- h. dust mask
- i. Ear defenders. etc.

First Aid and the essence of Accident Control

First aid as an immediate skilled treatment given to a victim of an injury or accident before the service of an expert is at hand. For the safety purposes in an oil and gas firm a first aid box with all required materials must be present. A well enlightened person about safety should be placed in charge of the first aid box to administer treatment in case of accident. A record of accidents and causes should be kept by the person in charge of the box to ensure such does not re-occur and materials administered should be recorded as well.

Theoretical Framework

This research work is anchored on the theory of needs hierarchy which was developed by Abraham Maslow. Maslow's hierarchy of needs is a motivational theory that explains how human beings are motivated by different needs, which are arranged in a hierarchical order.

Safety constitutes one of the essential human needs, as postulated by Abraham Maslow in his theory of needs hierarchy. Safety needs is the need for physical safety, security, and protection from harm. Feeling safe at work ranks as a very important factor in job satisfaction, (Kreitner, 2007). In attempt to satisfy this need certain organizations incorporate into their policy thrusts, guaranteeing workers' safe work execution under a climate capable of enhancing the physical, mental, and emotional conditions. Organizational policy of this nature is often categorized under health and safety. Under work environment, Hall and Goodale (1986) describe employee health as the absence of illness or disease resulting from the interaction of employee and the work environment.

In general term, health means a state of complete physical, emotional, mental, and social ability of an individual to cope with his environment, and not merely the absence of disease or infirmity (Hippocrate, 1981). Health is the art and science of preventing disease, prolonging life, promoting physical and mental health, sanitation and personal hygiene, control of infections and organization of health services (Lucas, 2001).

On the other hand, safety means freedom from the occurrence or risk of injury or loss (Aswathappa, 2010). He described industrial, occupational or employee safety as the protection of workers from the danger of industrial accidents.

Safety can as well be referred to as the absence of injuries due to the interaction of the employee and the work environment (Lucas, 2001). In a general perspective, safety means a condition of being safe from undergoing or causing hurt, injuries or loss. Hence, safety policies may encompass activities directed at either reducing or complete removal of hazardous conditions capable of causing bodily injuries. Organizational safety policy, according to Aswathappa (2010), specifies the company's safety goals and designates the responsibilities and authority for their achievement. According to him, such policy statement must emphatically declare four fundamental points:

- (i) The safety of employees and the public
- (ii) Safety taking precedence over expediency.
- (iii) Every effort made to involve all managers, supervisors and employees in the development and implementation of safety procedures.
- (iv) Safety legislation to be complied with.

Occupational health and safety in the context of this research work is concerned with the health and safety of workers, which Annah (2004) described as part and parcel of human security and as a basic human right.

According to ILO (2005), occupational health and safety focuses on the development of specific measures and programmes, aimed at protecting employees in the course of performing their duties to maximize productivity and improve the overall organizational performance. When it comes to the oil and gas sector, health and safety practices are crucial to meet the physiological and safety needs of employees. Working in this sector can be risky due to various hazards, such as explosions, fires, chemical exposures, and fall (Slovic, 1987). Therefore, companies in this sector must provide a safe working environment for their employees, including proper training, protective equipment, and emergency response plans. These measures help ensure the physical safety and security of workers, which is a crucial foundation for fulfilling higher-level needs such as love and belonging, esteem, and self-actualization. In summary, the oil and gas sector must prioritize the physiological and safety needs of employees to create a conducive working environment that fosters higher-level needs, such as personal growth and fulfillment of potential.

Empirical Review

Assessment of health and safety practices in the oil and gas downstream sector in Enugu is essential to ensure that the industry's risks are minimized. Studies have been conducted to assess the health and safety practices in the sector and identify areas for improvement.

A study conducted by Oyeyemi et al. (2020) assessed the occupational health and safety practices among petroleum downstream workers in Nigeria. The study used a cross-sectional survey design, and data were collected through self-administered questionnaires. The study found that the majority of workers in the sector were aware of the health and safety hazards associated with their jobs. However, the study also revealed that workers lacked adequate safety training and access to personal protective equipment (PPE).

Another study by Adisa (2017) assessed the environmental degradation and human health risk in the Niger Delta region of Nigeria, where the oil and gas industry is prevalent. The study used a review of literature and found that oil spills, gas flaring, and other environmental pollution caused by the industry had severe health impacts on local communities.

Furthermore, a study by Ajayi and Adebisi (2018) assessed the safety culture in the Nigerian oil and gas industry. The study used a survey design, and data were collected through self-administered questionnaires. The study found that the safety culture in the industry was generally poor, with workers having little regard for safety protocols.

In addition, a study by Oyedele et al. (2019) assessed the safety management practices in the Nigerian oil and gas industry. The study used a cross-sectional survey design, and data were collected through self-administered questionnaires. The study found that safety management practices in the industry were generally inadequate, with poor risk management and inadequate emergency response plans.

Muchemedzi and Charamba (2006) explain that accidents do not arise from a single cause but from a combination of factors which act simultaneously. A potentially unsafe situation does not cause an accident until someone is exposed to it. Accidents are caused by the result of unsafe acts or practices (the human element that results from poor attitudes, physical conditions and lack of knowledge or skills to enable one to work safely). They are also caused by the result of unsafe conditions of equipment or materials.

Koopman (2001) states that accidents bring pain and suffering to the worker and his family. When it results in permanent disability, the consequences are disastrous for both the victim and the company. The victim loses his earning capacity and ability to enjoy a normal active life, and the society and company are deprived of his/her skill and contribution to production.

Leoni (2010) carried out research on what drives the perception of Health and Safety risk in the workplace? The paper explores also the role played by personal characteristics and household structure for the explanation of risk perceptions. After controlling for job characteristics, workplace hazards, job satisfaction and health outcomes. The

study adopted descriptive statistics and finds that risk perceptions are strongly correlated with gender, age, and household structure.

Gap in Empirical Literature

Despite the growing attention towards health and safety practices in the oil and gas downstream sector in Enugu state, there is still a lack of comprehensive research on the effectiveness of these practices in reducing work-related accidents and illnesses. While some studies have explored specific aspects of health and safety in the sector, such as the use of personal protective equipment or the implementation of safety management systems, few have provided a holistic assessment of the overall health and safety culture in Enugu state and Nigerian oil and gas downstream companies at large. Additionally, there is a need for more research that examines the specific challenges faced by workers in this sector, particularly those related to cultural, social, and economic factors, in order to develop targeted interventions and policies that can effectively improve health and safety outcomes.

Methodology

Research Design

This study is survey research. It was designed to assess health and safety practices in oil and gas downstream sector in Enugu State. Descriptive research is seen as the best method which includes the use of questionnaire or interviews in the collection of data. Hence, the researcher used questionnaires to obtain information needed for this study. To identify the strength of the responses to various questions, percentage would be calculated and all the data obtained would be analyzed.

Population of the Study

The population for the study was 50 fuel service stations in Enugu State.

Determination of Sample Size

A sample of 22 fuel service stations that agreed to participate for the research were selected from the 50 fuel service stations in Enugu State. The 22 fuel service stations had a sample population of 340 workers but only 221 agreed to participate in the survey which represent a 65% response rate to draw inferences.

Methods of Data Analysis

The method adopted in this research was based on statistical table by distributing the respondents according to their answers from the surveyed for the purpose of data analysis. Simple statistical tools were used in most cases, frequency counts in tabular form, percentage, mean, standard deviation and fishers' exact test to verify the existence and association between perceived risk and occurrence of accidents, while influence of exposure time on the occurrence of occupational accidents and worker's risk perception were performed using Mann-Whitney test. This is necessary because the data obtained are qualitative and fixed. Software utilized was the latest version of SPSS.

Discussion of Findings

Data Presentation

Return Rate of Distributed Questionnaire

In the course of the study, three hundred and forty (340) copies of questionnaire were distributed to staff of the 22 fuel service stations in Enugu State. Out of the 340 copies of questionnaires distributed, 221 copies were correctly filled and returned. This number constitutes 65% of the total number of copies distributed. The other ones were incorrectly filled or uncompleted by respondents. This is presented in table 1

Table 1: Return Rate of Distributed Questionnaire

<i>Location</i>	<i>Distribution</i>	<i>Returned</i>	<i>Not Returned</i>	<i>% Return</i>	<i>% Not Return</i>
Enugu State	340	221	119	65	35
Total	340	221	119	65%	35%

Sources: Field Survey, 2023

From table 1, 65% (221 respondents) of the total copies distributed were returned while 35% which represents 35 copies distributed were not returned.

Participants Characteristics:

Table 2: Demographic characteristics of Study subjects (n=221)

<i>S/N</i>	<i>Variables</i>	<i>Categories</i>	<i>N</i>	<i>%</i>
1	Gender	Male	200	90.5
		Female	21	9.5
2	Marital status	Single	115	52
		Married	97	43.9
3	Skin color/ethnicity	Separated	9	85.54.1
		White	24	10.8
		Black	189	85.5
		Asian	5	2.3
		Indigenous	2	0.9
		Not known	1	0.5
4	Schooling	Elementary school (incomplete)	29	13.1
		Secondary school (incomplete)	32	14.5
		Secondary school	111	50.2
		Higher education (incomplete)	8	3.6
		Higher education	1	0.5
		Post graduate education	1	0.5
		Not answered	1	0.5

Sources: Field Survey, 2023

Table 2 above depicts responses from the workers of the selected fuel service stations in Enugu metropolis, most workers (200; 90.5%) were male 189 (85.9%) were ethnically coloured and 115 (52%) were single. Their ages ranged from 19 to 64 years with an average of 30.25 years (+9.58) and 111 (50.2%) had finished secondary school.

Risk perception

Table 3: Perception of filling station workers about physical, chemical, biological and physiological risk factors (n=221).

S/N	Risk factors	N	Percent %
1	Physical		
	-cold	162	73.3
	-Moisture	150	67.9
	-Noise	125	56.6
	-Heat	120	54.3
	-vibrations	47	21.3
	-non-ionizing radiation	17	7.7
	Abnormal pressure	17	7.7
2.	Chemicals		
	-Chemical products	176	79.6
	-Dust	159	71.9
	-Gasses	155	70.1
	-Vapors	131	59.3
	-Mist	106	48.0
	-Fumes	82	31.7
3	Biological		
	-Bacteria	115	52.0
	- Virus	110	49.8
	-Fungi	60	27.1
	- Protozoa	39	17.6
	-Parasites	35	15.8
	- Bacilli	28	12.7
4	Physiological		
	-Poor Posture	83	37.6
	- Repetitive Strain	83	37.6
	- Slippery	39	17.6
	- Inadequate lighting	29	13.1
	- Lifting heavy loads	25	11.3
	-Materials scattered on the floor	10	4.5

Sources: Field Survey, 2023

Table 3 which is the result of the questionnaire on risk perception in the work environment. It depicted various statistics for physical risk factor, chemical risk factor, biological risk factors and physiological risk factors. Among the risks factors identified, the most frequent contacted with chemical products in the workplace was cited by 176 (79%) workers.

Occupational Accidents

Occupational accidents were reported by 94% (208) of the participants. The most frequent reported occupational accidents reported was contact between fuel and skin, which was reported by 202 workers (91.4%)

Table 4: Occupational accidents reported by filling station workers (n=221)

<i>Variables</i>	<i>N</i>	<i>Percent %</i>
<i>Fuel leak</i>	163	73.08
<i>Skin contacts with fuel (gasoline alcohol diesel)</i>	202	91.4
<i>Outpouring of fuel (gasoline diesel) on the worker</i>	138	62.4
<i>Eye contact with fuel (gasoline alcohol diesel)</i>	164	74.2
<i>Contact with another substances (detergent grease, dust) in the eyes</i>	118	53.4
<i>Fuel inhalation</i>	172	77.8
<i>Collision between car and workers</i>	178	80.5

Sources: Field Survey, 2023

The self-reported occupational accidents were adjusted for duration of exposure and showed a significant difference ($p=0.012$) for contact of fuel with the eyes. For those with longer exposure to fuel, the risk for this type of occupational accident was greater. The self-reported (chemical Physical, ergonomic and biological) risk factors were adjusted for the occurrence of occupational accidents per risk type and the fuel set of risks. In the first case, the chemical and biological risks exhibited significant differences ($p=0.05$), as did the full set of risk grouped together ($p=0.629$).

Socio environmental intervention with Gas Station Worker is summarized in tables 5 and 6

Table 5: Personal protective equipment reported by filling station worker that could minimize the workplace risk (n=9)

<i>Individual protective Device</i>	<i>N</i>	<i>Percent %</i>
<i>Gloves</i>	7	77.7
<i>Apron</i>	2	22.2
<i>Mask</i>	9	100
<i>Boots</i>	3	33.3
<i>Working clothes</i>	3	33.3
<i>Safety glasses</i>	2	22.2

Sources: Field Survey, 2023

From table 5 above, depicted the preferences for personal protective equipment by the filling station worker that could minimize workplace risk. The result showed that mask is the most suitable and protective device as the whole respondents strongly accepted this option among others devices.

Table 6: Strategies identified by gas station workers that can be taken to minimize risk in the workplace (n=9)

<i>Strategies to minimizing risks</i>	<i>N</i>	<i>Percent %</i>
<i>Avoid contact with fuel</i>	2	22.2
<i>Wash hands regularly</i>	1	11.1
<i>Drinking water</i>	1	11.1
<i>Exercising regularly</i>	2	22.2
<i>Conducting workshops with managers</i>	2	22.2
<i>Use of PPD</i>	4	44.4
<i>Disclosure of risks at filling stations</i>	1	11.1
<i>Healthcare for workers about food</i>	1	11.1

Sources: Field Survey, 2023

From table 6 above, the result showed that the respondents were of the opinion that PPD can be used to minimize risk in the workplace more than other variables and strategies in the table.

Summary of the Findings

This study contributes to an understanding of the perception of risk factors and the occurrence of occupational accidents among fuel station workers. As regards the perception of risk factors that were identified that reported risks in decreasing order are; chemical, physical, physiological and biological. Regarding accidents occurring to fuel station workers, the study found that the accidental skin contact with fuel and constant inhalation of vapors emitted by vehicle can lead to a greater number of accidents. It must also consider that these workers face different types of vehicles. Depending on the type of vehicle, the fuel exposure can be larger or smaller. The greater the fuel exposure, the greater is the chance of contact with skin and eyes of the worker with the fuel.

Moreover, the need of workers to 'sniff' the tank cap to ensure the type of fuel contained in order to avoid mistakes causes fuel inhalation. The finding also suggests that the perception of chemical involving this risk were present more frequently. This risk perception related to the chemical risk and chemical occupational accident, is due to the raw material that the work handle in their daily work, for example, gasoline. Gasoline or fuel is derived from crude oil and composed of aromatic hydrocarbons, including benzene, toluene and xylene (BTX). Benzene is an important chemical because its physical properties can be modified as a function of vapor pressure, resulting in the production of dangerous toxic gases. According to the classification system developed by the International Agency for Research on Cancer (IARC), benzene belongs to group 1 which comprises compounds or physical factors carcinogenic to humans. Therefore, special attention must be paid to the degree and duration of benzene which are uncertain and depends on other factors, such as absorption susceptibility. Regarding chemical risk 20% of the investigated workers identified chemical used in their work environment, 17% identified gases derived from fuel, and 14% identified the vapors emitted by cars, for a total of 51% of the sample. In other studies, the frequent inhalation handling of gas or fuel pumps and daily exposure to several litres of fuels were indicated as the main factors of exposure

This study documented and reported that chemical occupational accidents are frequent among fuel station workers that have longer exposure time. In addition, the exposure time was higher in the case of eye contact with fuel chemical occupational accident. In this occupational accident example, it is known that the absorption capacity of the agent benzene can be increased by contact with the mucosa of the eye and the mouth. Skin contact with fuel was reported by 91.4% fuel station workers, and it is known that there is a potential way for absorption, because of the ability of the fuel (Liquid phase or vapor) to permeate the skin, small latency contact and high toxicity, even after brief exposure.

Conclusion

This study concludes that fuel service station worker have realized that they are exposure to risk factors, especially chemical risk factors due to their workplace being particularly dangerous. The frequency of occupation accidents tends to a state that allows the perceptions of risk factors to be realized from the accident to the worker. Such evidence confirms the findings of literature on risk factors that fuel service station workers face in the workplace and in similar situations to those formal in this particular study. This study highlight the importance of review and changes in work conditions of fuel service station workers (for example, avoiding skin contact with fuel with workers using gloves) like other realities that already exceed the unsanitary conditions. To appropriately address the needs of specific worker subgroup with the complexity that exists within the workforce, the study asserts that the risk communication is a participatory process designed to assist individuals or groups to make decision that will advance their health and wellbeing. Health promotion theorists define empowerment as a multidimensional construct that attends to individual, small group of workers and organizational of health promotion. The strategy of risk communication constitutes a positive possibility of learning about risk factors and the individual and collective measure to minimize the accidents. Occupational health professionals plays an important role in responding to the unique needs of individuals and subgroups that make up a diverse workforce, by targeting subgroups with health promotional campaigns and advocating for health work place.

Recommendations

Based on the findings the study recommends that:

- i. There is need to conduct regular safety audits: Regular safety audits can help assess the effectiveness of health and safety practices in the downstream sector. The audit can include a review of safety policies, procedures, and training programs, as well as a site inspection to identify potential hazards and risks.
- ii. There is need for employee feedback and involvement: Employee feedback and involvement can provide valuable insights into the effectiveness of health and safety practices. Regular surveys and focus groups can help gather feedback from workers on the safety culture, training programs, and overall safety performance. Additionally, involving employees in safety committees or other safety-related initiatives can increase their engagement and investment in health and safety practices.
- iii. Management should endeavor to analyze incident reports: Incident reports can provide valuable information on the types of accidents and incidents that are occurring in the downstream sector. Analyzing incident reports can help identify trends, root causes, and areas for improvement in health and safety practices in oil and gas downstream sector in Enugu state. This analysis can inform the development of targeted safety interventions to prevent future incidents.
- iv. Use leading indicators: Leading indicators can provide insight into the effectiveness of health and safety practices before an incident occurs. These indicators can include metrics such as safety training completion rates, safety observation reports, and safety inspection completion rates. Regularly tracking leading indicators can help identify areas of improvement in health and safety practices and proactively address potential risks.

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