

**A STUDY ON OCCUPATIONAL HEALTH HAZARDS AMONG OIL  
AND GAS COMPANY WORKERS IN ONEKPA RIVERS STATE  
NIGERIA**

**BY**

**ONWUSAH, VALENTINE CHINEDU**

**REG NO: 20174082028**

**A THESIS SUBMITTED TO THE POST GRADUATE SCHOOL,  
FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI.**

**JUNE, 2024**

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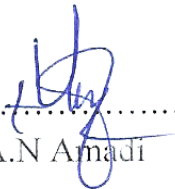
**A THESIS SUBMITTED TO THE POST GRADUATE SCHOOL,  
FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI.**

**IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE.**

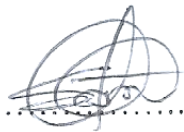
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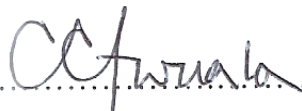
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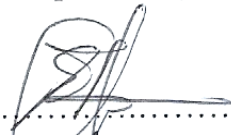
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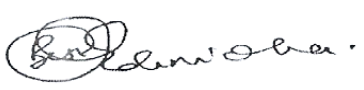
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## **DEDICATION**

This thesis is dedicated to the family of Sir Eze Onwusah

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## TABLE OF CONTENTS

Cover Page	
Title Page	i
Certification	ii
Dedication	iii
Acknowledgements	iv
Table of Contents	v
List of Figures	viii
List of Tables	ix
Abstract	x
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
1.1 Background to the Study	1
1.2 Statement of the Problem	2
1.3 Objective of the Study	3
1.3.1 General Objective	3
1.3.2 Specific Objectives	3
1.4 Research Questions	3
1.5 Research Hypothesis	4
1.6 Significance of Study	4
1.7 Scope of the Study	4
<b>CHAPTER TWO: LITERATURE REVIEW</b>	<b>5</b>
2.1 Conceptual Literature	5
2.1.1 Overview of Occupational Hazards	5
2.1.2 Classification of Hazards	6
2.1.3 Occurrence of Hazards	10
2.1.4 Sources of Occupational Hazards	11
2.1.5 Consequences of Occupational Hazards	13
2.1.6 Hazards Related to Oil and Gas Industry	15
2.2 Hazard Control Measures	19
2.2.1 The Effects of Oil Exploration	24
2.2.2 International Occupational Health	27
2.2.3 The International Labour Organization	28

2.3 Occupational Health Disease	29
2.3.1 Examples of Occupational Health Diseases	29
2.4 Occupational Health and Safety	30
2.5 Empirical Studies	31
2.5.1 Occupational Hazards	31
2.5.2 Knowledge, Attitude and Compliance with Occupational Health and Safety Practices	33
2.5.3 Appraisal of Occupational Health Practices of Workers in an Oil Producing Company	34
2.5.4 Effects of Occupational Hazards	34
2.6 Theoretical Framework	36
2.6.1 Domino Theory	37
2.6.2 System Theory	40
<b>CHAPTER THREE: MATERIALS AND METHODS</b>	<b>42</b>
3.1 Study Design	42
3.2 The Study Area	42
3.3 Study Population	43
3.4 Sample Size and Sampling Methods.	43
3.4.1 Sample Size Determination	43
3.4.2 Sampling Methods	44
3.5 Instruments for Data Collection	44
3.6 Validity of the Instruments	45
3.7 Reliability of the Instrument	45
3.8 Method of Data Collection	45
3.9 Method of Data Analysis	46
3.10 Ethical Consideration/ Informed Consent	46
<b>CHAPTER FOUR: RESULTS</b>	<b>47</b>
4.1 Socio-demographic Characteristics	47
4.2 Awareness of Hazards among Oil and Gas Company Workers in ONELGA	49
4.3 Physical Hazards among Oil and Gas Company Workers in ONELGA	50
4.4 Mechanical Hazards among Oil and Gas Company Workers in ONELGA	52
4.5 Chemical Hazards among Oil and Gas Company Workers in ONELGA.	54
4.6 Health Effect Associated to Exposure to Chemical Hazards among Oil and Gas Company Workers in ONELG	56

4.7 Health Effect Associated to Exposure to Physical and Mechanical Hazards among Oil and Gas Company Workers	58
<b>CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS</b>	<b>61</b>
5.1 Discussion	61
5.1.1 Social Demographical Characteristics	61
5.1.2 Physical Hazards among Oil and Gas Company Workers in ONELGA	61
5.1.3 Mechanical Hazards among Oil and Gas Company Workers in ONELGA	62
5.1.4 Chemical Hazards among Oil and Gas Company Workers in ONELGA	62
5.1.5 Effect Associated with Exposure to Chemical Hazards	63
5.1.5.1 Effect Associated with Exposure to Physical and Mechanical Hazards	64
5.2 Conclusion	64
5.3 Recommendations	65
5.4 Contribution to Knowledge	65
5.5 Suggestions for Future Research	66
REFERENCES	67
APPENDIX I	74

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
2.1: Illustration showing Safety and injury hazards and its possible causes	15
2.2: Illustration showing health effects from key processes in oil and gas industry	17
2.3: Graphic Illustration of Heinrich's Domino Sequence of Accident Causation	38
2.4: Illustration showing system theory and elements of safety system	40
3.1: Map of Rivers State	42

## LIST OF TABLES

<b>Table</b>	<b>Page</b>
4.1: Social Demographical Characteristics of Participants	48
4.2: Awareness of Hazards among Oil and Gas Company Workers in ONELGA	49
4.3: Identification of Physical Hazards among Oil and Gas Company Workers in ONELGA	51
4.4: Identification of Mechanical Hazards among Oil and Gas Company Workers in ONELGA.	53
4.5: Identification of Chemical Hazards among Oil and Gas Company Workers in ONELGA	55
4:6 Health Effect Associated to Exposure to Chemical Hazards among Oil and Gas Company Workers in ONELGA.	57
4:7 Health Effects Associated with Exposure to Physical and Mechanical Hazards	59
4.8 Z-test Analysis of the Difference between the Opinions of Workers between Health Problems and Exposure to Chemical Hazard	60

## ABSTRACT

Occupational health hazard has continued to have a serious public health impact with oil and gas sector being highly affected. Identification of these hazards provides the best approach on how to prevent their occurrence. This study was aimed to identify the occupational health hazards among oil and gas company workers in Ogba/Egbema/Ndoni LGA (ONELGA) the study is a descriptive design with a study population as 1233, three oil and gas companies were selected from one Local Government Area using simple random sampling technique. The sample size was 400 oil and gas company workers in ONELGA LGA, Rivers State. A well validated questionnaire was employed as part of the data collection process. The collected data were analyzed using Microsoft Excel 2010 and presented in frequency and percentages. A total of 312 and 88 male and female respectively as well as 240 and 160 tertiary and secondary educational certificates holders respectively responded to the test instrument. The null hypotheses were tested using z-test statistics at 0.05 level of significance. The result of this study revealed that 62% of the respondent are aware of the physical hazards in their work place, 59% were aware of the chemical hazards in their work place, 53% were aware of the mechanical hazards in their work place, 50% of oil workers agreed that they sustain injuries due to impact force collision and falls, 50% were exposed to heavy metals 75 % were exposed to noise. The study showed that there was a significant association between exposure to chemical hazards and occurrence of diseases. z-critical value of +1.96. The mean and standard deviation for the exposure to chemical hazards were 2.89 and 1.69 respectively. This study shows that workers in the oil and gas companies are exposed to physical, mechanical and chemical hazards, according to findings it is therefore recommended that Management should provide appropriate, adequate and modern Personal Protective Equipment (PPEs,) for workers in the oil and gas companies to improve the health and well-being of their workers. The management should provide first aid equipment in every working site to give first aid/emergency treatment in case of accidents before being taken to the hospital. Management should provide a functional firefighting system in case of fire outbreaks. The workers should ensure to always put on their personnel protective equipment (PPE) no matter how small or short the job may be to avoid injuries.

**Keywords:** Occupational health hazard, Company, Oil and Gas, Exposure, Workers, Rivers State

# CHAPTER ONE

## INTRODUCTION

### **1.1 Background to the Study**

Occupational hazards are the conditions that result from the occupational environment in relation to industrial activities that may pose threat to both machines, workers, and the environment (Achal, 2014), in the same vein Asuzu (2014) posited that occupational hazard is a work substance, process or situation that predisposes to or itself causes accident or disease.

Odesanya (2014), opined that occupational hazards are stresses and other factors that are found in the environment that arises from the workplace and may lead to ill-health, injury, malingering, significant discomfort, loss of property, inefficiency among workers and absenteeism. Six categories of occupational health hazards have been identified, they include; chemical hazard, biological hazard, physical hazard, mechanical hazard, ergonomic hazard and psychosocial factors. (West African Health Evaluation Board, 2013).

The control of occupational hazards is aimed at hazard prevention in the workplace or work environment. It also covers to prevent workers from departing their job due to health problems which are caused by working conditions in which they find themselves, to protect workers in their job from the risks that may result from factors that have harmful effect to health, to place and also maintain workers in occupational environment that adapts to their physiological and psychological state of feeling healthy and happy, and the change to suit different conditions of work to man and each man to the job he does (Kaborloomene, 2013). Eyayo (2014), stipulates that People tend to equate occupational illnesses with industrialization and huge factories which are in the urban areas hence overlooking the importance of occupational health.

Eyayo (2014), further pointed out that the narrow view in which people see occupational health has hampered the growth of occupational health in developing nations (such as Nigeria), workers face variety of hazards at workplace which are as numerous as the different types of

occupation exists, so as workers face variety of hazards at work place which includes biological agents, chemical and ergonomic conditions that has harmful effect on workers.

The importance of occupational health is continuously overlooked in Africa compared to other parts of the world, because there is low level of occupational health and safety services in different industries.

Man lives in a “chemical age” in today’s world as almost all industries makes use of it or produce chemicals in the work process. Petroleum products are by products of crude oil that occurs as a complex of chemicals, primarily hydrocarbons. When it undergoes fractionalization, it yields a variety of products for various uses. The oil industry due to its industrial processes is perceived to be the major source of pollution, these industrial processes ranges from searching for oil, refining of the crude oil and then the finished products (Eyayo, 2014).

## **1.2 Statement of the Problem**

Despite the measures and strategies designed to prevent, control and reduce or eliminate occupational hazards, there have been slow improvements. Hence leading to frequent occupational diseases, (cancer, musculoskeletal disorder and post- traumatic stress disorder) accidents and significant economic burden. Poor performance in safety and occupational health (OHS) has taken a heavy financial toll on businesses, not to mention the human cost of work related illness, injuries (slips, trips, electrocution, shocks and explosions) and fatality.

A recent ILO report estimated that 2 million occupational fatalities occur in the oil and gas complains every year, the highest proportions of these deaths being caused by work related cancers, circulatory and cerebrovascular diseases, and some communicable diseases (WHO 2013).

These occupational injuries cause irregularities of workers to work for up to four working days or longer depending on the time frame that is required for them to recover from the injuries.

### **1.3 Objective of the Study**

#### **1.3.1 General Objective**

The general objective of this study is to identify occupational health hazards among oil and gas company workers in ONELGA in Rivers State

#### **1.3.2 Specific Objectives**

Specific objectives of this study were:

1. to access the knowledge of workers on occupational hazards in their work place
2. to identify the physical hazards among oil and gas company workers
3. to identify the chemical hazards among oil and gas company workers
4. to identify the mechanical hazards among oil and gas company workers
5. to determine the health effects associated with chemical hazards
6. to identify the health effects associated with physical and mechanical hazards.

### **1.4 Research Questions**

1. Are workers aware of the occupational hazards in their workplace?
2. What are physical hazards among our and gas company workers in ONELGA?
3. What are the chemical hazards among oil and gas company workers in ONELGA?
4. What are the mechanical hazards among oil and gas company workers in ONELGA?
5. What are the health effects associated with exposure to chemical hazards?
6. What are the health effects associated with exposure to physical and mechanical hazards?

### **1.5 Research Hypothesis**

HO: There is no significant difference in the health effect of chemical hazard with respect to exposure to chemical hazards among oil and gas company workers in ONELGA.

### **1.6 Significance of Study**

The outcome of this study would be beneficial to top management in oil companies to take workers safety training and incentive very seriously in order to prevent some of the risks of accident and injuries in the industry. The findings of the study will assist oil companies to formulate and also improve upon policies towards averting some occupational accidents, hazards and diseases thereby promoting occupational health services among oil and gas companies in ONELGA. The study would help in sensitizing the management of the oil companies and the general public with occupational hazard and safety policy implementation for present and future workers. The findings of this study would also be beneficial to those in academics; this is because the study will remain an added contribution to the existing body of knowledge in this field of endeavor. This study would also be beneficial to those in the health sector and safety managers because it will help to articulate some salient factors that can help stem up occupational health practices among oil and companies in ONELGA. It will help the Government, oil company workers, safety institutes to be well informed on how best to improve occupational health practices in the workplace for a conducive work environment, effectiveness and efficiency of workers.

### **1.7 Scope of the Study**

The scope of this study will be delimited to oil and gas workers in ONELGA in Rivers State.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Conceptual Literature**

##### **2.1.1 Overview of Occupational Hazards**

Hazard is a source of exposure to danger, adding that danger means anything which may cause injury or damage to a person or property (The Occupational Health and Safety Act, 1993). Similarly, the New Webster's Dictionary of English Language (2014) defined hazard as the risk or chance associated with dangers. In his own position Osanyingbemi (2013) opined that hazard is a state with potentials that can cause injury or damage. In the same vein, Achalu (2014) defined hazard as conditions that possess potential of causing ill health or injury. Hazard may also be rated according to how severe the harm they cause.

The relationship between risk and hazard must be cautiously treated. If all other factors are equal more over the exposures and the people to such exposures then the risk is seen to be proportional to the hazard. Occupational hazards, could lead to injury, illness or death. The occupational hazards may include physical risk such as being exposed to heavy machines and falls, psychological hazards which could be stressors, other hazards that may exist are exposure to radiological agents, exposure to chemical agents and exposure to biological agents. In people who work in places or jobs where occupational safety hazards are recognized, special training is frequently provided for such people for them to be aware of the hazards present in their job (Eyayo, 2014). Occupational hazard has also been defined as a work substance, process or situation that predisposes to or itself causes accident or disease (Achalu, 2014), in their own view Pratibha and Anupama (2013), defined industrial hazard to be a potential condition which might be converted into an event (accident). They also stated that industrial hazard is a state, physical or chemical having potential to injure the person or impairment of health and that risk or danger arises out of hazards.

Occupational hazards according to Kaborloomene (2013) are hazards generated during industrial operations. He also went further adding that they contain large quantities of raw materials, intermediate products, processing chemical solvents, cyanide mineral, and organic acids, oils, dyes, phenolic compound, fats, ammonia, bleaching agents, sulphides and pigments. Many of these substances are known to be toxic. Industrial hazard may also be seen as environmental factors and stresses occurring in the work place. Furthermore, Kaborloomene (2013) opined that industrial hazards are factors and stressors present in the environment that arise from or in the work environment and has the potential to cause significant discomfort, ill health, injury which could result to man- hour loss, injury, loss of property, inefficiency among workers, malingering and absenteeism.

### **2.1.2 Classification of Hazards**

Hazards are broadly divided into Physical, Chemical, Biological, Behavioural, Psychosocial, and Mechanical/Ergonomics.

#### **a) Physical Hazards:**

Physical hazards are often said to be less important than chemical hazards but this is not so. They can cause several health problems, injuries or even death. The nature of physical agents is wide and should not be underrated but the main ones capable of causing occupational disorders and injuries are:

1. Noise
2. Illumination
3. Vibration
4. Radiation (ionizing and non-ionizing)
5. Microclimatic conditions in the case of extreme heat and cold. (WHO, 2013)

### **b) Mechanical and Ergonomics Hazards:**

Unshielded machinery, unsafe structures in the workplace and dangerous tools are some of the most prevalent workplace hazards in developed and developing countries. In Europe, about 10 million occupational accidents happen every year (some of them resulting accidents). Adoption of safer working practices, improvement of safety systems and changes in behavioural and management practices could reduce accident rates, even in high-risk industries, by 50% or more within a relatively short time. Approximately 30% of the workforce in developed countries and between 50% and 70% in developing countries may be exposed to a heavy physical workload or ergonomically poor working conditions, involving much lifting and moving of heavy items, or repetitive manual tasks. Workers most heavily exposed to heavy physical workloads include miners, farmers, lumberjacks, fishermen, construction workers, storage workers and healthcare personnel. Repetitive tasks and static muscular load are also common among many industrial and service occupations and can lead to injuries and musculoskeletal disorders. In many developed countries such disorders are the main cause of both short-term and permanent work disability and lead to economic losses amounting to as much as 5% of GNP. (WHO, 2013)

### **c) Biological Hazards:**

Exposure to some 200 biological agents, viruses, bacteria, parasites, fungi, moulds and organic dusts occurs in selected occupational environments. The hepatitis B and hepatitis C viruses and tuberculosis infections (particularly among healthcare workers), asthma (among persons exposed to organic dust) and chronic parasitic diseases (particularly among agricultural and forestry workers) are the most common occupational diseases resulting from such exposures. Blood-borne diseases such as HIV/AIDS and hepatitis B are now major occupational hazards for healthcare workers. This can be classified into:

1. Human tissue and body fluids
2. Microbial pathogens (in laboratory settings)

3. Genetically modified organisms
4. Animals and animal products
5. Organic dusts and mists

**d) Chemical Hazards:**

About 100 000 different chemical products are been used in modern work environments and the number is growing. High exposures to chemical hazards are most prevalent in industries that process chemicals and metals, in the manufactures of certain consumable goods, in the production of textiles and artificial fibres, and in the construction industry. Chemical hazards could be classified into:

1. Particles, fibres, fumes and mist: Carbon Black, Welding Fume, Oil Mist
  2. Metals and metalloids: Arsenic, Cadmium, Chromium, Mercury, Zinc
  3. Organic, solvents and compounds: Acetone, hydrocarbons, Benzene
  4. Inorganic gases: Carbon monoxide, Hydrogen sulphide, Sulphur dioxide
- Chemicals are also increasingly used in virtually all types of work, including non-industrial activities such as hospital and office work, cleaning, and provision of cosmetic and beauty services.

Exposure varies widely. Health effects includes metal poisoning, damage to the central nervous system and liver (caused by exposure to solvents), pesticide poisoning, dermal and respiratory allergies, dermatomes, cancers and reproductive disorders. In some developing countries, more than half of the work force are exposed to dust-containing silica in certain high-risk industries (such as mining and metallurgy) are reported to show clinical signs of silicosis or other types of pneumoconiosis. About 300–350 substances have been identified as occupational carcinogens. They include chemical substances such as benzene, chromium, nitrosamines and asbestos, physical hazards such as ultraviolet radiation (UVR) and ionizing radiation, and biological hazards such as viruses. In the European Union alone, approximately 16 million

people were exposed to carcinogenic agents at work. The most common cancers resulting from these exposures are cancers of the lung, bladder, skin, mesothelium, liver, haematopoietic tissue, bone and soft connective tissue. Among certain occupational groups, such as asbestos sprayers, occupational cancer may be the leading factor in ill-health and mortality. Due to the random character of effects, the only effective control strategy is primary prevention that eliminates exposure completely, or that effectively isolates the workers from carcinogenic exposure (WHO, 2013).

Having conceptualized industrial hazards as industrial activities that can cause ill health and significant discomfort, therefore hazards resulting from industrial activities have been classified into several categories. Achalu (2014) classified hazards into five categories such as: chemical, psycho-social, biological, physical, and ergonomic hazards. Kaborloomene (2013) categorized industrial hazards into physical, chemical, biological, mechanical, and psychological hazards. Similarly, Kotze (2016) as cited in Kaborloomene (2013) opined that hazards could be grouped into chemical, physical, mechanical, biological and psychological hazards. Emeharole (2013) classified industrial hazards under toxic/chemical hazards, physical energy hazard, mechanical hazard and biological hazards. Agreeing with Okonya (2013), opined that occupational hazards are of six types which include chemical, biological, mechanical, ergonomics and psycho-social hazards. Alakija (2013) identified five classes of industrial hazards such as chemical hazards, mechanical hazards, biological hazards, physical hazards, and psychological hazards. Eyayo (2014) categorized Occupational health hazards into six, such as: (a) Physical hazards (b) Chemical hazards (c) Biological hazards (d) Behavioural hazards (e) Mechanical/Ergonomics hazards (f) Phycho-Social hazards. According to Pratibha and Anupama (2015), hazards may be broadly grouped under the following: chemical hazards, mechanical hazards, biological hazards, environmental or

potential hazards. Jain and Rao (2014) classified industrial hazards into mechanical hazards, environmental hazards and radiation hazards.

Furthermore, Kaborloomene (2013) added that chemical hazards are resultant pollutants which include, oxides of sulphur, fibrogenic, plastic, carbon monoxide, nitrogen, hydrocarbon, sulphur oxides and oxide of nitrogen which are emitted into the air and become incorporated with the cloud, mixed with vapour condensed and drop as sulphuric acid rain. To Pratibha and Anupama (2013), chemical hazards are chemical substances when absorbed by the skin, or when they are ingested or inhaled, the results are often disastrous. Such substances are carbon monoxide, carbons, ozone, sulphuric acid, acetic acid, funeric acid and tannic acid. Chemical hazards according to Achalu (2014) are substances of chemical nature that constitute health hazards. They include dusts, vapour, drugs dyes, explosives, fertilizers, fibrogenic mineral dusts, paints, pesticides, plastics, solvents, woods, plant and organic dust, carbon monoxide, mists, forge, fumes among others. Eyayo (2014) identified chemical hazards to be chemical substances such as benzene, chromium, nitrosamines and asbestos.

### **2.1.3 Occurrence of Hazards**

Industrial hazard has played a tremendous negative role on the health of industrial workers. In our country today, due to insufficient accident statistics, Nigeria were until recently using only the experience of the developed countries to be able to highlight the effects of accidents. Schaefer (2013) reported that in 1986 a number of explosions set off a large disastrous nuclear reactor accident at Chernobyl in Ukraine. At least about 32,000 people were killed in this accident then about 300,000 residents in the city had to be moved out, and the area became uninhabitable for 19 miles in any directions. Also, in 1978 as reported by Schaefer (2014) the love canal close to Nigeria falls in New York City, United States of America, was declared an area of disaster due to chemical contamination. Horsfall and Spiff (2013), estimated that about 3 million man-days are lost every year in Nigeria through accidents. They posited that some of

the industries that are worst hit are mining, milling quarries and construction workers. They also stated that in Nigeria, 90% of the accidents result in temporary disability, 60% in permanent disability and approximately 2% result to death. Kaborloomene (2013) reported that in Akuta Nigeria, four workers were killed in an oil pipe explosion and about seven others were injured and hospitalized. It further disclosed that the death of a textile worker was traced to the inhalation of cotton dust when post-mortem examination resulted in the extraction of two lumps of cottons from his lungs. Awake (2013), noted that the main source of stress in adult's life is work. It also noted that problems and stresses caused by work in their lives is about 39% and then followed by family with about 30%.

#### **2.1.4 Sources of Occupational Hazards**

In an industry, there are a number of machines and equipment's that have large number of moving parts and other dangerous projections which may cause hazardous accident and fatal injuries if proper measures are not taken to safeguard the workers in the industry. Hence accident may lead to more death than more infectious diseases. Several workers are injured in industrial accidents every year which results to un-coverable personal loss, lost income cost by accidents and vast sum of money been spent annually in medical expenses (Egunema, 2016).

According to Onuzulike (2014), actual and potential causes are the causes of industrial accidents. He went further to posit that actual causes include air transportation of all kinds. While potential causes are negligence, an act of omission or commission, carelessness, lack of adequate control of errors, judgment, insomnia and lack of supervision. Achalu (2014), identified human or individual factors, environmental factors, machinery and equipment, and work characteristics as the major causes of industrial accident. Nwachukwu (2014) listed some of the following points to be the major causes of industrial accidents, puling, slippery surfaces, lifting, supporting or lowering heavy objects, chemicals, very hot objects, radiant, touching

revolving objects and picking up tool boxes, steam boilers, inflammable materials, lighter and matches, open pit and wells, automobile power tools and electric conductors.

In their opinion, Khurmi & Gupta (2013) posits that accidents have common, direct, indirect and root causes which are usually caused by poor housekeeping, lack of skill or knowledge (e.g unskilled worker), loosed clothing of the worker, inadequate working space, workers carelessness, tools that are improper or nonfunctional, improper working conditions like machines not guarded, poor illumination, poor ventilation and improper machine maintenance culture operating at unsafe speed, violating safety rules, not observing safety precautions and bad layout planning processes. Iweriebor (2016) stated that statistical abstract of department of commerce in the U.S.A reveals long term internal medical effect; stress and associated hazards are the causes of industrial accident. The World Health Organization (2013) gave example of unsafe conditions that could lead to industrial accidents as “defective worn-out broken or cracked tools, and equipment, overcrowding, poor ventilated or illuminated and noisy workplace.

Hazardous procedures and arrangement such as improper stacking or filling of materials, deviation from acceptable safe procedures, faulty design and construction, unguarded hazardous parts of machine or non-insulated electric wire. Iweriebor (2016) revealed that the first law of good work is to be orderly and clean; yet many are tempted to ignore safety procedure hence accident could result due to work pressure leading to short acts to make up work demand.

According to Anupama and Pratibha (2015), accidents are caused, they do not just happen out of nothing. Whenever an accident occurs, there must be some cause, which may be obvious, or difficult to trace. Furthermore, they posited that a large number of factors combine to cause accidents. Each of these factors is different in different situations. They also identified some basic factors responsible for causing accidents to be: Unsafe acts of the employees, unsafe

working conditions and the chance occurrences. In their own part, Jain and Rao (2014) posited that accidents are preventable and an accident can be prevented if we understand the underlying causes of accidents in order to prevent future occurrences. An accident can occur by any human event which is not planned or not controlled, it could also result from some situational and environmental factors or when these factors are combined, hence interrupting the work process which has potential to result in minor or major injury, illness, damage or undesired event. They argued that accident can occur when a person acts unsafely or when there is an existence of a hazard which could be mechanical or physical. Hence, they identified the following as major causes of industrial accident: overload (Balance and Imbalance between load and capacity of person at the time of action), wrong response by the person to a certain situation (insufficient training, fatigue, anxiety or other reasons could be responsible for this) and improper activity. They also identified the three interacting components in accident situation to be man, machinery, and environmental changes which can alter the probability of occurrence of an accident.

### **2.1.5 Consequences of Occupational Hazards**

The consequences of industrial accidents and occupational health hazards exert adverse effect not just on the company alone but also extends various effects to individual workers who are the victims to their families, and social support system unto the society as a whole (Agwu, 2016). According to Achalu (2014), accidents have a significant impact on society both emotionally and financially. Occupational accidents are the causes of economic and personal loss to workers and their families, employers, and the nation at large. He further posited that for the workers, some of the cost includes sufferings and pain of the injuries they sustain, possibility of losing their jobs, spending on health care services and loss of income.

Pitan (2013) posited that the factories in Nigeria record large number of accident occurrence which sometime result in death, sometimes in permanent disablement, absence from work,

infections or any other illness which may be contracted as a result of injury and shock. He also revealed that on an average, three people are killed and about seven hundred and fifty (750) injured every day in industrial accident. Achalu and Achalu (2014), stated that damage to plant and animal involves leaf spotting and decay decreased food crop yields and decreased rate of photosynthesis disrupts crops production and also kills livestock and other animals. They also pointed out that pollution creates oxygen deficiency in the blood, causes eye irritation, damages respiratory system, causing emphysema, bronchitis, asthma, pneumonia, cancer and sometimes human genetic and reproductive damage leading to birth defects and tertiary changes (mutagens), leads to heart diseases due to lack of oxygen to the body.

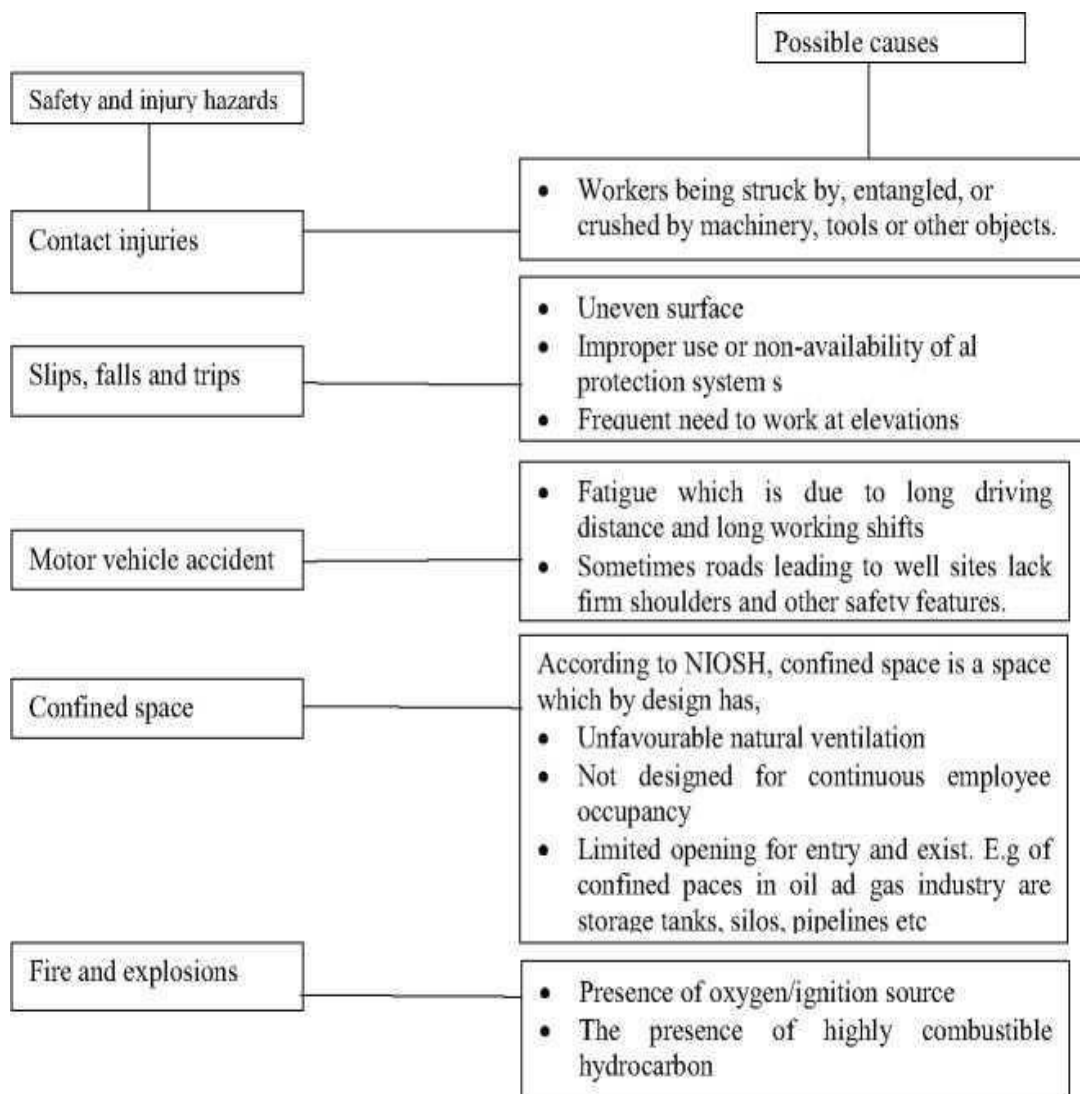
Meanwhile, in the past three decades, the intensified industrialization in Nigeria has risen due to technological advancement globally and this has also rendered Nigerian workers vulnerable to high risk of diseases related to their work, injuries and illness, e.g. Diseases relating to ones work are put at one hundred and sixty million every year while more than two million, two hundred thousand occupational deaths and two hundred and fifty million industrial accidents occur worldwide each year (ILO, 2013; Ajakaye, 2014).

It is worthy to note that in Nigeria, most workers in the factory when being employed are not always exposed to trainings or being educated on the health hazards that are related with their jobs and how they can improve in managing the risks in such jobs (Bankole & Ibrahim, 2016). This which could be probably because majority of Nigerian employees in the oil industry are placed on temporary employment which may result in workers in factories fall victim of some occupational health hazards that can or could be prevented. Probably, if workers had been trained and retrained through health education programme, the skills to be able to manage risk at workplace and taking measures to preventing hazards would have been derived (Bankole & Ibrahim, 2016). Agreeing with the above mentioned assumption, Cooper and Cotton (2014) comments that when training is provided, occupational health is a statutory requirement in any

industry and not only forming a base to satisfy the basic rights of employees to be protected from workplace hazards. Bankole and Ibrahim (2016) noted the scanty nature of health education in different workplace. They also asserted that the better tool for a good occupational health practice in the workplace is education and training in occupational health

### 2.1.6 Hazards Related to Oil and Gas Industry

According to Neha (2013), the oil and gas industry is prone to two major categories of hazard namely: Safety/injury hazards and Health/illnesses hazards.



**Figure 2.1:** Illustration showing Safety and injury hazards and its possible causes.

**Source:** (Neha, 2013).

## **Safety and health management system in oil and gas industry.**

**Health and Illnesses Hazards:** According to Neha (2013), the workers in the oil industry are generally susceptible to agents of all kind that lead to various health problems and illnesses. These agents arise through: (1) Physical hazards such as noise, vibration, radiations, extreme temperature (2) Ergonomic hazards such as manual handling, activities, awkward postures, repetitive motions (3) Chemical hazards that include toxic, corrosive, carcinogens, asphyxiates, irritant and sensitizing substances (4) Biological hazards like viruses, parasites, bacteria and (5) Psychosocial hazards such as overwork, odd working hours, isolated sites, violence.

Segments	Key Processes	Agents	Possible Health Effects
Upstream	<ul style="list-style-type: none"> <li>• Seismic evaluation</li> <li>• Exploration</li> <li>• Production</li> </ul>	<ul style="list-style-type: none"> <li>• Drilling mud</li> <li>• Mechanical</li> <li>• Silica/asbestos</li> <li>• Radioactive</li> <li>• Pathogenic</li> <li>• Ergonomic</li> <li>• Addictives and</li> <li>• Extreme</li> <li>• Infection Vectors</li> <li>• Petroleum products (hydrocarbons)</li> <li>• Metals (pb, cd,</li> <li>• Psychosocial.</li> </ul>	<ul style="list-style-type: none"> <li>• Cumulative trauma</li> <li>• Sleep deficits</li> <li>• Heat stroke</li> <li>• Gastrointestinal</li> <li>• Parasitic diseases and infections (hepatitis A, cholera, typhoid fever)</li> <li>• Noise induced hearing Loss</li> <li>• Dermal and issues</li> <li>• Neoplasms/cancer</li> <li>• Infections parasites such as typhoid fever &amp; Cholera</li> <li>• Chronic obstructive pulmonary disease</li> <li>• Stress, Spinal disorders, Drug and alcohol abuse</li> </ul>
Midstream	<ul style="list-style-type: none"> <li>• Transport and</li> <li>• Marketing</li> <li>• Pipelines</li> </ul>	<ul style="list-style-type: none"> <li>• Dust from filing scaling (from pipes and tanks</li> <li>• Petroleum products (hydrocarbons)</li> </ul>	<ul style="list-style-type: none"> <li>• Dermal and eye issues</li> <li>• Neoplasms/cancer</li> <li>• Pulmonary disorders</li> <li>• Gastrointestinal disorders.</li> </ul>
Downstream	<ul style="list-style-type: none"> <li>• Sales and</li> <li>• Product</li> </ul>	<ul style="list-style-type: none"> <li>• Petroleum products (hydrocarbons)</li> <li>• Treatment</li> <li>• Solvents</li> <li>• Noise/vibration</li> <li>• Silica/asbestos</li> </ul>	<ul style="list-style-type: none"> <li>• Neoplasms/cancer</li> <li>• Dermal and eye issues</li> <li>• Gastrointestinal</li> <li>• hearing loss caused by noise.</li> </ul>

**Figure 2.2:** Illustration showing health effects from key processes in oil and gas industry.

**Source:** (Neha, 2013).

## **Work Environment**

The work environment in which workers or employees are exposed to, play a major role in their productivity at the workplace. To this effect, Yesufu (2014) asserted that improved work environment tends to enhance the productivity of the employee. For instance, the presence of a standard health care facility will help in the protection of employees' life. Also, in case of any kind of hazard that arise in their job, the workers can be rest assured of some financial reward income possible to reduce any kind of fear on the employees that devotes themselves fully to their work. He further explained that any corporate organization's performance can determine its growth and its survival, which depends largely on the level of productivity it gets from its workforce. He also asserted that the wealth of any nation and its socioeconomic well-being is based on the efficiency and effectiveness of its different sub-components.

In his assertion, Akinyele (2014) disclosed for workers in any organization or industry to have the ability to share knowledge or awareness is strongly based on the condition of their workplace or environment throughout that system. Work environment according to Akinyele (2014) is all the people, situation around them and the events which has power to control the way people live or work. He further described work as a job or activity someone does at regular basis in order to be paid or to earn money. According to Kohun (2013) as cited in Akinyele (2014) work environment involves the total action, forces and other external and internal factors that influences the activities and performance of the employee; such actions, forces and factors could be current or potentially contending to the activities of the employee. Also work environment could be the totality of the interrelationship which exist among the employee and also the interrelation between the employees and the work environment.

Opperman (2014), as cited in Akinyele (2014) opined that work environment is a composed of three major sub-environments which include: the technical environment which involves the tools, equipment's, technological infrastructure and physical or technical elements. The human

environment; this may refer to partners and work groups, the management and leadership, peers others who workers relate interactional issues with, while organizational environment include philosophies, value, system, procedures, and practices. He noted that management has total control over the organizational environment.

According to Jain and Rao (2014), today's work environment is riddled with ever increasing newer processes apart from heat or noise or fume. Such newer processes are chemicals, increasing mechanization and computerization of machinery and control devices. They noted that the basic cause of occupational diseases and work related diseases is a badly maintained work environment. Good industrial hygiene practice in industry involves timely surveys, sampling an analysis of environment. They identified majorly two types of work environment such as (i) Conducive work environment: this entails giving workers the enabling environment to actualize their abilities and behaviors and also provide pleasurable experience for the workers, (ii) Toxic work environment involves decasualizing the workers behavior, provides unpleasant experiences for workers and also enforces low self-actualization.

## **2.2 Hazard Control Measures**

In any oil industrial operation, the best approach to controlling hazards is to bring together personnel, materials, and equipment in a well-balanced safety system. Such a system will result in cost-effective and efficient production and performance. Safe operations need to take into accounts both present and potential hazards and hazards that may act independently or synergistically with other hazards (Charles, 2014).

Egunema (2016), identified that uncontrolled hazards may result in accidents, usually at significant cost to the operation or industries. Hence the future operation of the industry itself may be in jeopardy. Damage to equipment, process materials and products, property can be substantial; there will usually be hidden costs and losses in operation efficiencies. She further posits that government regulatory agencies may scrutinize the operation, levy fines, and restrict

or even close the industry. As a result, both public and employee's family and relations will suffer, for these reasons, hazards must be reduced to prevent accidents.

Ididi (2014), posits that at the inception of industrial evolution occupational hazard was taken as an occurrence that was destined to occur, which no one could do anything to prevent. But as its frequency and severity increased and became creepy, and crippling to industrial growth, it was considered necessary to find how and why the accident occurred. In other to control occupational hazards, it means such occupational environment must be observed. Consequently, the specific methods to be employed depend on the type of hazard.

Kaborloomene (2015), asserts that during an oil spillage, the medium to be monitored to enhance control (or the safety of the environment) include the physico-chemical medium. Thus, such specific methods are pH, temperature, solids, total dissolved solids, toxicity etc. Wami (2013), also identified other specific methods such as Biochemical Oxygen Demand (COD), gravimetric, volumetric etc. Furthermore, Banigo (2013), unveiled some specific methods of occupational hazard control which includes:

- a. Radiation: Geiger Muller counter, scintillation counter, diffusion cloud chamber, film badge, personal decimeter.
- b. Light: Photoelectric meter
- c. Noise: Noise decimeter
- d. Particulates: gravitational setting, chambers electrostatic cyclone, wet absorbers.
- e. Physical treatment of water: Sedimentation, reverse osmosis, electro dialysis, water spectrophotometer.

Anupama and Pratibha (2015), recognized the following as various ways on how employees exposure to occupational hazards can be reduced. (1) Hazard control through Engineering (2) Hazard control through Work practice (3) Administrative control of hazard (4) Hazard control through Personal protective equipment

1. **Hazard control through Engineering:** This measure is the equipment's installation, or physical facilities which includes selecting and arranging experimental equipment. This is the most effective method in hazard control, especially when the method is brought in at the conceptual stage of planning, when control measure can be integrated more easily into the design. This hazard control method removes the source where the hazard emanates from and it also reduces the hazard instead of lessening the damage that may be generated from the hazard. To achieve the aims and objectives of this method, four basic phenomena must be carried out viz:

- i) **Substitution:** This applies to the replacement of a process or a material that is hazardous with one that is less hazardous (Example, is the substitution of a noisy machinery with less noisy one or the use of fibre glass rather than asbestos).
- ii) **Minimization:** This is used to express the decrease in hazard which may be achieved through scaling down the hazardous process.
- iii) **Isolation:** It is the term employed when there is an introduction of a barrier which is inserted between equipment, material or process hazard and a person or property which the hazard may harm. Such barriers that may be introduced are gloves, blast shield, apparels, goggles etc.
- iv) **Ventilation:** This method is used in controlling the atmosphere that is toxic or flammable through air supply or exhausting which may either dilute the toxics to a safe level or remove hazards at their origin. Two types of ventilation have been identified such as local exhaust and general ventilation.

2. **Work Practice Control:** This control measure alters the manner of executing a task.

Below are some basic work practice controls which are easily implemented:

- (a) Changing work practices that are already in existence to follow proper procedures that help in minimizing exposures while operating control equipment and production.
- (b) Regularly examining and maintaining control equipment and processes.

(c) Housekeeping procedures should be implemented.

(d) Providing good supervision.

(e) To decree that eating, smoking, drinking, applying cosmetics, chewing tobacco and chewing gum in controlled areas be prohibited.

3. **Administrative Control:** This measure consists of managerial efforts in hazard reduction which can be achieved through planning, training and information (Example: communicating hazard to others), procedures and documented or written policies (Example: chemical hygiene plan), safework practices, medical surveillance and environmental surveillance. (Example: exposure monitoring, equipment preventive maintenance and workplace inspections).
4. **Personal Protective Equipment:** This measure may be introduced when engineering controls or during the establishment of such controls, suitable personal protective equipment are used. PPE's are articles or equipment's that could be used to protect the human body to avoid injury; such areas that can be protected are the eyes, respiratory tract, head, skin etc. Examples are: Respirators, Coats, Goggles, Gloves, Aprons, Face mask etc.

Jain and Rao (2014) identified the following to be taken into account regarding control measures to contain the problems of hazardous substances in industries:

1. **Storage:** Proper storage and handling specially that of materials in bulk or in large quantity need special care and attention. Haphazard storage and handling of hazardous materials can trigger off accidents.
2. **Temperature and pressure:** The processes in industrial plants are associated with high temperature and pressure which when ignored may cause damage to equipment, systems and can trigger off fire hazards. Hence through control of temperature to permissible limits is one of the prime considerations.

3. **Operations and processes:** If there are defect in design or any deviation from the design may lead to serious consequences. Therefore, proper design of the whole operational and process systems coupled with suitable follow up in the actual practice/working is to be followed.
4. **Education and training:** In oil companies which are associated with hazardous chemicals, proper education and training must be imparted to the personnel regarding the use of proper labels, warning signs and color codes, proper methods of storage and handling etc.
5. **Information, data collection and monitoring:** This play a major role because some of the information as regards to the identification of hazardous substances or their toxicity, the emergency requirements as well as proper handling and storage are to be recorded in the safety data sheets. Suitable monitoring of hazardous substances can further bolster the safety measures and control.
6. **Repair and maintenance:** This measure requires regular repair and maintenance as for example in the pipeline systems, valves, pressure gauges etc. helps to minimize accidents.
7. **Personal protective equipment:** All persons exposed to hazardous substances must be provided with personal protective equipment's. It involves the use of gloves, aprons, safety boots, goggles etc. This especially applies to new employees who should be specially trained or instructed on the use of personal protective equipment.

Achalu (2014), also posited that the most effective method of controlling hazard is by complete elimination of the hazard, or to substitute or replace with a safer or less hazardous substance or process, for example, use of scanning instead of x-ray, replacement of asbestos with fibre glass, etc. Other methods identified by him include:

1. Total enclosure of hazard or isolation
2. Partial enclosure with exhaust ventilation
3. Segregation of harmful work process

4. Limitation o time of exposure
5. Use of wet methods or suppression
6. Maintenance of equipment and guarding of dangerous machines
7. Adequate ventilation
8. Good house-keeping and environmental condition
9. Research and monitoring of the work environment. Other methods that could be used in occupational hazard control include: use of legislation, personnel control measures, medical measures amongst others.

### **2.2.1 The Effects of Oil Exploration**

According to Okaba (2013), oil exploration has various stages in the mineral oil business; geophysical, production, drilling, refining, transportation and prospecting cause hazardous effects of one type/degree or the other. Similarly, (Olorode *et al.*, 2013), asserted that a close look at the menace posed by the oil companies to the environment reveals that petroleum operations have rendered massive environmental pollution in the oil providing areas. Specifically, there have been pipeline leakages, spillages and well- blow-outs which have had severe effects on water resources, micro-climate, and residents of the affected regions and on land. Okaba (2013) outlined some of the common environmental hazards and impacts of oil exploration. Such factors are as follows:

1. **Destruction of aquatic ecosystem:** The disruption of the aquatic ecosystem, is a major area of concern in the activities of oil industry in the Niger Delta. This is because of the impacts it has on the area, such as:
  - (a) The Destruction of aquatic flora and fauna of spills by acute and sub-lethal toxicity present in water and benthic macro invertebrates.
  - (b) The quality of the ground water and surface water has been deteriorated in terms of how portable, recreational and aesthetics they are.

- (c) There is disruption and reduction of the life of fishes in the water and the fisheries production of the waters.
2. **Land deprivation:** Due to the huge land requirement for oil exploration, the host communities are deprived of such lands which they may use for other activities. The most conspicuous production activities include constricting flow line and trunk lines networks, terminals, location waste pits and barrows pit etc. There are other physical impacts arising from land preparations for seismic drilling. There is also that removal of soil cover from deforestation and the attendant soil and coastal erosion.
  3. **Air pollution and related health problems:** The pollutants released are carbon particle, carbon monoxide, sulphur, carbon oxide, noise from machinery vibration, sound waves and other gaseous oxides, hydrogen sulphide and oxides of nitrogen etc, these are the most visible cause of air pollution and health problems, and they occur through gas flaring at the flow-stations (horizontal or vertical). When these gasses that are flared get dissolved in water in the cloud, it results to a downpour as rain containing solutions which is the acid rain that causes a lot of health problems.
  4. **Alternative of soil quality:** This type of negative impact of oil industrial activities is consequent upon the numerous and frequent crude oil spillage due to several cause such as pipeline leakage, burst, blow-outs, equipment failure, human error, send-cut, sabotage or third party interference, line over pressures, etc. The resultant effects of these activities on land involves the physical loading and interaction of the hydrocarbon and chemical components with those of the soil, which may lead to the impairment of soil quality, textural changes and improvement.

Kaborloomene (2015), emphasized that pollutants like nitrogen oxides and sulphur oxides in combination with other atmospheric substances form acid rain, which in return has negative effects on land, ecosystem and fresh water, which is basically the interaction of plants, animals

and their physical environment. Acid rain may kill fishes that are acid sensitive, can corrode metal roofs, kill vegetation and can also release some heavy metals such as mercury, lead and cadmium in the soil hence these heavy metals can filter into the waterways thereby polluting the water, or its surroundings. When humans associate with crude oil, it exposes them to carcinogenic, mutagenic and teratogenic fractions. Fear of cancer is probably the greatest risk that affects human health from crude oil and petroleum products exposure.

Secondly, there is the development of skin disease culminating in sensitization dermatitis. When pollutants are released into the air, there could be health reactions such as masophary irritation and cough, bronchitis, respiration function impairment that is associated with carbon monoxide toxicity.

Nwabie (2013), as cited in Kaborloomene (2015), stated that oil related operations are the most obvious industrial activity in Rivers State. This source also added that the hazards that are related to such industrial activity are oil spillage, which may be due to lack of pipeline maintenance, or could be in connection with the separation of oil and water, either at installations in both offshore and onshore. Such spillages usually kill sea food such as fish and oysters, apart from the contamination and killing of mangrove swamp. In the same vein, Briggs (2014), posited that oil spills are usually accidental and flow from leaks in pipelines, shipwrecked oil tankers, or offshore wells. When this occurs, the hardest hits are birds that become covered with oil and starve to death because they are unable to fly. Oil can also coat the respiratory surfaces of fish and other organisms, which will lead them to death.

### **Administrative and Legislative Framework on Hazard Control**

Egunema (2016), stated that on December 29, 1970, the occupational safety and health act was created to serve the purpose of reduction of work related injuries, death and illnesses. Incidentally, this act also covers the area of cutting down resulting costs such as medical expenses, compensation, disability, lost wages and productivity. According to Egunema

(2016), occupational health and safety standards are developed jointly by the department of labour, occupational safety and health administration (OSHA) and the national institute for occupational safety and health (NIOSH).

Asogwa (2014), stated that the legislation on the factories Act of 1987 cap 126 law of the Federal Republic of Nigeria deals on how to control the industrial hazards by avoiding placement of wrong person on a work bench that does not suit his/her physiological endowment. In the same vein, Factory Act (1955) emphasized on the need of having First Aid facilities and clothing meant for workers in case of emergency accident. Similarly, Osayingbemi (2013), declared that workmen compensation Acts of 1941

covers injuries caused by activities at workplace and disease listed in declaration of occupational diseases notice 1956. The factory Acts 1958 points to the importance of guarding transmission machinery and all parts of electric generators and motors. It also elaborates on the importance of adequate and sufficient training for machine operators and periodic inspection of plants and machineries. Labour Health Area Regulations, 2013; Legislations stressed the importance of provision of housing for workers. The regulations also imposed on the employer the responsibility of looking after the health of the workers. For instance, the employer should be responsible for the fees charged for the first 6 weeks of any of his employees' treatment in any hospital. While the Labour Regulations 1958 emphasized the duration of work, it stipulates that labourers should not work more than 10 hours in a day, adding that they are also entitled to two hours break within this time (Osayingbemi, 2013).

### **2.2.2 International Occupational Health**

As industrialization spread from one country to another, according to (Asogwa, 2013) so also did the diseases and ailments associated with different trades. Gradually, occupational health was being recognized as a distinct area of medicine deserving special attention in those countries that were the pioneers of industrialization in Europe and America. Many different

approaches were followed in these countries but the final goal was essentially the same. The main aim and goal were to safeguard lives and ensure that the well-being of working people are protected maintained and promoted. The oldest international bodies in modern times concerned with global health and safety of people at work are the International Labour Organisation (ILO) and the World Health Organisation.

### **2.2.3 The International Labour Organization**

(ILO) The International Labour Organization (ILO) was founded in 1919 in Geneva, Switzerland under the League of Nations to promote International Labour standard and improvement of working conditions.

The ILO programmes, as well as international labour Standards in the form of conventions and recommendations, were approved and adopted by the annual international Labour Conference held in Geneva. The Conference consists of two governments, one employer and one worker representative from each member states. Hence ILO is said to be a tripe tide body made up of representatives from governments, employers and employees (Asogwa, 2013).

The International labour Office with regional offices in Africa, Asia, Europe, Latin America, the Middle East and a number of governing body execute the programmes under supervision of the governing body, half of whose members were elected from governments and a quarter from employer and worker groups (Grace Abbott 2021).

ILO's health work included safety and health of all types of workers especially from chemical and other industrial risks, hygiene of seamen, social and medical insurance systems and workmen's compensation. In compliance with multi-disciplinary approach, it collaborates with the World Health organisation (WHO) in holding a number of Joint Expert Committee meetings in the field of occupational health and safety and publishes inter alia International Medicine guide for slips and ship sanitation.

The International Programme for the Improvement of Working Conditions and Environment (known as ILO-OSH) activities, emphasize that the improvement of occupational safety and health and working conditions should be considered as a complex problem in which various factors are interrelated, such as protection against risks in the working environment, adaptation of work processes to the physical and mental capabilities of workers, improvement of work schedules and job content (ILO, 2020). A multidisciplinary approach is stressed.

### **2.3 Occupational Health Disease**

Disease can be defined as a compensable disease contracted by the worker due to exposure to hazards in the work places.

Asogwa (2013) defined it as diseases associated with particular processes or agents which the worker is exposed to in the course of his work.

Osanyigbemi was quoted by (Achlu, 2013) defined occupational disease as those diseases which occur with characteristic frequency and regularity in occupations where there are specific hazards. It can also be explained as any chronic ailment that occurs as a result of occupational activities.

#### **2.3.1 Examples of Occupational Health Diseases**

(a) **Cancer:** is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally human cells grows and multiply (through a process called cell division) to form new cells as the body needs them. When cells grow old or become damaged they die, and new cells take their place.

Cancer is a genetic disease that is, it is caused by changes to genes that control the way our cells function, especially how they grow and divide.

Genetic changes that cause cancer can happen because

(ii) of errors that occurs as cells divide.

(iii) of damage DNA caused by harmful substances in the environment, such as the chemicals in tobacco smoke and ultraviolet ray from the sun  
Iii they were inherited from our parents.

(b) **Musculoskeletal disorder:** This are injuries or disorders of the muscles, nerves, tendons, joints, cartilage and spinal discs. Work- related musculoskeletal disorders are conditions in which

(iv) the working environment and performance of work contribute significantly to the condition.

(v) the conditions are made worse or persists longer due to work condition.

(c) **Post- traumatic stress disorder:** this is a disorder characterised by failure to recover after experiencing event.

The condition may last long (months or years) with triggers that can bring back memories of the trauma accompanied by intense emotional and physical reactions.

## **2.4 Occupational Health and Safety**

Management System (OHS – MS) Occupational Health Hazards could impact on the health and well-being of the workforce if not properly and adequately monitored and controlled by the management of an Industry or Company.

It is obvious that staff and management of industries shy away from identifying the health Hazards that are prevalent amongst them, for the workers, the fear of losing their jobs and for management, to avoid National and International Occupational Safety and Health Policies. But most of the Occupational diseases that result from exposure to hazards in Nigerian industries are largely due to ignorance.

Hence, the general well-being of the workforce is an overriding condition of all decisions made in the company's management of occupational health. As the workforce is the major asset of the Company, without which no production can be made. Thus, apart from social, moral and legal obligations, it is vital to maintain and keep the workforce fit and healthy.

This involves promoting and protection of the health of the workforce from all agents hazardous to health that may be inherent in all activities in the work environment and sometimes outside the work environment (Oluwagbemi, 2016). OHS – MS is the Management Protocol that should be followed in Occupational Health and Safety in order to protect, promote and rehabilitate the health and well-being of workers in the workplace.

## **2.5 Empirical Studies**

### **2.5.1 Occupational Hazards**

Eyayo (2014) evaluated the occupational health hazards among oil industry workers. The data for the study was collected through open-ended questionnaires. The respondents for the study were randomly selected and a total of eighty-five (85) respondents participated in the study. The study was guided by five (5) research questions and no hypothesis was tested. The study was a cross sectional descriptive study, the population for the study was constituted within seven industrial departments. The descriptive statistic was used to analyze the data. The findings from the study showed that workers were exposed to a wide variety of hazards which could be physical, chemical, mechanical or ergonomics. The study also revealed that noise, gas, chemicals and carbon dust were the most common occupational health hazards. The researcher recommended that occupational health and safety management system should not be toyed with by employees and employers of any industrial and production organizations and the oil and gas industry should not be seen lacking in this area.

Asikha and Emenike (2013) studied occupational health and safety in the oil and gas industry in Nigeria. Four research questions guided the study with no hypothesis. The research design

adopted was the survey research design and the study had a sample size of two hundred and seventeen (217) workers in the oil and gas industry in Nigeria which was randomly selected. The instrument used for data collection was a structured questionnaire and data collected was analyzed using the SPSS. Findings showed that workers are exposed to various hazards in their workplaces. The researchers recommended among others that there should be health assessment of all workers, appropriate health facilities should be provided at workplace and there should be the enforcement and strengthening of existing legislation to mitigate these hazards.

Ezejiofor (2014) in his study titled Risk Assessment: Re-appraisal for potential hazards in the operational environment and facilities of petroleum refining and distribution industry in Nigeria. The objective of the study was to appraise operational environments and facilities of petroleum refining and distribution industry in Nigeria. The study was a qualitative study that involved participatory approach and structured interviews of staff concerning the health hazards of their workplace. The results of the study shows that the major occupational hazard categories revealed were physical, chemical, biological, psychological and ergonomic hazards. The study suggests that there should be immediate need for facility upgrade and that industrial health services at workplaces should be updated.

Osungbemi, Adejimo, Akinbodewa and Adelosoye (2016) in their study titled Assessment of occupational health safety and hazard among government health workers in Ondo city, southwest, Nigeria. The study had no research question but aimed at identifying common occupational hazards present in the occupation, the study adopted the descriptive cross-sectional research design, data was collected through a standard questionnaire, the sample size for the study was four hundred (400) workers and the data obtained was analyzed using SPSS version 17. The results showed that the common hazards identified among the respondents were physical hazards, biological hazards and psychological hazards. The study recommends

that there should be regular in-service training for workers on occupational health and safety and that an active occupational safety policy system that will be supervised by occupational health and safety officers should be established.

Chineke, Adogu, Egenti, Ezemenahi and Egwuatu (2016) studied “Occupational hazards among workers in petroleum-allied industries in Nigeria: A case study”. The study was a cross sectional descriptive study, the population of the study comprised all the 152 workers in all units of the industry. Data was collected using both self and interviewer-administered questionnaire and was analyzed using SPSS version 20. The result of the study revealed that; majority of the respondents were able to mention some occupational health problems such as respiratory disorders and others. The respondents also agreed that they were exposed to physical, chemical, mechanical and psychological hazards, the study therefore recommended that the use of protective equipments should be the priority of the company’s management and that there should be mandatory periodic medical and pre-employment examination of employees.

## **2.5.2 Knowledge, Attitude and Compliance with Occupational Health and Safety**

### **Practices**

Adebola (2014) studied the knowledge, attitude and compliance with occupational health and safety practices among pipeline products and marketing company (PPMC) staff in Lagos. The study had four objectives and was a cross-sectional descriptive study, the study had a population of comprising of all 142 staff of Atlas Cove and Ejigbo depots. Data was collected through a self-structured questionnaire and the data collected was analyzed using Epi-info 2002 windows version (3.5.1). The result of the study showed among others that the respondents identified physical, chemical, mechanical, biological and psychosocial hazards as the hazards in their workplace. The respondents agreed that personal protective equipment (PPEs), adequate water supply were the occupational hazard control methods. The study therefore

recommended among others that there should be funding of safety programmers, staff members should be able to comply with safety precautions in the company and that management of the company should provide for staff appropriate and modern personal protective equipment (PPEs).

### **2.5.3 Appraisal of Occupational Health Practices of Workers in an Oil Producing Company**

Inyang (2014), in a study on appraisal of occupational health practices of workers in an oil producing company in Port Harcourt, Rivers State, Nigeria in which about two hundred (200) participants were studied. The findings of the study revealed that there is presence of poor occupational health practices by the workers which gives rise to victims of occupational hazards in the company. It also revealed that safety gadgets were not sufficiently provided by the company. Furthermore, it shows that most employers in the developing countries are known not to be providing occupational health services for their employees or workers while most workers do not also comply with the safety standards of their company. The study then recommends that there is need to apply the tools of health education, monitoring and supervision in order to ensure service utilization by the workers.

### **2.5.4 Effects of Occupational Hazards**

The consequences of industrial accidents and occupational health hazards exert adverse effect not just on the company alone but also extends various effects to individual workers who are the victims to their families, and social support system unto the society as a whole (Agwu, 2013). According to Achalu (2000), accidents have a significant impact on society both emotionally and financially. Occupational accidents are the causes of economic and personal loss to workers and their families, employers, and the nation at large. He further posited that for the workers, some of the cost includes sufferings and pain of the injuries they sustain, possibility of losing their jobs, spending on health care services and loss of income.

Pitan (2008) posited that the factories in Nigeria record large number of accident occurrence which sometime result in death, sometimes in permanent disablement, absence from work, infections or any other illness which may be contracted as a result of injury and shock. He also revealed that on an average, three people are killed and about seven hundred and fifty (750) injured every day in industrial accident. Achalu and Achalu (2004), stated that damage to plant and animal involves leaf spotting and decay decreased food crop yields and decreased rate of photosynthesis disrupts crops production and also kills livestock and other animals. They also pointed out that pollution creates oxygen deficiency in the blood, causes eye irritation, damages respiratory system, causing emphysema, bronchitis, asthma, pneumonia, cancer and sometimes human genetic and reproductive damage leading to birth defects and tertiary changes (mutagens), leads to heart diseases due to lack of oxygen to the body.

Meanwhile, in the past three decades, the intensified industrialization in Nigeria has risen due to technological advancement globally and this has also rendered Nigerian workers vulnerable to high risk of diseases related to their work, injuries and illness, e.g. Diseases relating to ones work are put at one hundred and sixty million every year while more than two million, two hundred thousand occupational deaths and two hundred and fifty million industrial accidents occur worldwide each year (ILO, 2011; Ajakaye, 2010).

It is worthy to note that in Nigeria, most workers in the factory when being employed are not always exposed to trainings or being educated on the health hazards that are related with their jobs and how they can improve in managing the risks in such jobs (Bankole & Ibrahim, 2012). This which could be probably because majority of Nigerian employees in the oil industry are placed on temporary employment which may result in workers in factories fall victim of some occupational health hazards that can or could be prevented. Probably, if workers had been trained and retrained through health education programme, the skills to be able to manage risk at workplace and taking measures to preventing hazards would have been derived. (Bankole &

Ibrahim, 2013). Agreeing with the above mentioned assumption, Cooper and Cotton (2000) comments that when training is provided, occupational health is a statutory requirement in any industry and not only forming a base to satisfy the basic rights of employees to be protected from workplace hazards. Bankole and Ibrahim (2013) noted the scanty nature of health education in different workplace. They also asserted that the better tool for a good occupational health practice in the workplace is education and training in occupational health.

## **2.6 Theoretical Framework**

One of the theoretical framework that was adopted for this study is the Thomas Legge's aphorism approach. According to Achalu (2014), Sir Thomas Legge in 1899 introduced the idea of notifying occupational diseases especially lead poisoning. Thomas Legge in his aphorisms stressed quite a number of preventive aspects which is known as the Legge's aphorism approach. The Thomas Legge's Aphorisms include the following:

1. Unless the owner or the employer of labour has done everything, and this everything means quite a great deal, no responsibility can be put on the side of the workman or employee to protect himself from the hazards of his employment.
2. If the employer can bring some influence to bear external to the workman or employer, that is any influence over which the workman or employer has no control, you will be successful, and if you cannot or do not introduce any influence, you can never be wholly successful.
3. The industrial lead poisoning is practically due to the inhalation of dust and fumes in the workplace, and when the inhalation of the dust and fumes are stopped, the poisoning will be stopped.
4. This approach also stipulates that all employees are to be told something about the hazards in which they come in contact with at the workplace, and that the workman or

employee should not be left to find out the hazards themselves which sometimes maybe at the cost of their lives.

The Legge's aphorism approach is also an approach to enhance productivity by recognizing the importance of hazard control by the employer. It used any set of techniques of hazard control measures which are appropriate for the problem in hand.

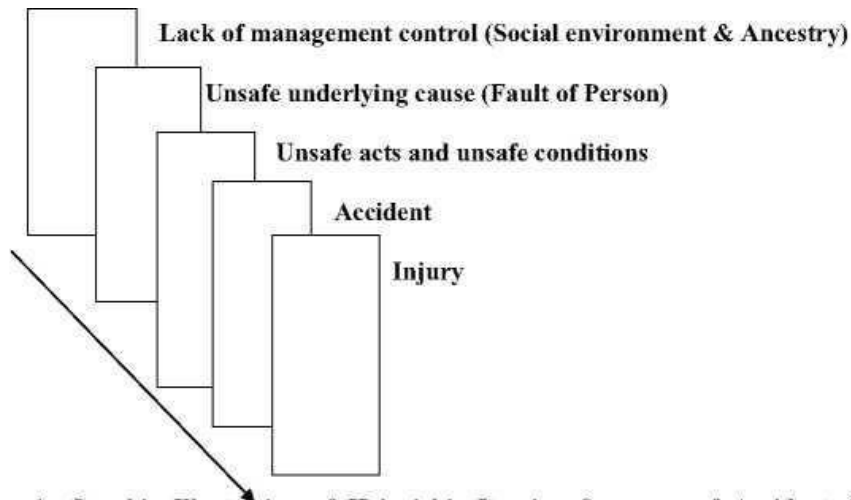
Kaborloomene (2013) recognizing the significance of the Legge's aphorism approach identified some advantages of this approach. According to him, it draws attention to the judgmental duties of the employer which include: Identifying the hazards present in the work place, assessing the risks to employees' health and safety determined by these hazards and in the light of this assessment, take steps to eliminate or mitigate the hazards.

The implication of this approach to the study is that the study exposed the inadequacies of oil servicing companies in hazard control methods; reveal the hazards present among workers of these companies; reveal if the management of the companies make available; provide or even maintain safe working environment which is free from hazards; unveil if the management of the companies take the responsibility of telling the employees about the hazards in their employment and finally establishing if the employer adhere to its final responsibilities of providing good health and safety to their employees.

### **2.6.1 Domino Theory**

The domino theory was propounded by Herbert William Heinrich in 1929 and the theory states that: the events that lead to an accident are like a row of dominos. It further explained that immediately a domino is knocked over, the next event follows quickly until the last event also falls (Oppong, 2013). The steps that lead to the causation of accidents are labeled on five metaphorical dominos which occur sequentially as shown below. The illustration below shows

that lack of management control can set off the chain of these events which definitely results into an accident.



**Figure 2.3:** Graphic Illustration of Heinrich's Domino Sequence of Accident Causation

**Source:** Oppong, (2013)

Heinrich in his domino theory showed that accident among others is one of the factors in a sequential occurrence such that;

1. **Social Environment:** The environment could be how and where an individual was educated or raised up. Some personal characteristics like greediness, bad temper, recklessness etc. may be inherited or acquired from one's social environment. These traits can contribute to fault of person.
2. **Faults of persons:** These are some traits or manners that are inherited or acquired as a result of a person's social environment or acquired from their ancestors. Such of these unpleasant traits or manners are: bad temper, ignorance, recklessness etc.
3. **Unsafe acts and unsafe conditions:** Mechanical or personal hazards exist when persons are careless and also through improperly maintained equipment or poorly designed equipment. They are seen as the most significant factor which causes an accident. When

this domino is lifted, it is the most efficient and easiest way or option to prevent the occurrence of an accident.

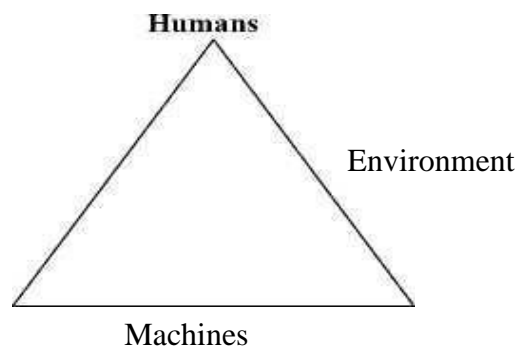
**Accident:** Accident occurs as a result of any mechanical or personal hazard that happens and leads to cause injury. Such events that can cause injury could be when a person falls from a height and or when a person is struck due to the collapse of an object.

**Injury:** Injury which is the final domino occurs only as a result of an accident.

As a result of the above process, intervention or the elimination of any factor seen at the pre contact phase of the process will prevent the occurrence of any injury or loss. The implication of the domino theory to this study is that when the management fails to adhere or comply to occupational health and safety rules, regulations or laws, that begins the chain of events that will tend to compromise safety at workplace and when safety is not in place, workers tend to develop ailments, diseases and injuries. This theory is also in agreement with the thought that if employers fail in complying to occupational health and safety regulations or laws, then the perception of the employees' on the importance of workplace safety and their judgment of risk/hazards will get affected. Once the perceptions of the employees' are compromised, their intention and motivation towards acting safely will be affected, this will in return affect their safety behavior thereby leading to the contact of occupational diseases and other ailments or injuries at the workplace. Furthermore, for intervention which is the recommendation that safety can be enhanced through the three "Es" which are: Engineering, Education and Enforcement implies that once the work environment and the equipment used at work are designed to contain less errors, the employees at workplace through education taught how they can do their work safely and the organizations management makes sure that all external and internal rules, regulations and standard operating procedures as regards to safety are followed by workers as well as management, it will likely result to the low occurrence of accident and illnesses at workplace.

### 2.6.2 System Theory

The system theory was developed by Bakke in 1959. The theory anchors on the view that an organization works as a system. The theory states that accidents arise from the interactions which exist among humans, machines and the environment (Oppong, 2013). The theory adds that under normal circumstance, the chances that an accident occurs are expected to be low.



**Figure 2.4:** Illustration showing system theory and elements of safety system.

**Source:** (Oppong, 2013)

This theory therefore advises that rather than looking at the environment as full of hazards and people prone to errors, system safety assumes harmony (steady states) which exist between individuals and the work environment. System theory sees safety as an emergent property that arises when components of the system interact with each other within a larger environment.

The implication of this theory to the study is that the system consists of the company workers (Humans), the machines in which the workers work with at the workplace and the whole company infrastructure as the environment. Thus accident, diseases and ailments that occur in this sector should be seen as failures of the entire system (interaction between the elements such as humans, machines and environment) rather than the failure of one element, say the employee. The following can be deduced from the theory as it affects the study at hand:

1. That the workers are the victims, assuming that the demands in which the entire system places on them may be too complex for their limited capacity to process such information, hence the need to be educated by their employers.

2. As a result of the above assumptions, the system must be designed to be less complex so that errors can be prevented from occurring.
3. The system must also reduce the negative consequences of errors. For example, introducing safety margins that may allow the workers to incur an error without being hurt too seriously. These safety margins could be personal protecting equipment or other procedures that may reduce the negative impact of errors.

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Study Design

A cross-sectional descriptive study was adopted, to assess the occupational health hazards in oil and gas companies in ONELGA.

#### 3.2 The Study Area



**Figure 3.1:** Map of Rivers State

**Source:** (Google, 2016)

The study was conducted in rivers state. Rivers state is a state in the Niger Delta region of southern Nigeria (old eastern region) the state is ranked 7th most populous state in Nigeria, with total population of 5198716 as of 2006 census, rivers state has a total area of 11,077km<sup>2</sup> (4,277sq mi) rivers state comprised of three senatorial zones namely: rivers south east, rivers west, rivers east (Okoronkwo *et al.*, 2018) rivers state borders include Imo State to the North, Abia and Akwa Ibom State to the East, and Bayelsa and Delta State to the West, the State is considered to be the commercial centre of Nigeria oil industry (Amaechi *et al.*, 2016) river state has a total of 23 local government areas.

Ogba/Egbema/Ndoni (ONELGA) was selected as the local government area of this study. The individuals living in this local government area partake in the day to day activities of Nigerian Agip Oil Company Limited, Nigerian Liquefied Natural Gas Company, Total/ELF Plc etc (Amaechi *et al.*, 2016)

### **3.3 Study Population**

According to the last population census in 2006, the total population of Ogba/Egbema/Ndoni LGA (ONELGA) is 283,294. The total number of workers in the oil and gas companies in ONELGA is 58329 (Ogba-29164, Egbema- 17235, Ndoni- 11929) and these workers are engaged in drilling, pipe fittings and construction, structural fitting, oil field maintenance and lots more.

### **3.4 Sample Size and Sampling Methods.**

#### **3.4.1 Sample Size Determination**

The sample size n was determined using the Yaro Yamane formula where:  $n = \frac{N}{1 + N(e)^2}$

(Yaro, 1967), with 95% confidence level. Where:

n = the sample size (total number of oil and gas workers in ONELGA)

N = the infinite population

e = level of significance (limit of tolerable error) at 0.05 1= unity (a constant)

$$n = \frac{58329}{1 + 58329 (0.0025)}$$

$$1 + 58329 (0.0025)$$

$$n = \frac{58329}{1 + 58329 \times (0.0025)}$$

$$1 + 58329 \times (0.0025)$$

$$= 58329$$

$$n = \frac{58329}{1 + 145.822} = 16.822$$

$$1 + 145.822 = 16.822$$

$$n = 399.513s$$

$$n = 400$$

### **3.4.2 Sampling Methods**

Participant were selected using multi-stage sampling techniques where three towns (Omoku, Ebocha, and Obiafu) were randomly selected from the Ogba/Egbema/Ndoni Local Government Area. In stage two, one company was selected randomly from each of the town through balloting. In stage three simple random sampling was used to select 400 workers which represents the sample size as shown above (Omoku-160, Obiafu- 120 Ebocha 120) from the 58329 workers in the oil and gas companies.

### **3.5 Instruments for Data Collection**

Structured questionnaire was used for data collection. It was constructed in line with the objectives of the study. The content of the question was concise and presented in logical sequence. The questionnaire consists of five sections in line with the specific objectives of the study. Section A comprises of Socio-demographic characteristics, section B comprises of physical hazards exposure, section C comprises of chemical hazards exposure section D comprises of, mechanical hazards while section E comprises of health effects associated with

chemical exposure and health effects associated with exposure to physical and mechanical hazards. The response options ranges from ‘strongly agree to strongly disagree ‘ according to the Likert scale.

### **3.6 Validity of the Instruments**

The face and content validity was used to authenticate the validity of the questionnaire. The questionnaire was prepared in line with the specific objectives of the study and was presented to the supervisor and other two experts in the Department of public Health in order to vet the questionnaire with regard to the study objectives. Their suggestions were used to modify the questionnaire before administering the instrument. According to Nwankwo (2013), instruments have validity when they measure what they are supposed to measure.

### **3.7 Reliability of the Instrument**

The reliability of the instrument was established through the test-retest method. In using this method, twenty (20) workers who were not to participate in the actual study were selected randomly from three oil and gas companies and the instrument was administered to them. The same questionnaire was administered again to the same set of 20 workers after 3 weeks interval. The different results of the two occasions were scaled and compared for consistency using Pearson Product Moment Correlation Coefficient Method. This procedure yielded a reliability index of 0.77 which showed that the instrument was reliable.

### **3.8 Method of Data Collection**

After obtaining informed consent from workers in the three selected oil and gas companies, the questionnaire were administered by the research assistant to respondents who gave informed consent. The literate respondents were allowed to fill the questionnaire themselves while for the non- literate respondents the questions were translated to their local language by an interpreter while their response were filled by the research assistant. The questionnaire took

about 5 minutes for the literate respondents and about 10 minutes for the non-literate respondents to be completed. The instrument for data collection was self-developed semi-structured questionnaire, designed after a thorough review of literature based on the objectives of the study.

### **3.9 Method of Data Analysis**

The data from each questionnaire was categorized and edited for accuracy and completeness of information. Data obtained from the questionnaires, was entered and analyzed by using Microsoft excel 2010.

Descriptive statistical method that includes frequencies and percentages of distribution was used to describe the data collected, tables were constructed for all class variables and were expressed as the percentage of distribution.

T- test was used to compare the relationship between exposure and effect of chemicals in oil and gas companies in Onelga, analysis was performed at 5% significant level, probability value was used for the determination of level of association, such that values less than 0.05 was considered as significant.

$$\text{Note, } \frac{4+3+2+1}{4} = \frac{10}{4} = 2.50$$

(Any mean scores from 2.50 and above were regarded as agreed while mean scores below 2.50 were regarded as disagreed).

### **3.10 Ethical Consideration/ Informed Consent**

Written informed consent was obtained from the department (HOD public health) before being allowed to participate in the study.

## CHAPTER FOUR

### RESULTS

#### 4.1 Socio-demographic Characteristics

A total of 400 respondents participated in the study. The distribution of the socio-demographic characteristics of the workers is shown in Table 4.1. Clearly shows that more proportion of the respondents were between 21- 40 years of age with a total number of 268 (67%), followed by 41years and above 132 (33%) and the -Majority of the respondents were male 312(78%) while 88(22%) were female. less than half of the respondents had secondary education 160(40%) while more than half 240(60%) have studied up to tertiary education. 240 (60%) of the respondents are from the Igbo tribe 120 (30%) Yoruba tribe while 40 (10%) are from the Hausa tribe. 320 (80%) of the respondents are Christians while 80 (20%) are Islamic and 240 (60%) of the respondents are married 120 (30%) are single, 8 (2%) divorced while 32 (8%) are widows or widowers. 240 (60%) of the respondents have one wives while 160 (40%) have more than one wives. 200 (50%) of respondents have been working in the companies for 6-9 years, 120 (30%) for 10-14 years while 80 (20%) have been working for 15 years and above. 240 (60%) of the respondents are on contract 80 (20%) are full time while 80 (20%) are casual staff. 360 (90%) of the respondents run shift while 40 (10%) do not run shift.

**Table 4.1: Social Demographical Characteristics of Participants**

<b>Age Group</b>	<b>Frequency</b>	<b>Percent %</b>
21 – 40	268	67
41 >	132	33
<b>Sex</b>		
Female	88	22
Male	312	78
<b>Education Status</b>		
Primary	0	0.0
Secondary	160	40
Tertiary	240	60
<b>Tribe</b>		
Igbo	240	60
Hausa	40	10
Yoruba	120	30
<b>Religion</b>		
Christianity	240	60
Islam	120	30
<b>Marital status</b>		
Married	240	60
Single	120	30
Divorce	8	2
Widow		
Widowers	32	8
<b>How many Wife</b>		
One	240	60
Two	160	40
<b>Working experiences</b>		
<5		
6-9	200	50
10-14	120	30
15>	80	20
<b>Nature of employment</b>		
Backup		
Full Time	80	20
Contract	240	60
Casual	80	20
<b>Do you run shift</b>		
Yes	360	90
No	40	10

#### 4.2 Awareness of Hazards among Oil and Gas Company Workers in ONELGA

From table 4.2 it shows that 62% of respondent agreed that they are aware of the physical hazards in their work place, 59% agreed that they are aware of the chemical hazards in their work place while 53% of the respondent agreed that they are aware of the mechanical hazards in their work place.

**Table 4.2: Awareness of Hazards among Oil and Gas Company Workers in ONELGA**

S/N	WORKER'S AWARENESS OF OCCUPATIONAL HAZARD					
	SA	A	D	SD	MEAN	SD
Are workers aware of the various physical hazards in work place?	248 (62%)	144 (36%)	8 (2%)		3.00	1.73
Are workers aware of the chemical hazards in their work place?	236 (59%)	160 (40%)		4 (1%)	2.66	1.63
Are workers aware of the mechanical hazards in their work place?	212 (53%)	188 (47%)			3.50	1.87
					3.05	1.74

### **4.3 Physical Hazards among Oil and Gas Company Workers in ONELGA**

From Table 4.3 it shows that 75% of the respondent which is about 300 respondents agreed to been exposed to noise, 55% agreed to been exposed to vibration, 50% agreed to been exposed to vibration, 60% agreed to been exposed to extreme heat, while 60% disagreed to been exposed to inadequate lightening. Drawing inference from the above the results indicated that exposure to noise, exposure to vibration, exposure to radiation, and exposure to extreme heat at workplace were the physical hazards among oil and gas company workers. The table also showed an aggregate mean score of 2.76 which was greater than the criterion mean score of 2.50. This implies that all the respondents agreed that there was presence of physical hazards among oil and gas company workers in ONELGA.

**Table 4.3: Identification of Physical Hazards among Oil and Gas Company Workers in ONELGA**

S/N	PHYSICAL HAZARD					
	SA	A	D	SD	MEAN	SD
Workers are exposed to noise in my work place	300 (75%)	80 (20%)	20 (5%)		3.00	1.73
Workers are exposed to vibration at their point of duty.	220 (55%)	120 (30%)		60 (15%)	2.66	1.63
Workers are exposed to radiation in my area of work.	200 (50%)	120 (30%)		80 (20%)	2.66	1.63
There is inadequate lightening in my place or work.		160 (40%)		240 (60%)	2.00	1.41
Workers are exposed to extreme heat in my job.	240 (60%)	160 (40%)			3.5	1.83
					<b>2.76</b>	<b>1.64</b>

#### **4.4 Mechanical Hazards among Oil and Gas Company Workers in ONELGA**

From Table 4.4, it shows that all respondent can identify and agreed to been exposed to mechanical hazard in their work place.50% agreed that they work in an area of confined space, 55% of the respondent agreed that they sustain injury due to struck by object, 65% of them agreed that they work in an area of compressed air and high pressure, 50% of the respondent agreed that they sustain injury due to impact force, collision and falls, while 55% of the respondent disagreed that they sustain injury due to malfunctioning of equipment. Drawing inference from the above the results It is evident that the workers do sustain injury due to struck by object in their work place and they do work in area of compressed air and high pressure was the mechanical hazards seen among oil and gas company workers as was shown by the respondents. The table also showed an aggregate mean score of 2.56 which was greater than the criterion mean score of 2.50. This implies that the respondents agreed that there was presence of mechanical hazards among oil and gas company workers in ONELGA.

**Table 4.4: Identification of Mechanical Hazards among Oil and Gas Company Workers in ONELGA.**

S/N	MECHANICAL HAZARD					
	SA	A	D	SD	MEAN	SD
Workers sustain injury due to malfunctioning of equipment in my place of work.		40 (10%)	200 (55%)	140 (35%)	2.00	1.41
Workers work in confined spaces in my workplace.	40 (10%)	200 (50%)		160 (40%)	2.66	1.63
Workers sustain injuries due to struck by object in my workplace.		220 (55%)		180 (45%)	2.00	1.41
Workers in my workplace work in areas of compressed air and high pressure.	260 (65%)	100 (25%)	40 (10%)		3.00	1.73
Workers sustain injuries due to impact force collision and falls.		200 (50%)	200 (50%)		2.50	1.58
					<b>2.56</b>	<b>1.55</b>

#### **4.5 Chemical Hazards among Oil and Gas Company Workers in ONELGA.**

Table 4.5 shows that all the respondent identifies and agreed to been exposed to chemical hazards. 50% of the respondent agree that they are exposed to alkaline, 50% of the respondent agreed to been exposed to heavy metals, 51% agreed to been exposed to petroleum products (solvents) 50% of the respondent agreed to been exposed to flammable chemicals. While 50% of the respondent disagreed to been exposed to particles (dust) in their work place. The result indicated that exposure to alkaline and acidic chemicals, exposure to heavy metals, exposure to petroleum products (solvents) and exposure to flammable chemicals were found to be the chemical hazards inherent in the oil and gas companies while exposure to particles (dust) was not found to be a chemical hazard among oil and gas companies. The table also revealed that the aggregate mean score of 2.91 was greater than the criterion mean score of 2.50. This implies that the respondents all agreed that there was presence of chemical hazards among oil and gas company workers in ONELGA.

**Table 4.5: Identification of Chemical Hazards among Oil and Gas Company Workers in ONELGA**

S/N	CHEMICAL HAZARD					
	SA	A	D	SD	MEAN	SD
Workers are exposed to alkaline and acidic chemicals in my workplace.	200 (50%)	140 (35%)	60 (15%)		3.00	1.73
Workers in my workplace are exposed to heavy metals.	200 (50%)	180 (45%)		20 (5%)	3.00	1.73
Workers in my workplace are exposed to particles (dust)	120 (30%)		200 (50%)	80 (20%)	2.33	1.52
Workers in my workplace are exposed to petroleum products (solvents).	204 (51%)	188 (47%)		8 (2%)	2.66	1.63
Workers in my workplace are expose to flammable chemicals	200 (50%)	200 (50%)			3.5	1.87
					<b>2.89</b>	<b>1.69</b>

## **4.6 Health Effect Associated to Exposure to Chemical Hazards among Oil and Gas**

### **Company Workers in ONELG**

Table 4.6 shows that the respondent develop disorder due to exposure to chemical hazard.53% of the respondent agreed that they develop respiratory disorder due to exposure to chemical hazard, 60% agreed that they develop urinary track disorder due to exposure to chemical hazard. 63% agreed that they develop lungs disorder due to exposure to chemical hazard while 50% of the respondent disagree that they develop kidney disorder due to exposure to chemical hazards the result indicated that health effect due to exposure to chemical hazard such as urinary tract disorder, respiratory disorder lungs, and liver disorder were the health effects associated to exposure to chemical hazards faced by workers at their workplace while kidney disorder was not seen to be a health effect associated to exposure to chemical hazard among oil and gas company. The above table also revealed that the aggregate mean score was 2.83 and is greater than the criterion mean score of 2.50. This implies that the respondents all agreed that exposure to chemical hazards has its effects on the health of the workers in oil and gas company in ONELGA.

**Table 4:6 Health Effect Associated to Exposure to Chemical Hazards among Oil and Gas Company Workers in ONELGA.**

S/N	EFFECT OF CHEMICAL HAZARDS					
	SA	A	D	SD	MEAN	S
Workers in my workplace develop respiratory disorder due to exposure to chemical hazard	212 (53%)	148 (37%)	40 (10%)		3.00	1.73
Workers in my workplace develop Urinary track disorder due to exposure to chemical hazard	240 (60%)	160 (40%)			3.50	1.87
Workers in my workplace developed lungs disorder due to exposure to chemical hazard		252 (63%)	148 (37%)		2.50	1.55
Workers in my workplace developed kidney disorder due to exposure to chemical hazard	148 (37%)		188 (47%)	64 (16%)	2.33	1.52
					<b>2.83</b>	<b>1.66</b>

#### **4.7 Health Effect Associated to Exposure to Physical and Mechanical Hazards among Oil and Gas Company Workers**

The table below, shows that 52% of the respondent develop difficulty in hearing due to exposure to physical hazards, 69% develop redness of skin due to exposure to physical hazard, 60% develop heat cramps due to exposure to physical hazard, 50% develop lower back pain due to exposure to physical hazards while 61% disagreed that they develop eye strain due to exposure to physical hazards, also in the table below it can see that 80% of the respondent develop rib fracture due to exposure to mechanical hazards, 60% develop spinal injuries due to exposure to mechanical hazards, 70% develop fatigue due to exposure to mechanical hazards while 60% disagreed that they develop traumatic brain injuries due to exposure to mechanical hazards.

The result indicate that difficulty in hearing, redness of skin, heat cramps, lower back pain, rib fracture, spinal injuries, and fatigue were the health effects associated to exposure to physical and mechanical hazards while eye strain and traumatic brain injuries was not seen to be a health effect associated to exposure to physical and mechanical hazards.

The table also shows an aggregate mean score of 2.62 which is greater than the criterion mean score of 2.50, this implies that exposure to physical and mechanical hazards has it effects on the health of the oil and gas company workers.

**Table 4:7 Health Effects Associated with Exposure to Physical and Mechanical Hazards**

S/N	EFFECTS OF PHYSICAL AND MECHANICAL HAZARD					
	SA	A	D	SD	MEAN	SD
		208 (52%)	192 (48%)		2.50	1.58
	276 (69%)		124 (31%)		3.00	1.73
	240 (60%)	160 (40%)			3.50	1.87
			244 (61%)	156 (39%)	1.50	1.22
	200 (50%)	120 (30%)		80 (20%)	2.66	1.63
	80 (20%)	200 (50%)	80 (20%)	40 (10%)	2.50	1.58
		240 (60%)	160 (40%)		2.50	1.58
	280 (70%)	120 (30%)			3.50	1.87
		160 (40%)		240 (60%)	2.60	1.47
					<b>2.62</b>	<b>1.60</b>

**Table 4.8: Z-test Analysis of the Difference between the Opinions of Workers between Health Problems and Exposure to Chemical Hazard**

Variable	N	Mean (x)	SD	Df	z-cal	z-crit	Level of significance	Decision
Exposure	400	2.89	1.69	398	5.72	+1.96	0.05	H <sub>0</sub> 3 is
Health effects	400	2.83	1.66					Rejected

The result of the z-test statistical analysis in Table 4.7 shows that at 398 degrees of freedom and at 0.05 level of significance, the z-calculated value of 5.72 is greater than the z-critical value of +1.96. Based on this result, the null Hypothesis is rejected. This shows that the different exposures of the respondents affect their opinions on the effect to chemical hazards in their work place. The result therefore shows that; there is a significant difference in effect to chemical hazards with respect to exposures among oil and gas company workers in ONELGA.

### Summary of Findings

1. Respondents agreed that they are aware of the occupational hazards in their work place
2. Respondents agreed that exposure to noise in workplace is a physical hazard inherent in their occupation.
3. Respondents identified that working in confined spaces and sustaining injuries due to impact force collision and falls are the mechanical hazards in their occupation.
4. Respondents also agreed that they develop urinary tract diseases due to exposure to chemicals. The findings also showed that respondents were exposed to alkaline and acidic chemicals.
5. Respondent also agreed that they have difficulty in hearing and have rib fracture due to exposure to physical and mechanical hazards.
6. There is no significant difference in effect to chemical hazards with respect to work department of oil and gas company workers in ONELGA.

## CHAPTER FIVE

### DISCUSSION, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Discussion

##### 5.1.1 Social Demographical Characteristics

The findings from this study revealed that this is a male (78%) dominated occupation (fig 4.1). This is not surprising considering the nature of work involved in crude oil production. This is consistent with the findings in earlier studies (Aliyu, 2021). Majority of the respondent had completed tertiary education (60%). The high literacy level among these workers agreed with the work of (Asuzu, 2017) which shows that 73% of workers in a construction industry have completed at least high school. Also, from the study it can be seen that percentage of those that don't run shift (69.4%) is higher than those that run shift (30.6).

The findings of this research work clearly revealed that (62%) of respondent agreed that they are aware of the physical hazards in their work place, (59%) agreed that they are aware of the chemical hazards in their work place while (53%) of the respondent agreed that they are aware of the mechanical hazards in their work place.

##### 5.1.2 Physical Hazards among Oil and Gas Company Workers in ONELGA

The findings of this research work clearly revealed that (75%) of employees are exposed to noise, (55%) vibration, (50%) radiation and exposure to extreme heat (60%). The findings of this study are in line with the findings of Eyayo (2014), which stated that the occupational health hazards identified that could affect the health and well- being of refinery workers are exposure to noise in their workplace while radiation could cause cancer and premature skin aging, Also, Asikhia and Emenike (2013), in their study which, revealed that noise, Heat stress, Vibration and Lightening are all physical hazards that exist in the oil and gas industry in Nigeria. The findings of this study also agree with the study of Ezejiofor (2014), who identified physical hazards such as extreme heat, radiations (cathode rays, cosmic rays, x- rays etc), and

vibration as potential hazards in the environment and facilities of petroleum refining and distribution industry in Nigeria.

A study carried out in Lagos State to assess the knowledge, Attitude and compliance with Occupational Health and Safety practices (Adebola, 2014) was found to be in agreement with the findings of this study. The study identified excessive heat, light, radiation and noise to be the physical hazards among pipeline products and marketing company staff. The test of hypothesis one showed that there is a significant difference in the exposure to physical hazards with respect to years of working experience among oil and gas company workers in Onelga. The employees who have different years of working experience believe that experience at work could reduce their exposure to physical hazards at workplace.

### **5.1.3 Mechanical Hazards among Oil and Gas Company Workers in ONELGA**

Workers in the oil and gas companies agreed that workers sustain injuries due to impact force collision and falls (50%), also workers agreed that they sustain injury due to struck by object (65%) and disagreed that workers sustain injuries due to malfunctioning of equipment. This is in line with Asikhia and Emenike (2013), who identified struck by object as the major mechanical hazard. The findings of this study also agreed with the findings of Inyang (2014) which was conducted in Port Harcourt metropolis which revealed that workers face mechanical hazards in their occupations such as sustaining injury from struck, sustaining injury from falls during work. Neha (2013) also affirmed that confined spaces, falls, slips, workers being struck by tools or other objects are the mechanical hazards that exist in the industry, this affirmation also agreed with the findings of this study.

### **5.1.4 Chemical Hazards among Oil and Gas Company Workers in ONELGA**

Respondents agreed that 50% of workers are exposed to alkaline and acidic chemicals while (51%) of workers are exposed to petroleum products such as solvents. The findings of this

study also revealed that the respondents disagreed that workers are exposed to particles such as dust. The findings of this research study are in line with (Asikhia & Emenike 2013), whose study revealed that exposure to acid was a major chemical hazard, the result also showed that base (alkaline), heavy metal, solvents (petroleum products), particles (dust) were also chemical hazards in the oil and gas industry in Nigeria. It is important to note that this study disagreed that workers are exposed to particles (dust) which is contrary to the findings of Asikhia and Emenike (2013). In line with the findings of this study Eyayo (2014) posits that the chemical health hazard which could be injected, ingested, absorbed and or inhaled through any part of the body which may include the skin, nose, mouth etc. could be systematic and tends to cause some occupational diseases or illnesses such as respiratory diseases, reproductive disorder, renal or urinary tract disorder. It is worthy to note that all these depends on the duration, multitude and multiplicity of expose, age of a person, genetic factor, gender, physical properties, the health status of the person, life style and tribe of the person.

These findings are in agreement with the findings of Ezejiofor (2014) conducted in Eleme, Port Harcourt which revealed that employees are exposed to chemical hazards of diverse nature either as process or production chemicals. The findings showed that there is exposure to gases, chemicals, heavy metals, solvent, particles, fumes etc, among workers in the petroleum refining and distribution industries in Nigeria.

#### **5.1.5 Effect Associated with Exposure to Chemical Hazards**

This study clearly revealed that 53% of the respondents agreed that workers develop respiratory disorder due to exposure of chemical hazard, 60% of workers develop urinary tract infection, while 63% experience lungs disorder due to exposure to chemicals. The findings of this study is in agreement with the findings of Eyayo (2014) which posits that risk factors associated with chemical hazard could be injected, ingested, absorbed and or inhaled through any part of the body which may include the skin, nose, mouth, which could result to occupational diseases or

illnesses such as respiratory diseases, reproductive disorder, renal or urinary tract disorder. It is worthy to note that all these depends on the duration, multitude and multiplicity of expose, age of a person, genetic factor, gender, physical properties, the health status of the person, life style and tribe of the person.

#### **5.1.5.1 Effect Associated with Exposure to Physical and Mechanical Hazards**

This study clearly revealed that 52% of the respondents agreed that workers develop difficulty in hearing due to exposure to physical hazard 69% develop redness of skin, 60% develop heat cramp, 50% develop low back pain due to exposure to physical hazard, it also revealed that 80% of respondents develop rib fracture due to exposure to mechanical hazard, 60% develop spinal injury, 70% develop fatigue due to exposure to mechanical hazard. The findings of this study is in agreement with the findings of Eyayo (2014), which stated skin redness, difficulty in hearing and heat cramp are the health effects associated to exposure to physical hazard. The findings of this study also agreed with the findings of Neha (2013), which state that rib fracture, spinal injury and fatigue are the health effects associated with exposure to mechanical hazard. It is Worthy to note that all these depends on the duration, magnitude, Life style and health status of the person.

## **5.2 Conclusion**

The study assessed the occupational hazards among oil and gas company workers in ONELGA. The workers were aware and able to identify various occupational hazards available in their various companies. The hazards as identified by the workers included physical hazards such as noise, vibration, radiation, inadequate lightening and extreme heat. The mechanical hazards identified were workers' working in confined spaces, injury due to struck by object, injuries due to impact force collision and falls etc. Chemical hazards include alkaline and acidic chemicals, heavy metals, petroleum products (solvents). The workers identified. Urinary

(renal) tract diseases, respiratory diseases etc. which were the risks associated to exposure to chemical hazards

### **5.3 Recommendations**

Based on the findings of this study, the following recommendations were made.

1. Management should provide appropriate, adequate and modern Personal Protective Equipments (PPEs,) for workers in the oil and gas companies to improve the health and well-being of their workers.
2. The management should provide first aid equipment in every working site to give emergency treatment in case of accident before taken to the hospital.
3. Management should provide a functional firefighting system in case of fire outbreak.
4. Management should take seriously the permit to work system to avoid errors that can lead to explosion.
5. Workers should endeavor to comply with safety rules and precautions in their company.
6. Workers should as a matter of urgency report all hazards, near misses and accidents.

### **5.4 Contribution to Knowledge**

The health and well-being of workers in their workplace improves effectiveness, efficiency and productivity thereby improving the economy of a system. Therefore, the findings of the research study contributed to knowledge of the generality in the following ways:

1. This study has highlighted the diseases and illnesses associated with the workplace of the oil and gas company workers in ONELGA.
2. The study has broadened the knowledge of workers towards risk factors associated with chemical hazards.

## **5.5 Suggestions for Future Research**

Based on this study, the following suggestions were made for further studies:

1. Studies should be carried out in other parts of the local government area in Rivers State.
2. Studies should be carried out to investigate other related variables that were not addressed in this study

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## APPENDIX I

### Occupational Health Hazards Questionnaire

#### Occupational Health Hazards Among Oil Company Workers Section A: Bio data

1. Age: <20 [ ], 21-33 [ ], 34-40 [ ], 41-50 [ ], > 50 [ ]
2. Sex: M [ ], F [ ]
3. Department .....
4. Tribe: Hausa [ ], Yoruba [ ], Igbo [ ] Others [ ]
5. Religion: Islam [ ] Christianity [ ]
6. Educational level: Primary [ ] Secondary [ ], Tertiary [ ]
7. Marital Status: Married [ ], Single [ ], Widowers [ ]
8. Number of wives: One [ ], Two [ ], Three [ ]
9. How long have you been working in Plant? <5 [ ], 6-9 [ ] 10-14 [ ] >15 [ ]
10. Nature of Employment: Backup [ ] Part Time [ ] Contractor [ ]
11. Do you run shift? Yes [ ] No [ ]

#### Section B: Health Hazards Identification

SA = Strongly Agree; A = Agree; D = Disagree; SA = Strongly Disagree

<b>WORKER'S AWARENESS OF OCCUPATIONAL HAZARD</b>		<b>SA</b>	<b>A</b>	<b>D</b>	<b>SD</b>	<b>NON</b>
1.	Are workers aware of the various physical hazards in work place?					
2.	Are workers aware of the chemical hazards in their work place?					
3.	Are workers aware of the mechanical hazards in their work place?					
<b>(A)</b>	<b>PHYSICAL HEALTH HAZARDS</b>	<b>SA</b>	<b>A</b>	<b>D</b>	<b>SD</b>	<b>NON</b>
4.	Is the noise level in your work place always high					
5.	Are workers expose to radiation in your place of work					

6.	Is there inadequate lightening in your place of work					
7.	Are workers expose to extreme heat in your place of work					
<b>(B) CHEMICAL HEALTH HAZARDS</b>						
8.	Are workers expose to alkane and acidic chemicals in your work place					
9.	Are workers expose to heavy metals in your work place					
10.	Are workers expose to particles (dust) in your work place					
11.	Are workers expose to petroleum products (solvent) in your work place					
12.	Are workers expose to flammable chemicals in your work place					
<b>(C) MECHANICAL/ERGONOMIC HEALTH HAZARDS</b>						
13.	Do workers work in a confined space in your work place					
14.	Do worker sustain injury due to struck by object in your work place					
15.	Do workers sustain injuries due to malfunctioning of equipment's in your work place					
16.	Do works sustain injuries due to impacts, force collision and falls in your work place					
17.	Do workers work in an area of compressed air and high pressure in your work place					
<b>(D) HEALTH EFFECT ASSOCIATED WITH CHEMICAL HAZARD</b>		<b>SA</b>	<b>A</b>	<b>D</b>	<b>SD</b>	<b>NON</b>
18.	Do workers in your work place develop urinary track disorder due to exposures to chemicals					
19.	Do workers in your work place develop respiratory disorder due to exposure to chemicals					

20.	Do workers in your work place develop lungs disorder due to exposures to chemicals					
21.	Do workers in your work place develop kidney disorder due to exposures to chemicals					
22.	do workers in your work place develop difficulties in hearing due to exposure to physical hazards?					
23.	do workers in your work place develop redness of skin due to exposure to physical hazards?					
24.	do workers in your work place develop heat cramps due to exposure to physical hazards?					
25.	do worker develop eye strain due to exposure to physical hazards?					
26.	do worker develop low back pain due to exposure to physical hazards?					
27.	do workers in your work place develop rib fracture due to exposure to mechanical hazards?					
28.	do workers in your work place develop spinal injuries due to exposure to mechanical hazards?					
29.	do workers develop fatigue due to exposure to mechanical hazards?					
30.	due workers develop traumatic brain injuries due to exposure to mechanical hazards?					