

ENVIRONMENTAL IMPACT ASSESSMENT OF OIL AND GAS INDUSTRY IN
NIGER DELTA, NIGERIA: A CRITICAL ENVIRONMENTAL AND
LEGAL FRAMEWORK ASSESSMENT

by

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Submitted in partial fulfilment of the requirements
for the degree of Master of Applied Science

at

Dalhousie University

Halifax, Nova Scotia

August 2016

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DEDICATION

TO:

My Parents:

Jacinta Iheriohanma and in memoriam of my Dad

My Family:

Chima Iheriohanma, Chigozie Iheriohanma, Mimi Kaima Iheriohanma,
Assumpta Ezetulu, Kelechi Onyegbule and Chioma Ekem

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ABSTRACT

Crude oil has been the mainstay of Nigeria's economy and the major GDP since its commercial production in 1958 at Oloibiri. The unsustainable processes, human activities, obsolete equipment and laws involved in harnessing this natural resource has wrecked great havoc to the Niger Delta environment which is very sensitive and ecologically endowed. The aim of this research was to assess, examine and evaluate the Environmental Impact Assessment system, environmental regulatory framework enacted by the Department of Petroleum Resources for the Petroleum Industry in Niger Delta Region of Nigeria and the ensued environmental degradation in order to identify the significant environmental and social impacts of the industry, point out the gaps in the EIA process and regulations in solving the problems of oil spill and gas flaring and make appropriate recommendations to ensure environmental protection is achieved. In-depth expository analyses using secondary data, data from the NNPC, extracts from the Earth Summit in 1992 and African Charter on Human and Peoples' Right (ACHPR), World Bank Reports, UNDP, UNEP, Amnesty International, international books, newspapers, journals and the internet were performed. Assessment of oil spill impact on the Niger Delta environment using Egbematoro 1 in Southern Ijaw as a case study was conducted. This research concluded that despite the promulgated environmental regulations and EIA regime, the unsustainable manner of oil and gas operations in the Niger Delta keeps devastating the environment and putting the lives of the local people at risk. The laws are obsolete with no sanctions and enforcement ingredients in addition to corruption, multiplicity of functions, inter-jurisdictional rivalry and clash of interest by the regulators leading to a serious inter-generational and environmental injustice. Analysis of the soil and water in Egbematoro 1 community confirmed fresh contamination and concentrations of 7529.16 ppm and 6.3951×10^4 ppm of TPH in the soil and water samples respectively.

LIST OF ABBREVIATIONS AND SYMBOLS USED

| | |
|-----------------|--|
| ACHPR | African Charter on Human and Peoples' Right |
| AGIP | Aziende Generale Italiana Petroli |
| AGRA | Associated Gas Re-Injection Act |
| AGRCFGR | Associated Gas Re-Injection (Continued Flaring of Gas) Regulations. |
| AIDS | Acquired Immune-Deficiency Syndrome |
| bbl | Barrel |
| Bcm | Billion Cubic Meters |
| Bpsd | Barrels Per Stream Day |
| Btu | British Thermal Unit |
| CEA | Cumulative Effects Assessment |
| CEAA | Canadian Environmental Assessment Agency |
| CEQ | Council of Environmental Quality |
| CFR | Code of Federal Regulation |
| DPR | Department of Petroleum Resources |
| CO | Carbon (II) Oxide |
| CO ₂ | Carbon dioxide |
| CSR | Corporate Social Responsibility |
| EC | European Commission |
| EIA | Environmental Impact Assessment |
| EEC | European Economic Community |
| EGASPIN | Environmental Guidelines and Standards for the Petroleum Industry in Nigeria |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Impact Statement |
| EMP | Environmental Management Plan |
| EPA | Environmental Protection Agency |
| Etc. | Etcetera |
| EU | European Union |
| FEPA | Federal Environmental Protection Act |

| | |
|------------------|---|
| FME | Federal Ministry of Environment |
| GHG | Green House Gas |
| GNP | Gross National Product |
| H ₂ S | Hydrogen Sulphide |
| HIV | Human Immuno-deficiency Virus |
| IAIA | International Association for Impact Assessment |
| ICP OES | Inductively Coupled Plasma Optical Emission Spectrometer |
| ISO | International Organization for Standardization |
| Km | Kilometer |
| Kwh | Kilo Watt Hour |
| LASEPA | Lagos State Environmental Protection Agency |
| LFN | Laws of Federation of Nigeria |
| LGA | Local Government Area |
| mb/d | Million Barrel per Day |
| Mls | Milliliters |
| N ₂ O | Nitrous oxide |
| NDDC | Niger Delta Development Commission |
| NDGPSR | National Domestic Gas Pricing and Supply Commission |
| NEPA | National Environmental Policy Act |
| NEPDG | National Energy Policy Development Group |
| NESREA | National Environmental Standards and Regulations Enforcement Agency |
| NH ₃ | Ammonia |
| NLNG | Nigeria Liquefied Natural Gas |
| NNPC | Nigeria National Petroleum Corporation |
| NO _x | Nitrogen Oxides |
| NOSDRA | National Oil Spill Detection and Response Agency |
| OMPADEC | Oil Minerals Producing Areas Development Commission |
| OPEC | Organization of Petroleum Exporting Countries |
| OSPAR | Oslo-Paris |
| PAH | Poly Aromatic Hydrocarbon |

| | |
|-------------------|--|
| PDPR | Petroleum (Drilling and Production) Regulations. |
| PHCF | Petroleum Host Communities Fund |
| PIB | Petroleum Industry Bill |
| PM _{2.5} | Particulate Matter with Diameter less than 2.5 microns |
| PM ₁₀ | Particulate Matter with Diameter less than 10 microns |
| Ppm | Parts Per Million |
| SARA | Superfund Amendment and Reauthorization Act |
| ROD | Record Of Decision |
| RRC | Rail Road Commission |
| SIA | Social Impact Assessment |
| SCF | Standard Cubic Feet |
| SO ₂ | Sulfur Dioxide |
| TPH | Total Petroleum Hydrocarbon |
| TCEQ | Texas Commission on Environmental Quality |
| UK | United Kingdom |
| UNDP | United Nation Development Programme |
| UNEP | United Nations Environmental Programme |
| US | United States |
| USA | United States of America |
| VEC | Valued Ecosystem Component |
| VOC | Volatile Organic Compound |
| VSC | Valued Social Component |
| WHO | World Health Organization |

ACKNOWLEDGMENTS

My unalloyed appreciation and thanks goes firstly to the Almighty God who has been with me throughout this study. It was not easy, but only HIM made it possible.

I am sincerely indebted to my supervisor, Dr. Abdel Ghaly, Professor of Biological and Environmental Engineering, Department of Process Engineering and Applied Science, Faculty of Engineering, Dalhousie University Halifax for his continued patience, insights, support, invaluable directions and guidance during my study at Dalhousie University. The first words he told me when we first met will remain evergreen in my heart. I was overwhelmed completely. Prof. I owe you a lot.

I cannot forget to thank the members of my supervisory committee, Dr Su-Ling Brooks, Professor, Department of Process Engineering and Applied Science, Faculty of Engineering, Dalhousie University and Dr. Michelle Adams, Associate Professor, School for Resource and Environmental Studies, Dalhousie University for their support and guidance throughout my research.

My deepest gratitude extends to Dr Dozie Okoye of Economics Department, Dalhousie University and Ms. Mariam Al Hattab, Mr. Abdullah Alayafi, and Mr. Amr Hassan (PhD students) in the Process Engineering and Applied Science, Faculty of Engineering, Dalhousie University for their immeasurable assistance and support.

I also wish to appreciate my friends: Eva Mooers, Greg Duke, Uchenna Ibeleme, Cari White, Austin Chukwunyere, and my Fiancée, Onyinye Odoh for their positive impacts and moral support throughout my research.

Lastly, my profound gratitude goes to my brothers: Chima and Chigozie Iheriohanma, my mum, my sisters, Chidinma Iheriohanma, Valentine Njoku and my friends for their continued prayers, love and care. They are my pillar. Most times, I got saddled with contempt and discouragement but you guys kept me excelling. I appreciate you all.

CHAPTER 1. INTRODUCTION

Fossil fuels dominate the world's energy market. The annual production is worth over 1.5 trillion dollars (Goldemberg, 2006). According to Energy Information Administration (2007), the energy generated from fossil fuels will remain the major source and still expected to meet about 84% of energy demand in 2030. The high world demands of petroleum and other fossil fuels are increasing and the world oil resources are judged to be sufficient to meet the projected growth in demand until 2030, with output becoming more concentrated in the Organization of Petroleum Exporting Countries (OPEC) (Shafiee and Topal, 2009). According to O'Rourke and Connolly (2003), the eleven OPEC member states accounts for about 77% of proven oil reserves and 40% of world production. The current world energy consumption growth rate is 2% and crude oil accounts for 36.4% of the world primary energy consumption (Shafiee and Topal, 2009).

Although crude oil is an important national economic mainstay of many nations, being the largest single item in the balance of payments and exchanges between nations, and the major factor in local level politics regarding development, jobs, health, and the environment (O'Rourke and Connolly, 2003), the rapid exploitation of petroleum oil and natural gas poses a significant environmental and ecological danger to the immediate environment owing to oil spills, effluent discharge and gas flaring. Furthermore, Hunter (2015) stated that petroleum exploration and production activities present legal, political, economic, financial, technical and environmental problems. Oil spillage has become a global menace that has been occurring since the discovery, exploration and exploitation of crude oil, which was part of the industrial revolution (Kadafa, 2012).

Nigeria, an OPEC member state, has about 36-37.2 billion barrels proven oil reserve as of January 2013, making the country the highest oil producer in Africa and the 11th in the world. Nigeria produced 2.1- 2.3 million barrels per day in 2013 (Hunter, 2015). Eleven oil companies in Nigeria operated 159 oil and gas fields and 1481 oil wells located in the Niger Delta Region (Kadafa, 2012). In spite of the obvious economic gains of this industry, crude oil exploration, exploitation, refining and use have had numerous negative impacts and costs to public health, the environment, cultures and heritage. Oil and gas development in the Niger Delta region of Nigeria has significantly improved the

nation's economy over the past five decades; but it has also caused many environmental, social and ecological issues to the region. The Delta region is an endowed ecological zone of freshwater swamp, lowland rainforest, mangrove swamp forest, coastal barrier island and one of the highest concentrations of biodiversity of the plant and animal kingdoms. It supports numerous species of plants and animals making it a highly diverse and enriched ecosystem and the largest wetland in Africa. The aquatic life has also been greatly threatened by the toxicity of the oil spillages. According to Kadafa (2012), 1.5 million tons of oil has been spilled over a span of several decades in the Niger Delta region and has been either partially cleaned or not cleaned in some areas. About 9-13 million barrels (equivalent to 50 Exxon Valdez spills) have occurred in the region over 50 years (Nriagu et al., 2016). About 0.7-1.7 million tons of oil enters the water bodies in the Niger Delta region owing to many anthropogenic activities involving oil and gas development in the region (Kadafa, 2012). Akoroda (2000) reported a direct relationship of gas flaring and the emergent cancer in the Niger Delta region. The people in the area are now experiencing respiratory disorders as a result of long term exposure to gas flaring.

Therefore, there is need to provide an environmental justice framework and systematic process to evaluate the environmental, social, health and cumulative impacts of oil exploration, extraction, transportation, refining and use. This framework should seek to examine the distributional, procedural impacts and injustice of oil exploration, extraction, transportation, refining and use, and their effects on the socio-economic and ethnic groups, host communities, ecosystems and biodiversity. Environmental Impact Assessment is the systematic identification and evaluation of the potential impacts of proposed projects, plans, programs, or legislative actions relative to the physical-chemical, biological, cultural, and socio-economic components of the environment (Canter et al. 1977; Saheed et al. 2012). This process intends to provide decision makers the socio-economic and environmental consequences of the proposed actions in a bid to attain sustainability. The primary objective of the process is to arrive at plans, actions and decisions which are benign to the environment while enjoying the economic and political gains.

Nigeria, as a developing country, views sustainability in a neo-classical perspective where the ostensible aim for petroleum resource development is economic sustainability which is peculiar to dependent capitalist economies and with no price attachment to environmental degradation (Agbola and Alabi, 2003). Thus, this study was carried out to examine and evaluate the significant environmental and social impacts of the oil and gas industry in Nigeria, the Environmental Impact Assessment system and other environmental regulatory frameworks enacted by the National Environment Protection Act for Niger Delta Region environmental protection from Petroleum Industry. This study also points out the gaps in the EIA process and regulations, proposes mitigation measures and makes the necessary recommendations for socio-economic growth.

CHAPTER 2. OBJECTIVES

The aim of this study was to examine and evaluate the Environmental Impact Assessment system and environmental regulatory framework enacted by the National Environment Protection Act for Petroleum industry in Niger Delta Region, Nigeria in order to identify the significant environmental and social impacts of the industry, point out the gaps in the EIA process and regulations in solving the problems of oil spills and gas flaring, propose mitigation measures, and make the necessary recommendations for socio-economic growth while maintaining environmental stewardship. The past and present environmental menace of oil and gas exploration and exploitation in the region will be examined. The specific objectives of the study were to:

1. Study and compare EIA system for petroleum industry in Nigeria with other countries.
2. Identify flaws in the EIA legislation in the Petroleum industry.
3. Analyze the environmental and social aspects that have been significantly affected and/or will likely continue to be affected by the petroleum industry under the current legislation.
4. Analyze the environmental effects of the industry by quantifying potential loss and damage to habitat, flora and fauna.
5. Describe and identify key impacts of the industry and determine measures to mitigate them.

CHAPTER 3. LITERATURE REVIEW

3.1. History of Oil Production

3.1.1. World Oil Production

The world's foremost oil wells were drilled in China around 347 A.D, 4th century using bamboo poles at 800 feet deep (Haderer, 2013). In the later centuries, crude oil was mined at Baku, Azerbaijan, Poland and other parts of Europe and Asia. The crude oil was usually seen in natural pools where people collected it for liquid fuel and medicinal purposes. The world's first oil well was drilled in 1848 in Apsheron, eleven years before the first oil well was drilled in Pennsylvania (Bagirov, 1996). The first drilled oil wells in Europe were located near Bucharest Romania in 1857 and Bobrka in 1854 (Crain, 2000). According to Balcilar et al. (2015), the modern era of the petroleum industry typically began with the first drilled oil well in Titusville, Pennsylvania in 1859 by Colonel Edwin Drake and the first oil well was drilled in North America in Ontario in 1858. Drake's successful production of 30 barrels/day began the modern oil and gas industry.

Energy dense crude oil-derived fuels have displaced coal which has long since dominated as a transport fuel (Owen, 2010). Bentley (2016) stated that the world oil reserves are in 70,000 fields unevenly distributed in the world (Figure 1). Worldwide, these proved oil reserves contain about 1.5 trillion barrels and production averages roughly 89 million barrels a day (Oil peak, 2014). The top 10 countries with the biggest oil reserves are shown in Table 1. Out of the 70, 000 oil fields, 507 fields are classified as 'giant' oil fields and account for 60% of conventional oil production (Owen, 2010). According Bentley (2016), Ghawar field in Saudi Arabia is the world's largest and most productive field ever discovered, producing on the average of about 5 million barrels of oil per day.

The top oil producing countries from 1980-2010 are shown in Figure 2. World oil production increased to about 74 million barrels per day by January 2005, and was fairly constant until 2011 when it started to increase to 77.8 mb/d in 2014 (Murray, 2015). This sharp increment is not unconnected with shale oil production by the U.S. The production of the shale oil and gas in North America and China definitely has impact on

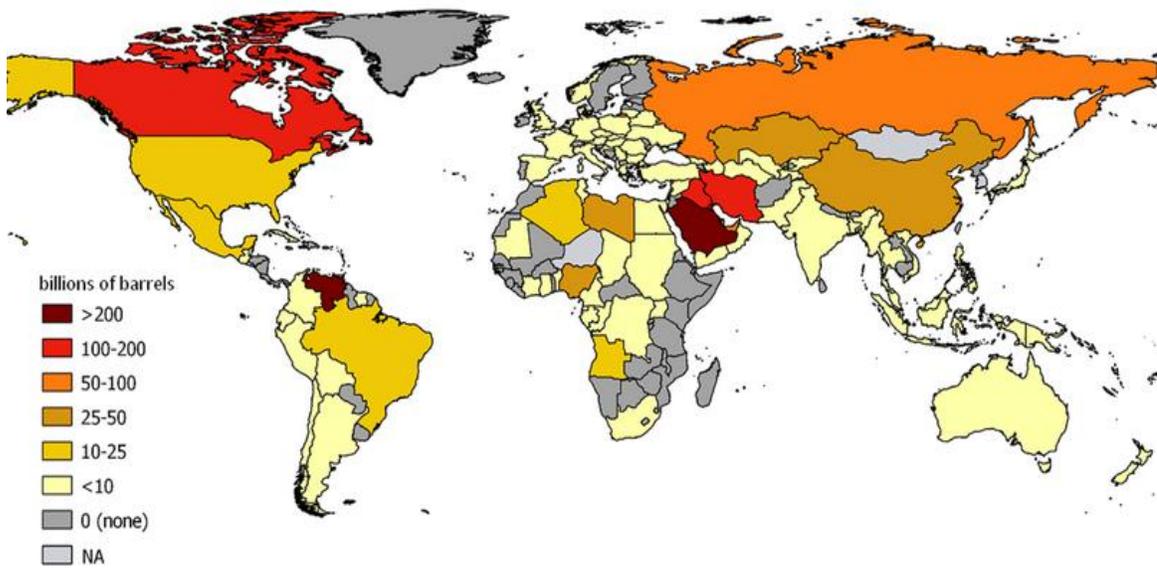


Figure 1. The world proved oil reserves in 2011 (Oil peak, 2014).

Table 1. The top 10 countries with the biggest crude oil reserve (Holodny, 2015).

| Country | Total Oil Reserve (Billions Barrels) |
|----------------------|---|
| Venezuela | 297.7 |
| Saudi Arabia | 268.4 |
| Canada | 173.2 |
| Iran | 157.3 |
| Iraq | 140.3 |
| Kuwait | 104 |
| United Arab Emirates | 97.8 |
| Russia | 80 |
| Libya | 48.47 |
| Nigeria | 37.14 |

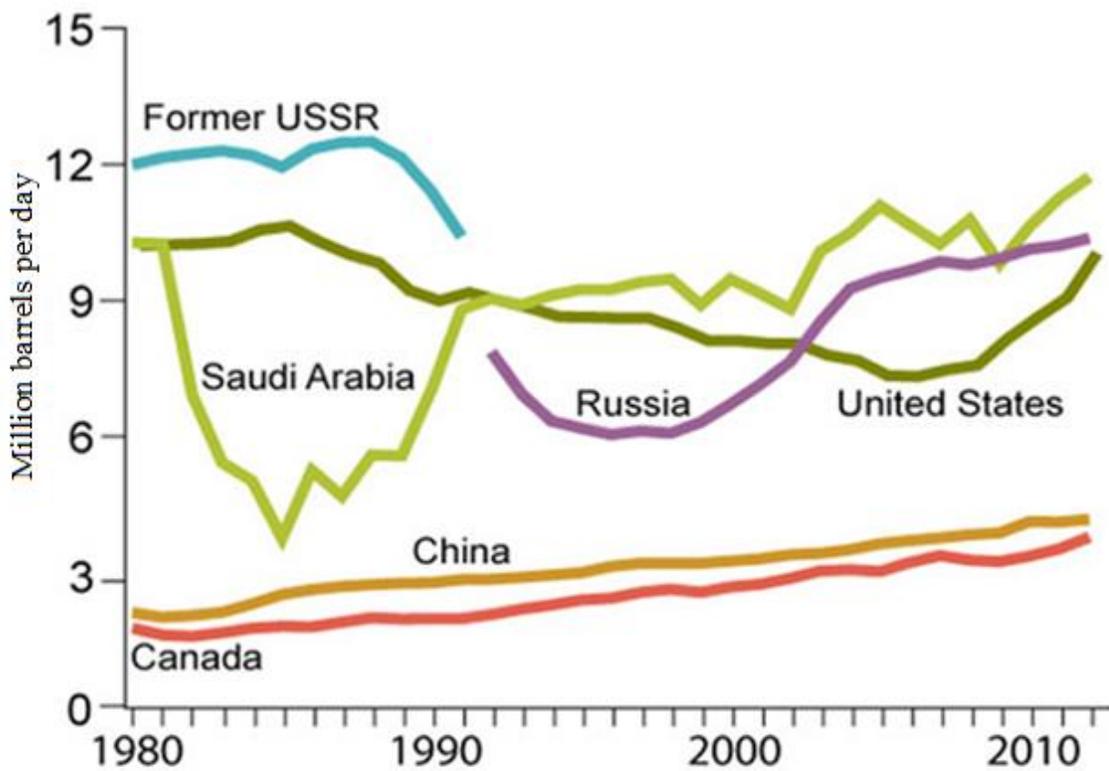


Figure 2. Oil production by the top oil producing countries during the period of 1980-2010 (Kilisek, 2014).

OPEC oil market. This amounts to a potential fall in demand for imported oil in the two largest economies and largest oil consumers in addition with increased production and possibly exportation of the shale oil thereby reducing OPEC's ability to control prices by pushing up supply relative to demand (Lin et al., 2015). According to Murray (2015), the surge will not last longer because the Light Tight Oil from the shale formation is expensive to produce. Despite this occurrence, OPEC has continued to dominate the global oil supply with various strategies like production quota for OPEC members which tend to curb excess supply.

The trend of OPEC oil supply from 1980-2013 is illustrated in Figure 3 and members sustainable oil production is shown in Table 2. Saudi Arabia despite having been under OPEC production quota maintains the highest capacity of crude oil production. For instance, they produced on average 11.6 million bbl/d of total petroleum liquid in 2013, of which 9.6 million bbl/d was crude oil production and 2 million bbl/d was non-crude liquids production which declined to accommodate non-OPEC production growth (EIA, 2012).

3.1.2. Oil Production in Nigeria

Nigeria is the largest oil producing nation in Africa and the eleventh largest producer of crude oil in the world, prospecting and extracting petroleum hydrocarbons in over 50% of the Niger Delta region (Hunter, 2015; Nriagu et al., 2016). The Niger Delta region is located in the south and comprises nine states as shown in Figure 4. Nigeria with total proven crude oil reserve of 37.1 billion barrels (bb) is among the top 10 countries with the biggest crude oil reserve and has a greater potential for gas. The oil reserves are predominantly in the on-shore Niger Delta, coastal offshore areas and lately in the deep waters (NNPC, 2016). As a developing country, Nigeria operates a concession system of exploration and production with the operating multi-national companies. The Nigeria National Petroleum Corporation (NNPC), which manages the exploration bidding activities, is the concessionaire while the operating companies are the operators.

Oil production in Nigeria started at Oloibiri in present Bayelsa state in 1956 at a modest rate of 5,100 barrels per day, rising steadily to 415,000 barrels per day in 1966 and to 2.3 million barrels per day in 1979 (Omotor, 2009). According to NNPC (2016), Nigeria has

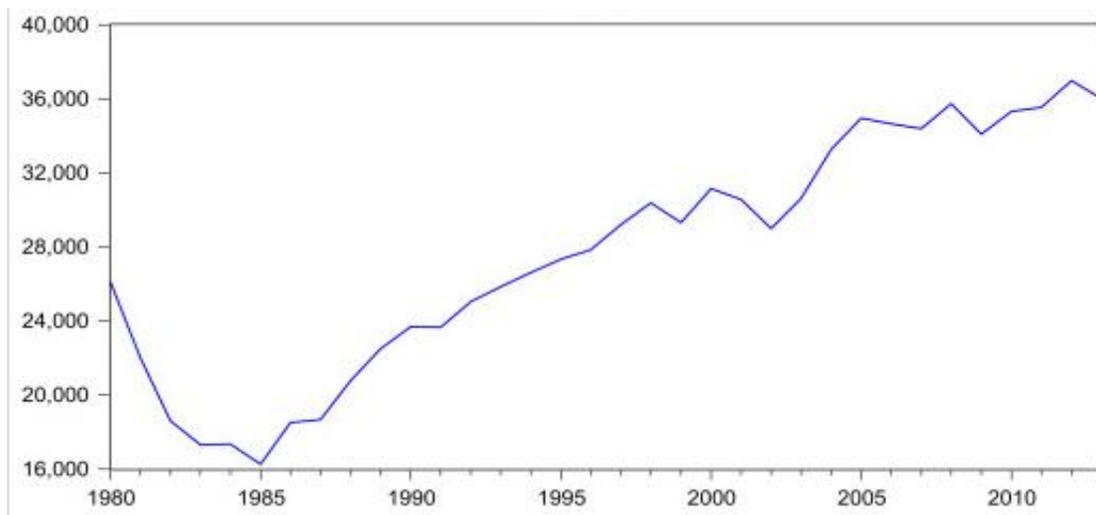


Figure 3. The trend of OPEC global oil supply from 1980 to 2013 (Lin et al., 2015).

Table 2. OPEC crude production (Hassey, 2014).

| Country | 2014 Supply (Million Barrel/Day) | Sustainable Production Capacity (Million Barrel/Day) |
|----------------------|--|--|
| Algeria | 1.12 | 1.15 |
| Angola | 1.65 | 1.70 |
| Ecuador | 0.53 | 0.53 |
| Iran | 2.78 | 2.90 |
| Iraq | 2.99 | 3.30 |
| Kuwait | 2.78 | 2.90 |
| Libya` | 0.50 | 1.20 |
| Nigeria | 1.92 | 2.25 |
| Qatar | 0.72 | 0.75 |
| Saudi Arabia | 9.76 | 12.40 |
| United Arab Emirates | 2.76 | 2.90 |
| Venezuela | 2.44 | 2.60 |

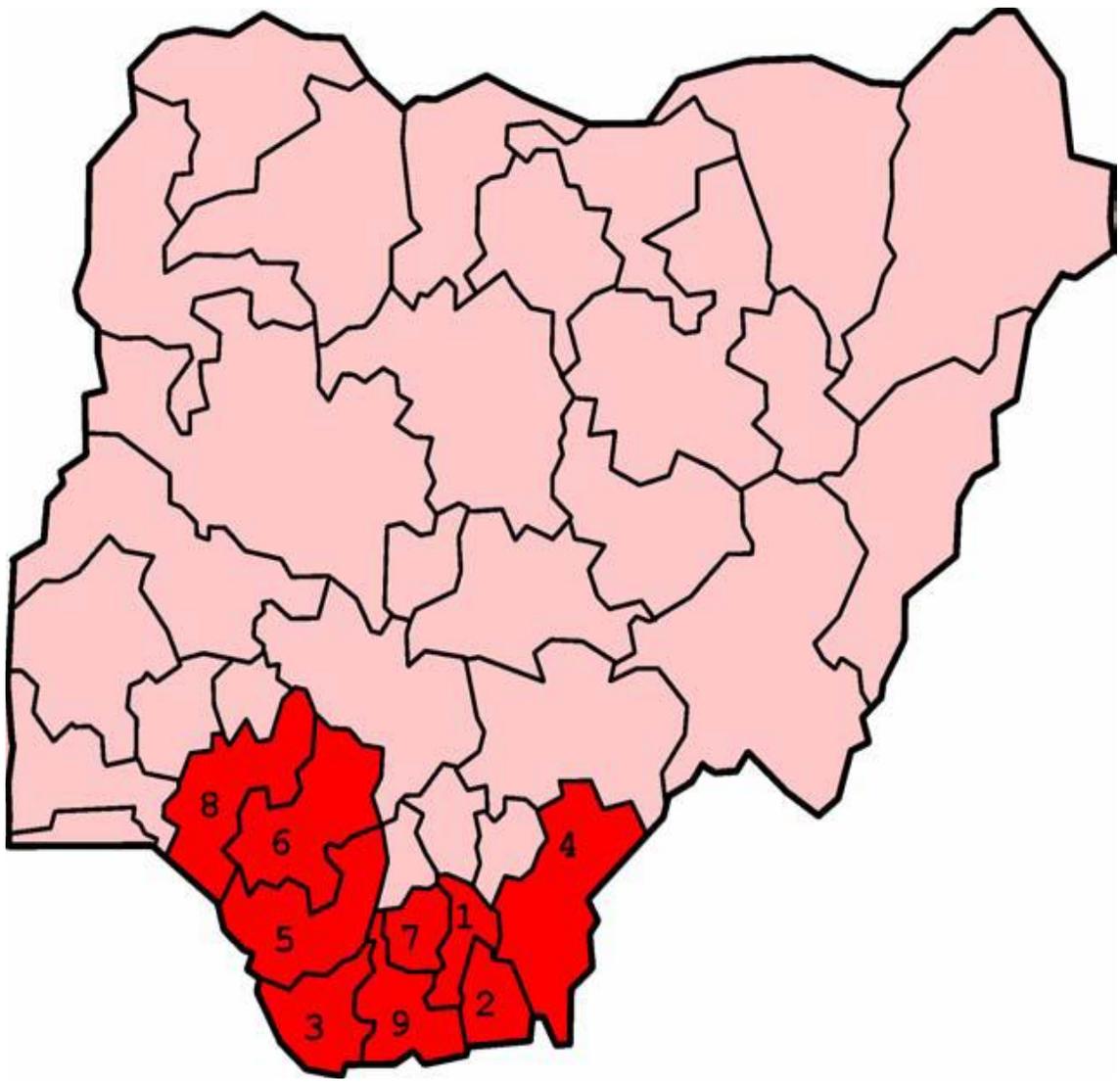


Figure 4. The Niger Delta region and 9 States (Uyigue and Agho, 2007).

a maximum crude oil production capacity of 2.5 million barrels per day which makes the country the highest crude oil producer in Africa, a capacity higher than Libya which has more oil reserves. The crude oil production in Nigeria during the period of 1980-2012 is illustrated in Figure 5, showing a peak production in 2005.

Nigeria joined OPEC in 1971. As an OPEC member, Nigeria has a sustainable production capacity of 2.25 million barrel per day but supplied a total of 1.92 million barrels per day in 2014 (Hassey, 2014). Ieconomics (2016) reported that crude oil production in Nigeria went down from 1.949 million barrels per day produced in January 2016 to 1.881 million barrels per day in February 2016. According to NNPC (2016), Nigeria produces only high value, low sulfur content, light crude oils ; mainly Antan Blend, Bonny Light, Bonny Medium, Brass Blend, Escravos Light, Forcados Blend, IMA, Odudu Blend, Pennington Light, Qua-Iboe Light and Ukpokiti.

3.2. Environmental and Health Impacts of Petroleum Hydrocarbons

Petroleum is believed to have been formed by heat and pressure on decaying plant and animal materials that have become incorporated in the sediments of shallow seas and later overlaid by a succession of strata (Kingston, 2002). Crude oil is a complex mixture containing hundreds of hydrocarbons (Kisic et al., 2009). Petroleum hydrocarbons are one of the wide range of chemicals released to the environment deliberately or accidentally. Each stage of petroleum development has serious ecological and public health risks and the development affects all aspects of the environment (land, water and air) as well as human and animal health.

Yalaju (1999) defined environmental pollution as any direct or indirect alterations of the physical, thermal, biological, radioactive properties of any part of the environment in such a way as to create a hazard to health, safety and well-being of any living species. The oil and gas related industries are the major cause of ecological degradation. The environmental pollution is a concern because of its toxicity to all forms of life. For example, oil refining causes pollution and releases toxins with ecological significance. Oil and gas development-related impacts have caused multiple ecological consequences to wetlands and coastal ecosystems, through the various stages of oil and gas

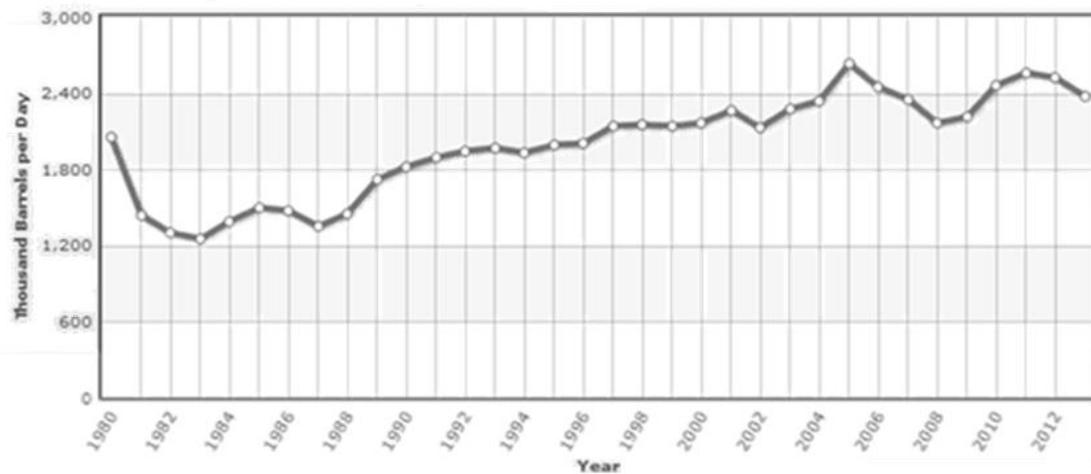


Figure 5. Nigeria crude oil production from 1980-2012 (Index Mundi, 2016).

development including oil exploration, site access, site preparation, drilling, production, pipeline installation, spill control and cleanup, and site closure (Ko and Day, 2004).

Oil pollution has become the most devastating of all environmental contaminants. According to Ko and Day (2004), oil and gas development-related impacts have caused multiple ecological consequences to wetlands and coastal ecosystems through the various stages of oil and gas development including oil exploration, site access, site preparation, drilling, production, pipeline installation, spill control and cleanup, and site closure. The pollution originates from: (a) oil and gas exploration and exploitation activities when different explosives and drilling patterns are used, (b) at the production stage after the discovery of commercial quantities of the oil, (c) at the refining stage during which toxic wastes are generated and (d) at the distribution stage either during the transportation of crude oil for export or during the distribution of refined oil through pipelines for domestic usage. During oil and gas exploitation, accidental discharges and spills occur as a result of equipment failure or sabotage.

Petroleum hydrocarbons are released to the environment by geochemical, biogenic and anthropogenic processes not limited to pyrolysis and burning of fossil fuels like oil, gas and coal, wood, garbage and many other organic matters. Anthropogenic source is the major cause of environmental pollution (Bamforth and Singleton, 2005). According to Ward and Singh (2004), 1% of the world's refining capacity of 25 billion barrels per year enters the environment through spills, waste disposal or volatilization. Through dry deposition, petroleum hydrocarbons are transported to the surface water and/or soil from the atmosphere.

Petroleum hydrocarbons have been considered among the strongest soil pollutants. Multiple studies on inhalation and exposure to petroleum hydrocarbons in occupational settings as well as residences near factories, oil spills and petroleum stations indicate an increased risk of eye irritations and headaches, symptoms of asthma, acute infant leukemia, acute myelogenous leukemia and multiple myeloma (Mckenzie et al., 2012; Marinescu et al., 2012). Petroleum contaminated soils reduces the usability of lands and weathered petroleum residuals in soil may remain bound in the soil matrix for several years (Kisic et al., 2009). In cold regions, oil spills are one of the most extensive and environmentally damaging pollution menaces affecting human and ecological health

owing to slower ecological recovery. Petroleum hydrocarbon components have been known to belong to the family of carcinogens and neurotoxic organic components (Das and Chandran, 2010).

It has been estimated that about 6–7 million tons of petroleum hydrocarbons are introduced into marine ecosystems every year (Claireaux and Davoodi, 2010). Aghalino and Eyinla (2009) stated that the most important pollution in the marine environment and coastal waters therefore, is petroleum and its products. Tanker disasters at North Atlantic (1967) and Amoco Cadiz (1978) incidents released 120,000 and 223,000 tons of petroleum products into the sea off South West England and the Coast of Brittany, France. The socio-economic impacts and cost of these spills are mostly considered while the ecological impacts remains poorly assessed. Claireaux and Davoodi (2010) reported a link between hydrocarbon exposure and myocardium morphological abnormalities and pericardial edema in herring embryos, rainbow trout and zebra fish. Considerable controversy has arisen over the biological consequences of long-term oil and gas production and the advisability of further development of oil and gas fields on the continental shelf off several regions of the United States (Peterson et al., 1996) and the degree of environmental harm in the industry should be determined by operator responsibility, government oversight, and conditions in particular ecosystems (Karl, 2005).

Currently, there are growing concerns regarding the environmental and social impacts of oil exploration, transport and refining (O'Rourke and Connolly, 2003). The impacts of oil and gas exploration and production also include threats to indigenous people, loss of biodiversity, deforestation and contamination from oil spills and produced formation water discharges. Habitats throughout the world have been losing their biodiversity at unprecedented rate. Some estimates are suggesting about 20-25 percent of the earth's biological resources may be extinct in the next few decades (Ogri, 2001). In the Western Amazon, oil and gas development has already caused major environmental and social impacts (Finer et al., 2008). Since the 1900s, the Mississippi Delta has experienced ecological impacts as a result of energy development (Ko and Day, 2004). The Alaskan Exxon Valdez spill of 1989 caused shoreline contaminations evident on wildlife mortality which prompted ecological impact evaluation (Peterson et al., 2003).

According to Braun (1998), short and long term habitat losses are always associated with energy and mining operations. The decline in the population of sage grouse bird in the Western North America was attributed to oil and gas development (Lyon and Anderson, 2003). O'Hara and Morandin (2010) reported that pelagic seabirds are particularly vulnerable to chronic oil pollution because of their biology and foraging behavior spending most of their annual cycle at-sea.

Oil and gas development causes air pollution. For example, the urban air quality problem experienced in Los Angeles in the summer periods as a result of photochemical smog and high ozone level have been attributed to oil and gas development. According to Rodriguez et al. (2009), ozone is formed through complex series of chemical reactions of volatile organic compounds (VOC) with oxides of nitrogen (NO_x) in the air in the presence of sunlight. Ozone is a strong oxidant and reduces the proper functioning of the lungs and causes damages to plants tissues even at low concentrations.

3.2.1. Impacts of Drilling

In the long life cycle of oil, drilling and extraction make up the upstream activities. Increasingly complicated and expensive processes for locating oil deposits in remote and inhospitable locations, bringing the oil to the surface, and then getting it to a market and refining have major environmental, cultural, and health impacts (O'Rourke and Connolly, 2003). During drilling and production, a lot of liquid, solid and gaseous wastes are generated and released to the environment. Apart from accidents during operation, prospecting and drilling, oil fields are of particular environmental significance, since not only oil, but other chemicals, particularly trace metals may be released to the environment during the drilling processes (Rezende et al., 2002).

With remote sensing and seismic testing of potential oil reserves, oil companies' drilling and extraction activities have significant effects on the ecosystem, cultures and human health and environmental impact assessments are not often conducted for the exploration phase of fossil fuel developments (Karl, 2005). Seismic testing has noise effects on fishes and marine mammals. Drilling platforms and rigs have impact on breeding patterns of fishes and other marine animals if stationed in their breeding grounds. Seismic activities lead to habitats destruction of rare birds and animals. Braun et

al. (2002) reported a link between oil and gas development and decline in population of sage grouse bird in Alberta, Colorado and Wyoming. Nuclear charges are sometimes used and the physical alteration by these activities on the environment is worse than an oil spill. Detonation of explosives alters the disposition of aquifers and the geochemistry of groundwater. The explosives distort soil structure and increase the chance for soil erosion. Omorodion (2004) reported a case in Gelegele community in Ovia South West Edo State Nigeria where a man became handicapped from exploratory explosive dumped in the forest by an oil company.

Drilling, both in exploration or extraction makes use of appreciable quantities of water which are contaminated during drilling and then discharged along with some drill cuttings and drilling fluids to the environment (O'Rourke and Connolly, 2003). Drilling fluids are used to hold cuttings in suspension; clean the wells and prevent caving. These effluents constitute chemical contamination of land and water bodies from drilling mud, produced water, petroleum waste and drilling cuttings. According to Epstein et al. (2002), the generated mud and other discharges on benthic populations, marine mammals and migratory birds pose environmental concerns for these ecosystems. In other hand, clearing the forest for drilling platforms can cause erosion, deforestation and encroachment into natural habitats and sacred forests as the case may be.

Oil and gas drilling produce a voluminous amount of drilling and associated wastes. During drilling of an offshore well, about 1000 metric tons of drilling solids are produced and intermittently discharged into the ocean and may generate 1.5 million liters of produced water per day (Neff, 1987). Appreciable quantities of rock fragments (cuttings) during the drilling process are brought to the surface, creating substantial quantities of waste materials which must be disposed of. The quantity of cuttings and mud produced from a well can range from 60,000 to 300,000 gallons per day (Karl, 2005). According to O'Rourke and Connolly (2003), 22 million barrels of associated wastes and 146 million barrels of drilling wastes were produced in U.S.A alone in 1995, together with 15 billion barrels of produced water though the majority of the produced water may be re-injected into wells under Resource Conservation and Recovery Act. According to Karl (2005) this water must be treated adequately before re-injection in order to prevent contamination of the soil and groundwater supplies.

Soil contamination at petroleum drilling and production sites is caused primarily by the intentional, accidental and incidental discharges of drilling fluids, crude petroleum and refined petroleum products used for machinery and equipment (Carls et al., 1995). According to Fingas (2010), between 1998 and 2007, 555 tons of crude oil was spilled into US waters from offshore exploration and production platforms. Crude oil and drilling fluids are a complex mixture of hydrocarbons containing PAHs and non-hydrocarbon(s) compounds including heavy metals which are potentially phyto-toxic and may interfere with normal plant development and reproduction (Kisic et al., 2009). Natural microbial communities, chemical and physical properties of soils are influenced by oil spills and petroleum hydrocarbons have been considered among the strongest soil pollutants (Ijah and Antai, 2003; Zhang et al., 2009 and Marinescu et al., 2012).

There is a toxicological and public health concern by the presence of poly aromatic hydrocarbons in soils owing to their carcinogenic, mutagenic and toxigenic properties. According to Okeagu et al. (2006), soil pollution from Royal Dutch Shell oil drilling, exploitation and transportation activities in Nigeria have destroyed thousand acres of farmlands and some palm trees in the areas no longer bear fruits. Soil pollution in the areas affects the soil fertility and the physical degradation leads to reduced soil structure, aeration, water holding capacity and biological activities.

Different fluid additives are used for drilling. Among the additives are Barite (BaSO_4) and Bentonite clays commonly used to increase density and viscosity and these are the major source of heavy metals contamination (Kanz and Cravey, 1987). Other additives are added to control pH, corrosion and bacterial growths. Disposal of these drilling fluids are the major release of heavy metals to the drilling sites. Table 3 shows the health and environmental impacts of drilling effluents. The heavy metals found in drilling mud are known toxicants that persist in the environment and tend to accumulate in food chains (Carls et al., 1995). Heavy metals are normal constituents of crude oil and are released to the environment following an oil spill or drilling activities having impacts. These heavy metals are barium, vanadium, nickel, chromium, lead, arsenic, copper, cadmium and mercury.

Oil based drilling mud is the world standard but Royal Dutch Shell uses water based mud in the Niger Delta oil and gas activities. The use of the water based mud has

Table 3. Impacts of some drilling effluents (Karl, 2005).

| Source | Chemical | Health/Environmental Impacts |
|------------------------------------|------------------|---|
| Produced water | Benzene | Carcinogen, reproductive and development toxicant |
| Produced water | Toluene | Suspected blood toxicant, development, neuro, liver and kidney toxicant |
| Produced water and drilling fluids | Mercury | Suspected blood toxicant, development, endocrine, neuro, reproductive and immune toxicant |
| Produced water and drilling fluids | Zinc | Suspected blood toxicant, development and reproductive toxicant |
| Produced water and drilling fluids | Lead | Carcinogen, reproductive and development toxicant |
| Produced water | Sodium | Contaminates soil |
| Natural gas extraction | Hydrogen sulfide | Suspected blood toxicant, neuro and reproductive toxicant |
| Natural gas flaring | Sulfur dioxide | Major contributor to acid rain |

serious environmental effects owing to their high starch and salt contents (Okeagu et al., 2006). The starch, when released into creeks, accelerates bacterial growth which in turn causes dissolved oxygen depletion. According to Karl (2005), one of the apparent impacts of offshore discharges has been mercury pollution; eating contaminated fish is increasingly regarded as a substantial cause of human exposure to mercury. At the Gulf of Mexico, the mercury level in the mud and sediments under oil platforms were 12 times higher than the U.S Environmental Protection Agency acceptable standard. According to Kusic et al. (2009), a significant part of the numerous impacts on soil quality is contributed by heavy metals. In Ecuador, an estimated one million hectares of tropical forest were colonized due to the construction of 500 kilometers of roads for oil production (Karl, 2005).

3.2.2. Impacts of Transportation

The difference between the locations of oil fields, point of sales, refineries and consumer markets necessitates the need for oil transportation. This has led to the development of increasingly complex and concerted transportation systems that allow oil to be delivered virtually anywhere in the world, stretching from the Middle East to Japan, from South America to Europe, and from Africa to the United States (O'Rourke and Connolly, 2003). After extraction from terrestrial wells or offshore, oil is transported by different means to refineries, industrial or individual consumers by tank vessels, pipelines, railroads and tanker trucks, each a potential source of spillage (Fingas, 2010). Pipelines are increasingly used to transport oil but oil tankers are commonly used.

As a consequence, oil pipelines in the world are now more miles than normal rail tracks despite half of the annual sea cargoes being oil. This has made the coastal communities adversely affected by ship transportation. Emissions from ships (Figure 6) have environmental impacts; change of radiative balance of the atmosphere and regional air quality which affects health (Endresen et al., 2003; Eyring et al., 2010). Sulfur and compounds of nitrogen emitted from ships oxidizes in the atmosphere producing sulfates and nitrates which cause acidification while the volatile organic compounds emitted leads to ozone formation and methane oxidation, worsening the greenhouse effect. Because of



Figure 6. Air pollution by bunker cargo ship (Port Strategy, 2010).

ship emissions, the United States Environmental Protection Agency (EPA) has adopted ship emissions standards for NO_x, CO and volatile organic compounds for all US ships with engines manufactured on or after 1 January 2004 (Eyring et al., 2010). The Arctic region is now subjected to a rapid climate change as a result of oil transport. The ecosystem in the region and in the Barents Sea region is vulnerable to different environmental threats, such as increasing amounts of chemical active air pollutants, radioactive materials, contamination and remobilization of persistent organic pollutants and heavy metals (Dalsøren et al., 2007). According to Eyring et al. (2010), about 15% of all global anthropogenic emissions of NO_x and 4–9% of SO₂ emissions are attributable to ships and nearly 70% of the emissions occur within 400 km of land. In transporting oil, many accidental spills occur throughout the world.

According to O'Rourke and Connolly (2003), cumulatively significant spills from pipelines, shipping and leaks often go undocumented. Transport by pipelines record less spills than transport by water. Crude oil and petroleum products transport by water spilled 3000 gallons per billion ton-miles in 1983 and 8000 gallon per billion ton-miles in 1984 but pipeline transport for both years spilled only 100 gallons per billion miles (Caswell, 1993). Tank ships carry the greatest amount of oil as much as 30,000 tons thus making the means the largest source of transport- related spills (Fingas, 2010). Tanker accidents are the major source of oil spills to the environment from transportation.

Accidents and spills occur at every component of the transport system and at every point of discharge. Table 4 shows sources of spills from marine oil transport in 1990. The Torrey Canyon tanker accident spilled 130,000 tons of oil to the coast of UK in March 1967, killing 15,000 birds and damaging 30 kilometers of the coastal lines. This accident was not even the first tanker spill. According to Chen et al. (2012), 484,200 tons of oil from torpedoed tankers in 1942, during the World War II was spilled within 90 km of Eastern coast of U.S. There have been series of tanker accidents in history ranging from tanker Metula incident, Chile in 1974, Amoco Cadiz, France in 1978 and Alaskan Exxon Valdez tanker incident in 1989 but pipeline leaks are one of the most common causes of oil spills. In 1997, for example, pipeline spills were twice as common as spills from tankers (Karl, 2005). Pipelines used to transport oil and natural gas can create

Table 4. Sources of oil spill from marine transport in 1990 (O'Rourke and Connolly, 2003).

| Emission source | Tons per year |
|------------------------------------|---------------|
| Bilge and fuel oil | 250,000 |
| Tanker operations | 160,000 |
| Tanker accidents | 110,000 |
| Non tanker accidents | 10,000 |
| Marine terminal operations | 30,000 |
| Dry-docking and scrapping of ships | 10,000 |
| Total | 570,000 |

serious environmental harm (Karl, 2005). Pipelines have environmental effects affecting soils, vegetations, wildlife and geology. The land in the oil producing areas in Nigeria has been 'criss-crossed' with pipelines (Figure 7). According to Ugochukwu and Ertel (2008), in 2004, the Nigerian Liquefied Natural Gas (NLNG) pipeline traversing the Kala-Akama and Okrika mangrove swamps leaked and caught fire; the fire burned uncontrollably for three days killing local plants and animals inhabiting the affected area.

3.2.3. Impact of Oil Refining

Oil in its crude form has limited use (O'Rourke and Connolly, 2003) and the refining stage of oil development has significant environmental and public health effects. Oil refineries and other petrochemical facilities development require class 2 EIA because they are considered to have the potential to cause significant environmental adverse effects and public health concerns. Before crude oil can be used as a fuel, many processes and techniques like thermal cracking, boiling, solvent treatment and vaporization are used to convert the crude oil to gasoline, diesel and other distillate fuels, jet fuel, kerosene, asphalt and lubricating oils. Pollution control technologies are always employed in the refining stage of oil and gas development. Any constituents not converted to useful and wanted products nor captured by pollution control technologies are released to the environment amounting to 0.3% of average daily refining capacity of a refinery (Epstein et al., 1995; Karl, 2005).

Refining activities release substances into the environment from refining processes, transport, effluents or storage tanks. Among the most important atmospheric pollutants emitted by refinery plants are volatile organic compounds (mainly hydrocarbons), sulfur compounds, nitrogen oxides as well as particulate matter (Kalabokas et al., 2001). According to Atubi (2011), the wastewater released from the refineries are characterized by the presence of large quantity of crude oil products, polycyclic and aromatic hydrocarbon, phenols, metal derivatives, surface active substances, sulfides, naphthalene acids and other chemicals. The fate of oil refinery effluent discharged into the environment depends on the conditions and hydrodynamics of the receiving water (Wake, 2005). Figure 8 shows the degree of pollution emission



Figure 7. Criss-cross of pipeline across a bush path (BBC News, 2011).



Figure 8. Kaduna refinery emission at Rido community in Chikun council (Salami, 2015).

from Kaduna refinery in Rido community in Chikun Local Government Area of Kaduna state.

Worldwide, the refining industry produced more than 48 million pounds of toxic air emissions in 2001, including tons of volatile organic compounds like cancer-causing benzene, and chemicals which, in significant enough quantities, can cause asthma and childhood developmental problems (Karl, 2005). According to O'Rourke and Connolly (2003), refineries are the fourth largest source of toxic air pollutants and in U.S, refineries are the second largest industrial source of sulfur dioxide, the third largest industrial source of nitrogen oxides, and the largest U.S. stationary source of volatile organic compounds (VOC) emissions, producing more than twice as many VOCs as the next sector, organic chemical plants (Figure 9). Oil refineries have an impact on the respiratory health of individuals living close to them, and cause acid rain and photochemical ozone production from the pollutants emitted. Rusconi et al. (2011) reported lower lungs functions and higher levels of markers of inflammatory and oxidative stress in children living in Sarroch in Sardinia, Italy which is close to the oil refinery in the Mediterranean Sea. By measuring job and tax subsidies per pounds of pollution emitted, it was observed that oil refining produces 1048 pounds of pollution per job while plastics manufacturing and food production produce 222 and 28 respectively in the U.S alone (Templet, 1993).

According to O'Rourke and Connolly (2003), in the 1990s, U.S EPA enforcement priority was on refineries and in 1999, 54% of them were not in significant compliance violating the Clean Air Act, 22% violated Clean Water Act and 32% violated the Resource Control and Conservation Act. Wastewater released by refineries and other petrochemical industries are characterized by the presence of large quantity of polycyclic and aromatic hydrocarbons, phenols, metal derivatives, surface active substances, sulphides, naphthylenic acids and other chemicals (Uzoekwe and Oghosanine, 2011). In many developing countries like Nigeria, the wastewater and other refinery effluents are discharged to water bodies untreated. According to Eaton (1997), Nigerian refineries have grossly inadequate waste treatment facilities characterized by inefficient and ineffective anti-pollution devices. Pollutants in natural waters do change their quality and are deleterious to the aquatic life. According to Otokunefor and Obiukwu (2005), there is



Figure 9. Sinclair oil refinery pollution emission, Wyoming U.S (Bob, 2012).

a link between refinery effluents and the health of aquatic organisms. Dissolved oxygen in water bodies is depleted when untreated refinery effluents containing oil is discharged into them.

Nigeria, the highest oil producing nation in Africa has four existing oil refineries with combined production capacity of 445,000 barrels per day (Oladimeji et al., 2015a). The various emissions from the refining operations of these refineries are a major environmental and public health concern because the majority of these emissions are criteria pollutants which include volatile organic compounds, sulfur dioxide, nitrogen oxides and particulate matter. Table 5 shows the amount of criteria pollutants released by the four refineries per year. According to Otti and Okafor (2012), consistent daily production of 60,000 bpd by Port Harcourt Refining Company I over a period of time pose an environmental adverse effect to the host community from the nitrous oxide present in the refinery flare. Nitrous oxide is a greenhouse gas and increases soil acidity and nitrate content following an acid rain and results in ground level ozone which is a major component of smog in the affected areas. Vegetables bioaccumulate nitrates from the soil and therefore are the major sources of nitrates in human diet. Distribution of nitrates in the plasma causes cyanosis (poor oxygen supply due to conversion of normal Fe^{2+} of hemoglobin to Fe^{3+} by nitrites) in adults and methemoglobinemia (Blue Baby Syndrome) in infants (Knobeloch et al., 2000).

The major environmental devastation from oil refining in Niger Delta region is caused by operation of illegal refineries. In the event of “cooking” the stolen crude oil in order to refine it, they pollute the soil, water and cause serious air pollution. Figures 10 and 11 show the activities of illegal refineries and the levels of environmental pollution they cause. Their activities aggravate the already worsened environment-polluted situation and self destruction. Establishing an oil refining requires class 2 EIA because of the significant negative effects they pose. Who prepares their EIA? Who monitors their activities and emissions? How do they mitigate the environmental adverse effects from their activities? How do they desulfurize? Their emissions may have more criteria pollutants than a normal refinery.

Asimiea and Omokhua (2015) stated that the activities of illegal refineries severely impacted biodiversity, aesthetic scenery of the forest, regeneration of plant

Table 5. Air pollutant emissions from Nigeria's refineries (Oladimeji et al., 2015).

| Refinery | Criteria pollutant emission (ton/year) | | | |
|---|--|-----------------|----------|------------|
| | SO ₂ | NO _x | VOC | CO |
| Kaduna Refinery | 109,233.38 | 55,660.80 | 8,492.86 | 56,738.56 |
| and Petrochemical Company (110,000 bpsd) | | | | |
| Port Harcourt Refining Company I (60,000 bpsd) | 2,972.14 | 11,562.38 | 205.13 | 12,973.20 |
| Port Harcourt Refining Company II 150,000 (bpsd) | 15,694.99 | 54,704.89 | 1,668.71 | 104,230.14 |
| Warri Refining and Petrochemical Company (125,000 bpsd) | 12,423.89 | 45,878.16 | 1,088.16 | 67,117.96 |



Figure 10. Illegal oil refinery and environmental damage (Taylor, 2013).



(a) Air pollution caused by illegal refinery (Sweetcrude reporters, 2012).



(b) Polluted water caused by illegal refineries (Izeze, 2014).

Figure 11. Pollution caused by illegal refineries.

species and destruction of wildlife habitat, disruption of water cycle and loss of medicinal plant species. This unlawful action is somehow necessitated by the continued injustice to the poorest community who do not get benefits from the oil wealth and the inability of the oil and gas companies operating in the area to stop and/or clean the polluted environment. Joint Task Force sometimes clamps down on these illegal refinery operators but end up worsening the environmental pollution (Figure 12). The operators are driven away and their “facilities” are set on fire with the crude and already refined products instead of providing jobs for them, vocational training and educating them on the environmental impact of their illegal activities.

3.2.4. Impacts of Gas Flaring and Venting

Crude oil is accompanied by varying quantities of extraneous substances such as water, inorganic matters and gases, and the removal of such substances does not change the state of the crude oil (Nwaugo et al., 2006). After the separation, crude oil is sent to the refineries or sold; the water is released to the environment and the gas is flared, vented or conserved. Gas flaring is widely used to dispose dissolved natural gas present in petroleum in production and processing facilities where there is no infrastructure to make use of the gas (Elvidge et al., 2009).

Environmental effects and issues from gas flaring have persisted in the world for several decades. According to Casadio et al. (2012), a gas flare is an elevated vertical stack found on oil wells, oil rigs, and in refineries, chemical plants and landfills, used for burning off unwanted gas and liquids released by pressure relief valves during unplanned over-pressuring of plant equipment. Figure 13 shows an offshore gas flaring site and a flaring site at Rumuekpe community in Rivers state. According to Ismail and Umukoro (2012), natural gas, propane, ethylene, propylene, butadiene and butane constitute 95% of the waste gases flared and CO₂ gas is produced when these gaseous hydrocarbons react with atmospheric oxygen. According to a World Bank sponsored study, gas flaring is one such anthropogenic activity defined as the wasteful emission of greenhouse gases (GHGs) that causes global warming, disequilibrium of the earth, unpredictable weather changes. It is a major natural disaster because it emits a cocktail of benzene and other



Figure 12. Scene of destruction of illegal refineries (Daniel, 2015).



(a). Offshore gas flaring (Elvidge et al., 2009).



(b) Gas flaring site at Rumuekpe community in River state (Uyigwe and Agho, 2007).

Figure 13. Gas flaring sites.

toxic substances that are harmful to humans, animals, plants and the entire physical environment (Ayoola, 2011).

According to (Zabbey, 2004), gas flares contain over 250 toxins and are detrimental to ecosystems and biodiversity with environmental and economic implications. This practice releases vast amount of energy to the environment and emits greenhouse gases. According to Johnson et al. (2001), it is estimated that 101.9 billion m³ of gases was flared or vented worldwide in 1997. Ismail and Umukoro (2012) reported that the World Bank has estimated the annual volume of associated gas being flared and vented to be about 110 billion cubic meters (bcm), which is enough fuel to provide the combined annual natural gas consumption of Germany and France. Flaring of natural gas is a common practice globally for oil and gas companies.

Algeria, Canada, Saudi Arabia and Libya flare 5%, 8%, 20% and 21% of their total production but Nigeria flared 79% of its total gas production in 1995, 76% in 2002 and 60% in 2006 (Ologunorisa, 2001; Odjugo and Osemwenkhae, 2009). Nigeria, like other oil producing countries, benefits as well as suffers from the positive and negative effects of crude oil drilling, such gas flaring (Nwaugo et al., 2006).

According to Nwankwo and Ogagarue (2011), the flaring of associated gas in Nigeria's oil exploration fields dates back to 45 years when oil and gas development began in the Niger Delta. With a daily crude oil output of about 2.25 million barrels per day, over 200 gas flaring sites exist in Nigeria and some of them are in perpetual flaring for over 20 years. Nigeria, like other oil producing countries, benefits as well as suffers from the positive and negative effects of crude oil drilling, such gas flaring (Nwaugo et al., 2006). The companies adopt an open-pipe flare method that is obsolete which they cannot practice in developed countries where they also operate. Ground–open flare method with sand banks is more accepted. In spite of the huge economic gains from harnessing this energy source or using other means of disposal, many oil companies operating in the Niger Delta Region of Nigeria choose to flare or vent the gas with impunity and pay the fines in spite of Decree 99 that bans unauthorized flaring.

3.3. Processes of Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is used to ensure the integration of the environment with developmental activities. EIA is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from major activities (policy, plan, program, or project) that are likely to have significant environmental effects (Barker and Wood, 1999). This makes the United Nations to state in **Principle 25** of Rio Declaration of 1992, that peace, development and environmental protection should be indivisible and interdependent. To achieve this, **Principle 17** of the Declaration prescribes Environmental Impact Assessment (EIA) as a national tool for proposed activities that are likely to have a significant adverse impact on the environment which are subject to a decision of a competent national authority (Rio Declaration, 1992). However, Tang et al. (2005) stated that EIA sometimes looks like a zero-sum game in which the economic interests of a development project come into direct conflict with ecological conservation interest.

Environmental impact assessment can be defined as the systematic identification and evaluation of the potential impacts of proposed projects, plans, programs, or legislative actions relative to the physical-chemical, biological, cultural, and socio-economic components of the environment (Canter et al. 1977; Saheed et al., 2012). According to Glasson et al. (2013), the International Association of Impact Assessment (IAIA) refers EIA as a process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of proposed development proposals prior to major decisions being taken and commitments made. Proposed actions do have a trade off and EIA clarifies them leading to a more structured decision making process. For instance, the impact of James Bay project in Canada on socio-cultural heritage to the native Indians should have been identified and mitigated through EIA process (Biswas and Agarwal, 2013). Therefore, EIA seeks to reduce or prevent the environmental effects of new proposed activities rather than manage the impacts of existing activities (Chongatera, 2012).

In the process of assessing and examining these environmental effects of a proposed action or impacting activity, the decision makers are urged to consider the opinions and expectations of those persons, groups or communities that may be likely

affected by the proposed action. Glasson et al. (2013) summarized the purposes of EIA as follows: (a) an aid to decision making, (b) a means for stakeholders consultation and participation, (c) an aid to formulation of development activities and (d) an instrument for sustainable development.

At the planning stage of a major project, impacting activity or action, EIA comes as a decision advising process which tends to evaluate the effects that will significantly affect the natural and man-made environment by the project. Before the decision on any project is made, EIA provides a systematic examination and inquest of the environmental implications of the proposed action. A measure of the effectiveness of EIA process is the extent to which it achieves its goals for environmental management and protection (Morrison-Saunders and Bailey, 1999). Procedural, political and analytical dimensions exist in the process and as such EIA is referred to as a systematic anticipatory and participatory environmental policy management instrument (Jay et al., 2007).

Antunes et al. (2001) identified several stages that need to be completed in an EIA process. These stages are: (a) project definition and characterization of environmental baseline information, (b) scoping and impact identification, (c) impact prediction (d) impact evaluation and (e) impact mitigation and compensation, and design of monitoring systems. The determination of the significant of environmental impacts makes the impact evaluation stage more important as it allows comparing the alternatives and biophysical components and supports the decision making, project acceptance, and the need for mitigation or compensation.

Morrison-Saunders and Bailey (1999) divided the process into three distinctive stages: (a) pre-decision stage which includes project planning and design activities, Environmental Impact Statement (EIS) preparation, public review and decision making and in which environmental management for potential impacts and impacts prediction are made (b) post-decision stage which deals with any unexpected outcome that the management activity stated in pre-decision stage cannot handle and in which modifications owing to uncertainty in impact prediction are made and (c) transitional stage which influences the environmental management activities and overlaps with the first and second stage and which comes in when there is an environmental management

provision in the EIA process at the pre-decision stage that will need post-decision stage attention.

Detailed steps in EIA process vary from one country to other, but many generic steps are followed internationally (Weaver, 2003). Morrison-Saunders and Arts (2004) divided the steps into preliminary assessment, detailed assessment and follow-up. Steps in the EIA process is briefly explained below and illustrated in Figure 14 (Weaver, 2003). They include: screening, scoping, baseline study, public participation, impact prediction, evaluation, mitigation and post decision monitoring and audit.

3.3.1. Screening

Screening is the process of determining whether or not an individual project proposal requires a full-scale EIA and what should be the level of assessment and the extent of process application (Weaver, 2003; Morrison-Saunders and Arts, 2004). This is the first step of the process which falls under preliminary assessment and involves a list of projects. According to Rajaram and Das (2011), the screening guidelines for EIA reflect the level of commitment a nation displays towards tightening its environmental protection system. Glasson et al. (2013) reported that screening is partly determined by the EIA regulations of a country at the time of the assessment. Many countries have lists of activities that require EIA while other have already identified sensitive environments that require EIA before they can accept any development. A stringent screening may hinder a nation's economic growth but a liberal or absence of screening may endanger life-supporting ecosystem and waste resources (Jones, 1999).

Rajaram and Das (2011) reported two fundamentally different approaches to screening in EIA process: (a) environmental centered approach that relies on the judgment of the proposal's likely impact on the environment and (b) development-centered approach that relies on the size and type of development. A case by case approach is centered on the environment regardless the size or capacity of the project while a threshold approach sets thresholds on projects in terms of size and capacity (Glasson et al., 2005). However, for a screening process approach to be effective, it should strike a balance between the environment and the development. The steps focus on the action (Project), by whom (Proponent), and to where (Environment).

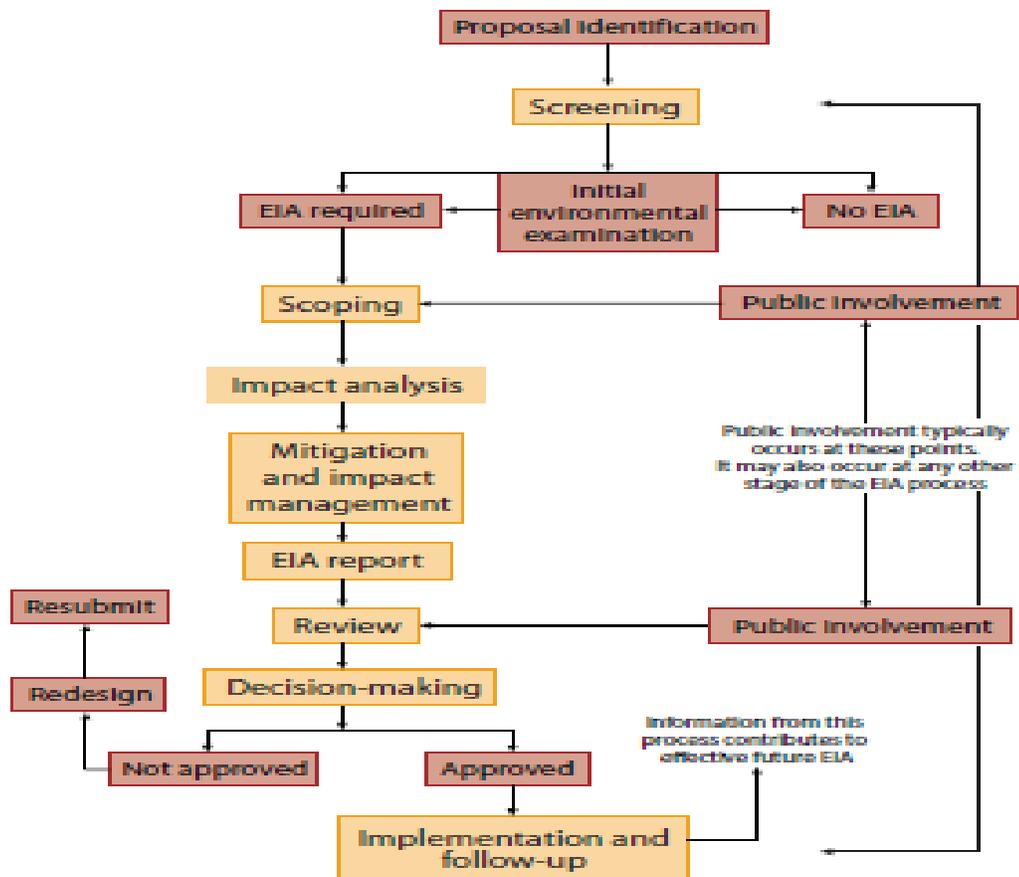


Figure 14. Steps in EIA process (Weaver, 2003).

3.3.2. Scoping

According to Noble (2000), scoping procedure was introduced to environmental assessment in the early 1970s to help improve the predictive capacity of the EIA process. Early attempts to initiate impact scoping were provided by U.S Council of Environmental Quality (Kennedy and Ross, 1992). The proposed action is associated with issues and determination of the extent of the issues to be considered in the assessment or reported in environmental statement is scoping. The process of identifying these issues and assigning priority and importance to them is called impact scoping (Ross, 1987).

Scoping determines the nature and extent of the required impact assessment (Weaver, 2003). At this stage of the EIA process, issues that are important are identified and examined, and the unimportant ones are eliminated. The scoping proposal characterizes the project, identifies impacts, defines the significance of the impacts and plans the EIA report. According to Glasson et al. (2013), scoping at an early stage, seeks to identify crucial and significant issues from the project's possible impacts and the alternatives that need to be addressed. When this is done, the scoping report forms the basis by which terms of reference for the EIA and Environmental Impact Statement (EIS) is prepared.

3.3.3. Baseline Study

Baseline study describes the current and predicted conditions of those elements of the environment which are likely to be significantly affected by the proposed development (Carroll and Turpin, 2002). It is an integral part of a competent assessment which is initiated from the information obtained from the scoping process. There is no clear difference between scoping and baseline study as scoping still uses baseline material. The quality of the baseline study establishes the viability of the appraisal of the impacts, and therefore of the EIA itself (Paliwal, 2006). According to Pinho et al. (2007), the baseline study should describe the different methodologies used to characterize each environmental factor, the methods applied for all analytical tasks and cartographic materials to achieve the best understanding of the baseline data and presentation of scientific justification. Although the regulations do not require baseline study

(identification and assessment of major environmental effects) but requires an indication of technical deficiencies encountered during information compilation.

Fairweather (1991) stated that monitoring relies on the scientific input from the environmental baseline study to ascertain what changes that should be expected if there is no impact (Null hypothesis) and changes to be detected if there is an impact (alternative hypothesis). The baseline study must tend to recognize the environmental receptors of impacts, information on population and economic activity in the area making the quality of the impact assessment to rely greatly on the quality of evaluation of the baseline conditions.

Baseline study should therefore be based on the predicted conditions of the environment at the time of the impacting development (Carroll and Turpin, 2002). According to Morris and Therivel (2001), valid impact prediction, effective mitigation and monitoring programmes can only be put in place when the baseline studies provides sound information of environmental and socio-economic systems.

3.3.4. Public Participation

EIA must include consultation and participation and public participation is a fundamental component of the environmental impact assessment (EIA) process (Hartley and Wood, 2005) and vital to its success (Province of Nova Scotia, 2009; Glucker et al. 2013). This is why the Rio Declaration of 1992, **Principle 10** says “Environmental issues are best handled with the participation of all concerned citizens at the relevant levels. At the national level, each individual shall have appropriate access to information concerning the environment, hazardous materials, activities in their communities and chance to participate in the decision making process of any proposed action” (Rio declaration, 1992). Canter et al. (1977) identified three ways public participation could be achieved during EIA process: (a) via an early scoping process, (b) public participation program during EIA study or (c) via the review process for draft EISs.

Transparency in decision-making, with the public, is a key role in the EIA process (Rega and Baldizzone, 2015). O’Faircheallaigh (2010) identifies three main roles for public participation in an EIA: (a) to aid in decision making, (b) as mechanism for achieving a role for the public and (c) as mechanism for reconstructing the decision

making framework. According to the Province of Nova Scotia (2009), the timing of public inclusion is very important. It has been suggested that early inclusion is a very effective time for participation (Hartley and Wood, 2005; Province of Nova Scotia, 2009; Rowe and Fewer, 2000). Continuing to include the public throughout the process is important to constantly engage with the public and relay information (Hartley and Wood, 2005). O'Faircheallaigh (2010) reported that a proponent will only seek the level of participation required to achieve the information desired.

A variety of methods have been suggested for engaging the public in an EIA. These methods may include newsletters, surveys and public meetings (Hartley and Wood, 2005; Province of Nova Scotia, 2009; Rowe and Fewer, 2000). Hartley and Wood (2005) strongly recommend the newsletter and site visitation methods of engagement; citing these as being highly successful. When engaging with the public, Province of Nova Scotia (2009) recommends using non-technical terms in order to elicit a better level of comprehension. While doing so, Rowe and Fewer (2000) suggested that providing all details is important. Doelle and Sinclair (2006) stated that providing the public with quality details about a proposal will increase the accountability, benefit the society by allowing better attention to multiple sustainability purpose, better selection among possible options and better design and implementation of the selected projects.

The role and importance of public participation in environmental decision-making have been emphasized by the Aarhus Convention on Access to Information, Public Participation and Access to Justice in Environmental Matters (United Nations Economic Commission for Europe, 1998). UK uses the provisions of Article 5(3) of Directive 97/11/EC to make scoping with integral public participation mandatory (Hartley and Wood, 2005). The public perceptions and views about the proposed actions may not be scientifically proven, but should not be ignored. Therefore, it must be recognized that decisions resulting from environmental impact assessments may be based as much on subjective judgments involving values, feelings and beliefs, and not the results of scientific studies (Beanlands and Duinker, 1983).

3.3.5. Impact Prediction

Duinker (1989) defined impact as a change in a variable of interest caused by change in another variable related explicitly to some aspect of the impacting development under investigation. These impacts may be adverse, beneficial, temporary, permanent, long term, short term, medium, reversible or irreversible. Impact prediction involves identification and evaluation of how the activities of the proposed action will impact negatively or positively on the various components of the environment (Weaver, 2003). According to Morris and Therivel (2001), EIA regulation requires impact prediction to include direct, indirect and cumulative impacts. It is often referred to constitute a “black box” in EIA studies (Tenney et al., 2006).

The impact prediction should foretell the significance of potential impacts of the project as well as explaining no anticipated significant impact. According to Glasson and Therivel (2013), impact prediction aims to identify the magnitude, size and extent of other dimensions of identified change in the environment with the project by comparing with the conditions without the project. Potential significance of risks, consequences and effects of proposed actions are analyzed, identified and evaluated. Change to baseline conditions which may occur in the absence of a development or the projected lifetime of the development are necessary for impact prediction of the development as well as good knowledge of the projects nature and timing, and the outcomes of similar projects including their mitigation measures.

Decision makers should be aware of hidden impacts in prediction uncertainty, otherwise they will not be able to react to such impacts effectively or stop them. The impacts are identified, evaluated and communicated to the competent authority and the public. When this is not appropriately done, there will be lack of confidence by the public which may lead to overreaction and possible termination of the project. Non-committal predictions assist the review agency and the general public to access the nature and probability of environmental impact that leads to reasoned decision about the acceptability of the project (Beanlands and Duinker, 1983).

3.3.6. Evaluation

Evaluation assesses the relative significance of the predicted impacts to allow a focus on the main negative effects of the proposed action (Glasson et al., 2013). According to Lawrence (2007), impact significance determination is generally recognized as a pivotal and critical EIA process though generally acknowledged as the most complex and least understood stage in an EIA process. It is an element of follow-up that deals with the appraisal of the conformance with standards, expectations or predictions as well as the environmental performance of the proposed action (Morrison-Saunders, 2007). Evaluation tends to examine the effectiveness and efficiency of the whole EIA system as regards to its influence in decision making.

Evaluation in an EIA process is much used in planning and policy for the generic process of gathering, structuring, analyzing and appraising information (Art et al., 2001). Its application explicitly involves value judgment rather than analytical or technological analysis. Two stages of evaluation exist: (a) ex ante evaluation which focuses on project goals and (b) alternatives pre-selection and planning cycle of the project. But post evaluation stage deals with policy appraisal.

3.3.7. Mitigation

Mitigation represents any process, schedule, activity or action designed to avoid, ameliorate or remedy significant adverse environmental impacts likely to be caused by a developmental project (Marshall, 2001). Mitigation of predicted impacts of a project is an integral part of an EIA process. According to Tinker et al. (2005), mitigation could be seen as the foundation of the whole EIA process, as it is the requirement to identify mitigation measures that translates the findings from the environmental assessment study into recommendations to reduce the environmental impacts. If project impacts are seen as 'problems', mitigation measures should be aftermath 'solutions' in an EIA process. Byron (2000) stated that though mitigation is inherent in EIA process, it does not give an indication of the effectiveness in reducing significant impacts. For mitigation to be effective, these recommendations and conditions must be monitored adequately. After the

Environmental Statement is prepared, impacts requiring mitigation measures are frequently identified in the EIA process.

Mitigation measures in an EIA process are introduced to avoid and/ or reduce social and environmental impacts of a proposed action. It remains the main focus of the European States Environmental Assessment Directive of 1988 (Wood, 2003). According to Bond and Wathern (1999), all EU countries have adequate legal provisions requiring mitigation measures to be designed and described in the Environment Impact Statement (EIS). The measure of the effectiveness of an EIA process has shifted from impact prediction accuracy to the ability to reduce significant impacts through adequate mitigation measures. According to Sanchez and Gallardo (2005), the utility of EIA process does not lie much on impact prediction rather impact management. Wilson (1998) stated that effective mitigation measures sometimes exist more in a written recommendation in an environmental impact report rather than implemented in the actual project and to make it effective, such mitigation measures should be reported, monitored, and properly audited.

3.3.8. Post Decision Monitoring and Audit

The importance and benefits of monitoring and auditing in an EIA process have been repeatedly highlighted in a wide range of literatures (Ahammed and Nixon, 2006). Monitoring as suggested by Beanlands and Duinker (1983) refers to the measurement of environmental variables after a development proposal has been initiated. It is a tangible link between the proposal and the mitigation measures (Gunn and Noble, 2009). According to Art et al. (2001), monitoring usually consists of a program of repetitive observation, measurement and recording of environmental variables and operational parameters over a period of time for a defined purpose.

Bai and Bai (2014) identified monitoring to be one of the most important stages of an environmental assessment. A well-planned scheme should be part of the development of study for all valued ecosystem components (VECs) (Beanlands and Duinker, 1983). Monitoring tends to be focused on the most important VECs recognized in the initial studies (Kilgour et al., 2007). Post-monitoring acts as a feedback loop which provides information about potential consequences on the environment from the proposed action.

The proposal monitoring scheme should remain flexible enough to be adjusted (Beanlands and Duinker, 1983). Follow-up activities form an essential strategic context due to the basis of long-range impacts and a good follow-up procedure should include a monitoring plan of environmental indicators to identify if and when a project needs to be reconsidered (Gunn and Noble, 2009; Walton et al., 2001).

Under the article 79(2) of Superfund Amendment and Reauthorization Act (SARA), it is a requirement to ensure that measures are taken to monitor all at risk species and the adverse effects a project may have on them or their environment (Government of Canada, 2010). Monitoring will help test the impact predictions and guide the proponents towards proper mitigation measures (Beanlands and Duinker, 1983) and the monitoring results can be used as an indicator to reassess and modify the proposal design (Kilgour et al., 2007).

An environmental assessment should provide an equivalent amount of technical detail for the monitoring processes as they do for the preliminary VEC identification (Beanlands and Duinker, 1983). It is important to include a public review of the monitoring procedure (Gunn and Noble, 2009). Kilgour et al. (2007) recommended the stressor-based method when regarding physical/chemical habitats and environmental effects-based method for biological indicator performance. Simulation monitoring is a commonly used resource in the follow-up component of an EIA (Duinker and Greig, 2006).

The Auditing concept in EIA has its origin from economics and accountancy where it involves objective examination (Arts et al., 2001). Environmental auditing has been used in two different ways: (a) environmental management auditing and (b) EIA auditing (Dipper, 1998). According to Tomlinson and Atkinson (1987), auditing encompasses a periodic activity that involves comparing monitoring observations with a set of criteria such as standards, predictions or expectations and reporting the results. Rigby (1985) stated that a post development audit tends to compare the predicted impacts prior to the project implementation and the actual impacts during the project's operation phases. Most EIA studies are only concerned with identification and prediction of impacts but fail to include adequate monitoring and auditing post development follow-up processes. EIA tends to fail when these post development activities are ignored.

3.4. Environmental Impact Assessment Guidelines and Regulations

Many industrial activities in many areas of the world put the quality of air, soil and water and human health at risk. Therefore, **Principle 25** of Rio Declaration states peace, development and environmental protection to be indivisible and interdependent (Rio Declaration, 1992). At the planning stage before a project can proceed, Environmental Impact Assessment (EIA) should be required to study, predict and evaluate the significant impacts of the proposed actions prior to decision making towards environmental protection. According to Ebisemiju (1993), Environmental Impact Assessment emerged as a response to the concerns expressed by the environmental movements of the 1960s about the serious effects of human activities especially pollution by industries, with which existing planning regulations and pollution control measures could not adequately cope. In 1969, with the passage of National Environmental Act, US introduced EIA for federal actions that have significant effects to the human and manmade environment. This Act together with Council of Environmental Quality (CEQ) guidelines ensure a balanced decision making in project planning as it affects the social, economic and environmental interests of the public.

Principle 17 of the Rio Declaration on development and environment adopted this EIA as a national tool for proposed actions with significant effects on the environment prior to decision of a competent national authority (Rio Declaration, 1992). EIA as a result has been portrayed as a tool for environmentally sound practices involving the prediction, assessment, estimation and communication of environmental effects of proposed major impacting activities (Sankoh, 1996). Environmental scientists are called upon to explain the relationship between these federal actions, environmental conditions and values.

3.4.1. Environmental Impact Assessment Guidelines and Regulations in Canada

Canada introduced environmental assessment legislation at the federal level in 1973 when the Canadian Environmental Assessment and Review Process were implemented (Kirchhoff et al., 2013). In Canada, the Federal Government and all the Provincial Governments have Environmental Assessment Laws. In the territories,

environmental assessment processes also exist. Although there has been a mandated federal role in environmental impact assessment since 1974 (Hanesbury, 1990), EIA process in environmental-responsible decision-making has dealt with multi-jurisdictional implications among the federal government, provincial governments and territories leading to overlapping legislative responsibilities.

According to Fitzpatrick and Sinclair (2009), Canada has a growing history of inter-jurisdictional coordination of EIA processes that serve to illustrate the costs and opportunities associated with different approaches that underscore EIA inter-jurisdictional coordination across different governance levels. Legislation and institutional bi-lateral arrangements are required for harmonization among the multiple jurisdictional levels. The powers, duties and functions of federal authorities and other stakeholders in an EIA process are defined by the Canadian Environmental Assessment Act but does not prescribe any co-ordination procedures for implementing the EIA.

Under the Canadian Environmental Assessment Agency (CEAA) 2012, environmental assessments are more concerned with potential adverse effects, cumulative effects, mitigation measures and public comments from projects under federal jurisdiction that include fish and fish habitat, other aquatic species, federal lands, migratory birds, environmental changes linked to any federal decisions, effects that cut across provincial boundaries and effects that impact on Aboriginal peoples. Figure 15 shows the process of EIA contained in CEAA 2012. The Canadian Environmental Assessment Act applies to all projects described in the Regulations Designating Physical Activities and the ones designated by the Minister of the Environment and conducted as early as possible (CEAA, 2012). The Canadian Environmental Assessment Agency is responsible for the Canadian Environmental Assessment Act, 2012. When the agency is the responsible authority, analysis is done upon receiving the project description to decide if federal environmental assessment is required within 45 days or the minister may refer the designated project to an environmental assessment by review panel. The CEAA 2012 makes equivalency provisions for cooperation and coordinated action between the orders of government to achieve the goal of "one project-one review". The Minister of the Environment allows provincial process to substitute for a Federal Environmental Assessment (not federal decision-making) only when conditions in CEAA 2012

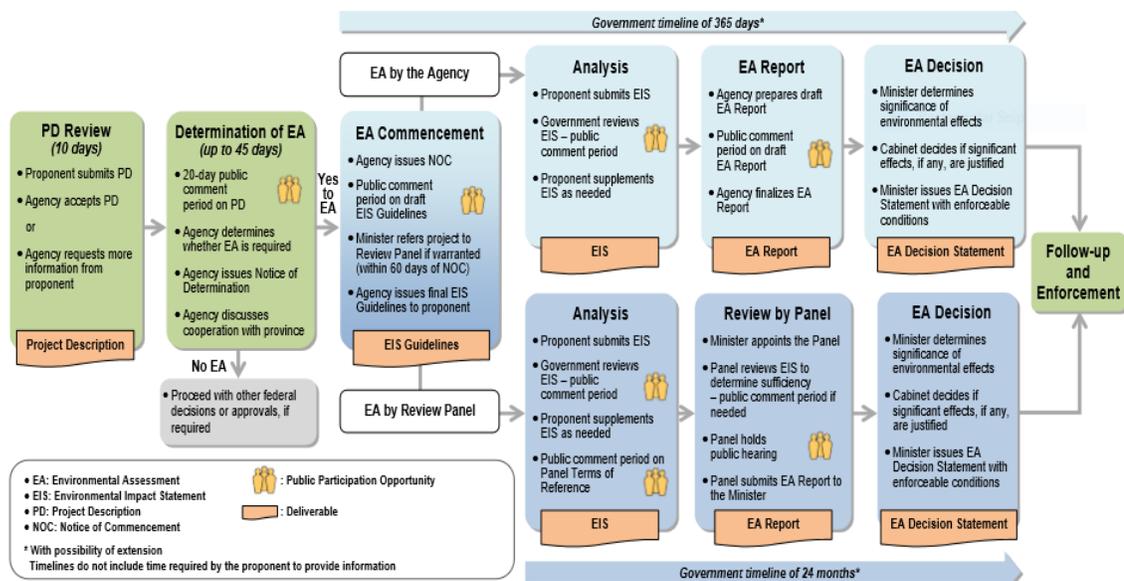


Figure 15. Canadian EA process (CEAA, 2012).

regarding factors to be considered, public participation and submission of an environmental assessment report are provincially fulfilled. The provisions from CEAA 2012 include: timeline, public participation, cooperation and communication with Aboriginal people and follow up programs and enforcement.

3.4.1.1. *Timeline:* Timelines are set by CEAA 2012 for government and panel activities to complete its work as required but not the periods of time required for the proponent to gather information needed to complete the environmental assessment. A period of 365 days is required from the commencement of an environmental assessment by the agency to the final environmental assessment decision and 24 months for an assessment by review panel from the time of referral to the final environmental assessment decision and the Minister of Environment sets project-specific timelines for each phase of the review panel process. The time for the public to review draft guidelines is a minimum of 45 days. A minimum of 60 days is required for the public to review the EIS and a minimum of 45 days for notice of information assessment meetings.

3.4.1.2. *Public Participation:* Public participation is a fundamental component of the CEAA 2012. It involves public input in decision making that will affect them since EIA is a communication of environmental effects of proposed impacting activities (Sankoh, 1996). Paragraph 18(3) (b) of the Environmental Act defines public participation as giving the public an opportunity to examine and comment on the screening report and any record relating to the project. This provision includes all aspects of public notice and access to registry records, but will also involve consultation or a higher level of engagement of the interested parties. The agency also made provision for Participant Funding Program to facilitate the participation of the public.

3.4.1.3. *Cooperation and Communication with Aboriginal Peoples:* This is another key component of the CEAA 2012. The Canadian Environmental Assessment Agency has recognized that the Federal Crown has a legal duty to consult aboriginal peoples about the potential impact of decisions associated with federal conduct on their rights (Kirchhoff et al., 2013). The Environmental Act contains explicit requirements to assess

changes to the environment that affect aboriginal peoples and sets out laudable goals with respect to aboriginal interests and engagement in the environmental assessment process (Walls, 2012).

“Environmental effects” as interpreted in Paragraph 2 (1) made provisions that explicitly relate to aboriginal peoples as it affects their current use of land and resources for traditional purposes structures, sites or things that are of historical, archaeological, paleontological or architectural significance, health and socio-economic conditions, physical and cultural heritage. The Agency’s Participant Funding Program is also made available to support the Aboriginal consultation and engagement in environmental assessment process.

3.4.1.4. Follow-up Programs and Enforcement: The Minister of the Environment, while determining if the project is likely to cause significant adverse environmental effects, takes into account mitigation measures that were identified during the environmental assessment. This leads to a decision statement condition that the proponent must comply. Follow up programs are set to verify the accuracy of the predictions regarding potential environmental effects and to ascertain if mitigation measures are working as intended. Compliance is carried out by enforcement officers and a maximum fine as high as \$400,000 may be imposed for a violation of the CEAA, 2012.

The Minister of the Environment in accordance with **Paragraph 84 (a) and (e)** may make regulations for a designated project as defined by the **subsection 2(1)**, a physical activity or class of physical activities that have environmental effects or public concern but not prescribed under regulation, using the authority in **Paragraph 14 (2)** of the Environmental Act. **Paragraph 15 (b)** listed regulated designated projects mentioned in **Paragraph 84 (a)** or the order made under the **subsection 14(2)** to include activities regulated under the National Energy Board Act and the Canada Oil and Gas Act.

Section 26 (2) of Canada Petroleum Resources Act says: “Subject to Subsection 3 and Section 27, the term of an exploration license shall not exceed nine years from the effective date of the license and shall not be extended or renewed”. The term for a production license under Canada Petroleum Resources Act is twenty five years from the effective date of issuance for frontier lands. The Canadian Petroleum Resources Act

protected the Aboriginal's and treaty rights in **Section 3**. Canada Petroleum Resources Act 1985 is similar to Nigeria's Petroleum Act of 1969.

3.4.2. Environmental Impact Assessment Guidelines and Regulations in USA

In 1969, with the passage of National Environmental Act, US introduced EIA for federal actions that have significant effects to the human and manmade environment. This Act together with Council of Environmental Quality (CEQ) guidelines ensure a balanced decision making in project planning as it affects social, economic and the environment in the interest of the public. According to Stampe (2009), the U.S law and regulations refer to the EIA document as Environmental Impact Statement (EIS) where as the process is called EIA. National Environmental Policy Act (NEPA) Section 102 (2) (c) requires an agency to include in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement which must include environmental impacts of proposed action, unavoidable adverse impacts of the proposal and alternatives to the proposed action (Mary and William, 1974).

The EIA process starts with submission of notice of intent which must be published by Federal Register first. Scoping of reasonable alternatives, relevant stakeholders, and issues of concern is the next step. The EIA process in the U.S is shown in Figure 16. According to Stampe (2009), there shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action (scoping report) after the agency must have published the notice of intent.

The U.S EIA process considers scoping very important and an integral part of Environmental Impact Assessment which provides a level playing ground and a platform for early involvement of stakeholders. The lead agency is responsible for projects and when contractors are used, they must sign and submit a disclosure statement that they have no financial interest in the project.

The NEPA involves the public in implementation of Environmental Regulations 40 (Code of Federal Regulations (CFR) 1501.4 (b) by mandating the federal agencies to involve environmental agencies, applicants and the public to the extent practicable. In

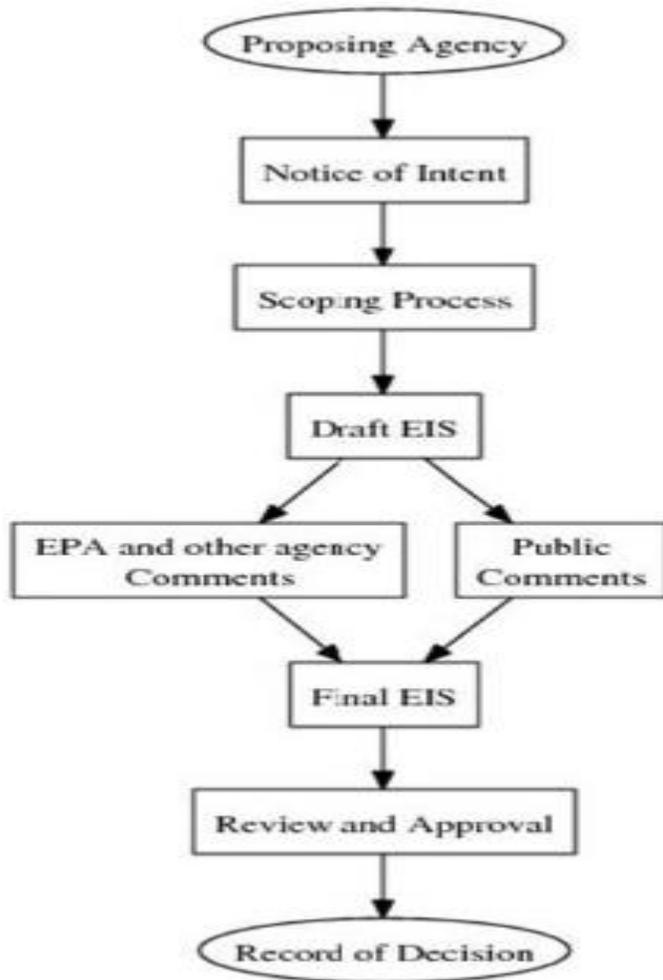


Figure 16. EIA process in the U.S. (Stampe, 2009).

response, the U.S EIS process in response requires a public comment period of 45 days, 90 days after notice of filling of a Draft EIS and 30 days after notice of filling of a final EIS. In addition to this, the Record Of Decision (ROD) prepared by the lead agency, which states decision, environmentally preferable alternatives, mitigation measures and commits to monitoring and enforcement program, is made available for public review but not circulated.

3.4.3. Environmental Impact Assessment Guidelines and Regulations in Brazil

Brazil is 8th largest total energy consumer, 9th-largest liquid fuels producer in the world, and 2nd petroleum producer in South America in 2014. However, Brazil is facing major social, economic, and environmental issues, including considerable regional disparity (Glasson and Salvador, 2000; U.S Energy Information Administration, 2015). Brazil has many regional environmental problems ranging from agricultural frontier occupation impacts, Amazon forest devastation and severe droughts. These issues make EIA practice variable between regions.

In 1981, the National Council of the Environment was created by Law 6938 and its role is establishment and coordination of national environmental policy, to make major regulations, and to propose federal laws. But the Brazilian Institute of Environment and Renewable Natural Resources is saddled with several roles, including the coordination and integration of actions at the national level, such as environmental licensing, EIA, pollution control, the licensing of projects related to natural resources exploitation, the licensing and EIA/EIS review of projects whose environmental effects are related to more than one state (Glasson and Salvador, 2000).

The earliest Brazilian EISs as required by the World Bank were voluminous and repetitive documents and they paid more attention to impact prevention than use as a decision management tool (Claudio, 1987). The EIA process in Brazil which encompasses both legal and environmental licensing links is shown in Figure 17. In spite of the guideline for public participation and public hearing by Conselho Nacional do Meio Ambiente (CONAMA) resolution 005/87, public participation is very rare and weak in Brazil (Glasson and Salvador, 2000). The public are involved in stages 10, 16, 20, 21 and 23 but the final EISs are never accessible to them. Environmental risk

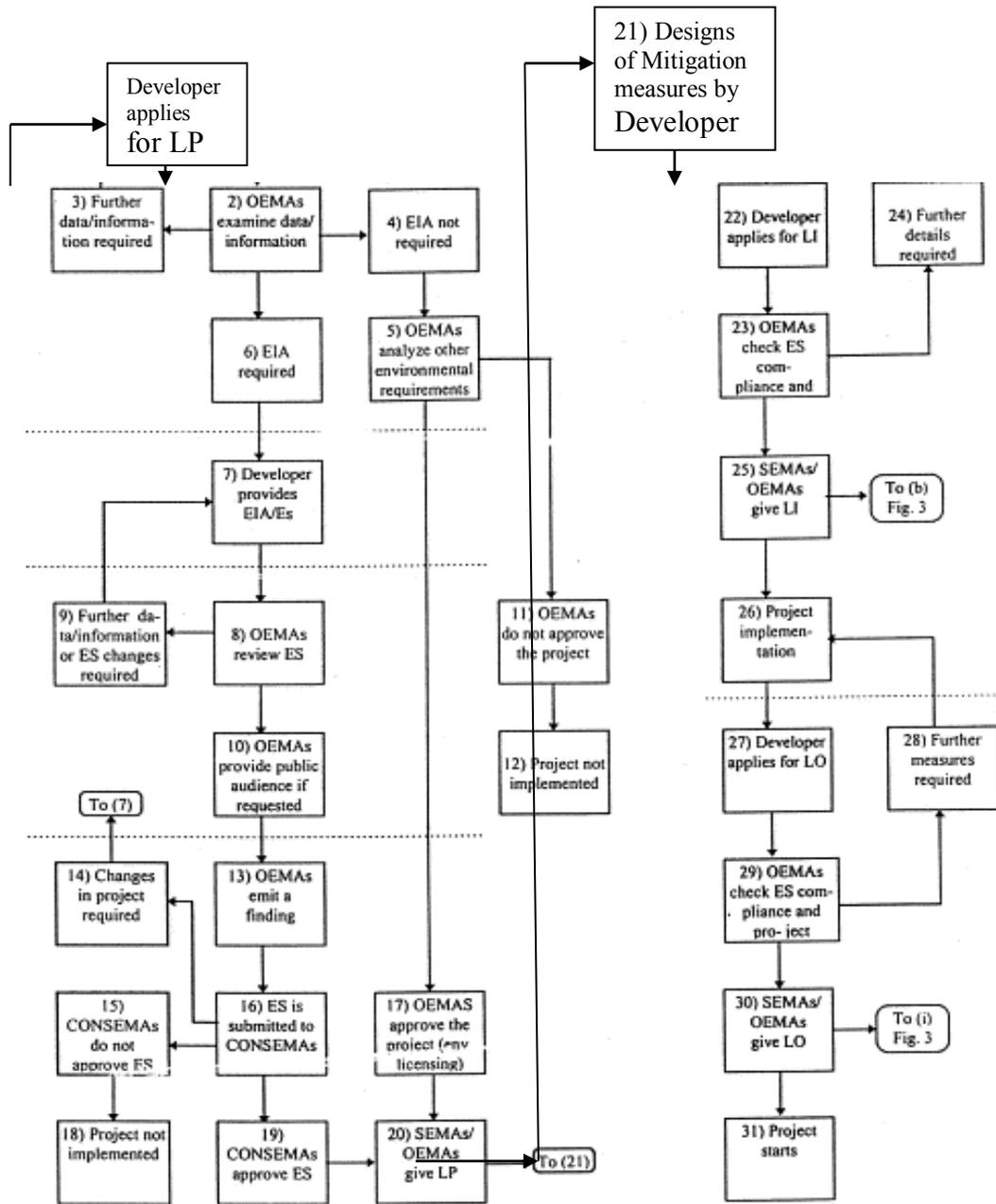


Figure 17. EIA procedure in Brazil (Glasson and Salvador, 2000).

analyses, cost benefit analysis and cumulative effects are improperly assessed. According to Glasson and Salvador (2000), provisions for EIA monitoring are made in stages 10, 19 and 21 but are rarely carried out in practice. The Brazilian EIA system performance is summarized in Table 6.

3.4.4. Environmental Impact Assessment Guidelines and Regulations in Nigeria

The EIA Act in Nigeria was enacted in accordance with **Section 5** (Functions of the Agency) of the Federal Environmental Protection Agency (**FEPA**) **Decree 58 of 1988** as a pre-requisite tool for effective implementation of sustainable development in Nigeria following Stockholm Conference and stipulation of **Principle 4** of Rio Declaration of 1992. **Section 5** (Functions of the agency) subsection **(a) of Federal Environmental Protection Act** mandates the Agency to “Prepare a comprehensive national policy for the protection of the environment and conservation of natural resources, including procedures for EIA of all development projects”.

The 1981-1986 Development Plan released by the Federal Government was the earliest attempt to require EIA in Nigeria. A Communiqué recognizing Environmental Impact Assessment as an indispensable prerequisite tool for the efficient and sustainable development of the environment was issued by the National Environmental Council in 1990 and a further directive in March 1991 for it to be an indispensable tool for all developmental projects in Nigeria. After 1991, the environmental regulations operated in the petroleum industry were maturing from reactive control measures to a proactive EIA system (Ogunba, 2004) which occasioned the Department of Petroleum Resources (DPR) to issue its Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN), which provided, for the first time, details of EIA processes for the Nigerian Government and this led to the promulgation of the Town Planning Act and the EIA Act in 1992 (Ingelson and Nwapi, 2004).

In a bid to curb and mitigate the effects of hydrocarbon extraction, the Nigerian Government promulgated many laws aimed at reducing the impact of pollution from hydrocarbon exploration and exploitation and protecting the environment from industrial activities (Anaejionu et al., 2015). But according to Eweje (2006), countries would, in the first instance, need a system which provides concrete evidence regarding the benefits of

Table 6. Summary of Brazilian EIA system performance (Glasson and Salvador, 2000).

| Criteria | Performance |
|--|----------------|
| Screening | Yes |
| Scoping | No |
| Review of EIS | Partial |
| Impact monitoring | No |
| Mitigation | Partial |
| Public participation | No |
| Cost and benefit | No |
| SEA | No |
| Institutional and Administrative framework | Deficient |
| Compliance monitoring and enforcement | Very deficient |
| Decision making | No |
| System monitoring | No |
| Alternatives in design | No |

adopting formal EIA practices before they can be in a position to finally decide on adopting such practices and its application is inevitably political despite providing its method of evaluation.

Section 1(Goals and objectives of environmental impact assessment) **and Section 2** (Restriction on public or private project with prior consideration of the environmental impact) set out the objective of the Act and request any person or authority embarking on any activity which is likely to have an environmental effect to take into account the environmental effects and notify and consult the people living in the affected environment. Li (2008) stated that in developing countries, EIAs most often lack a public announcement or “notice of intent” advising about the imminent preparation of an EIA, any designed process for involving the public and post-EIA monitoring.

The involvement of public participation as contained in **Section 1 (c)** is in accordance with **Principle 10** of Rio Declaration of 1992 which says: “environmental issues are best handled with the participation of all concerned citizens at the relevant level and that at the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes” and **Principle 22**. Principle 22 added the recognition and duly support of identity, culture and interests in enabling their effective participation in the achievement of sustainable development (Rio Declaration, 1992). This is why Eweje (2006) says: “the general principles set out in **Section 1 of the EIA Act of 1992**, and in the entire Decree, are consistent with the set of Environmental Guidelines and Principles set out and approved by the General Council of United Nations Environmental Programme (UNEP) in 1987 to assist member states in establishing laws and machinery for EIA”. Adomokai and Sheate (2004) stated that enactment of EIA Decree 86 of 1992 is a major milestone in the fight for the right of the public to environmental information and the right to participate in the process of environmental decision-making although the **FEPA Decree 58 of 1988** mentioned public investigations for pollution but did not make any reference to public participation in any form.

Despite this reference of public participation in the EIA Act, lack of baseline data is perhaps the greatest challenge to the Nigerian EIA process (Eweje, 2006). This may be

as a result of inadequate public participation as the **Principle 22** of Rio Declaration has encouraged involvement of indigenous community in environmental management and development because of their knowledge (baseline information). The community will not only enhance the quality of EIA by identifying the project effects on their environment but also provide some baseline information. According to Adomokai and Sheate (2004), the operating companies only decide what projects to do for the community as community or public service instead of their active participation in contributing to the real environmental decisions because there is no legal requirement and obligation for the project proponents to engage the affected public in its own assessment before submitting its reports to the Federal Ministry of Environment (Eweje, 2006).

Amnesty International (2009) criticized the EIA system in the Niger Delta for oil and gas activities on the grounds that it is usually carried out by consultants hired by the oil companies and not seen as a tool to protect the environment or the people but primarily is seen as a regulatory requirement. Independent EIA experts should conduct the EIA and this should be reviewed by other independent experts. The government needs to adopt a wider range of strategic environmental protection approaches that embrace the fundamental components of sustainable development, economic prosperity, environmental health and social equity and well-being and makes sure more environmentally sensitive decisions are taken to reduce environmental damage (Eweje, 2006).

Voluntary compliance to laws is a major problem in Nigeria. Therefore, in order to achieve a better environmental protection, the regulator should have the strong will power to enforce environmental laws with stiff sanctions for non-compliance. According to Anaejionu et al. (2015), the EIA process is not carried out with the required level of seriousness by companies and as a result not thoroughly executed because the agency saddled with the responsibility to review the EIA lacks the manpower to identify the lapses. The entire Act did not consider the ethno-diversity nor support the identity and culture of the host communities, its rich biodiversity and conservation of wildlife. Canada has Species at Risk Act for Canada's natural heritage and wildlife because of their value in aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons for Canadians.

The Canadian Environmental Assessment Agency (CEAA) has explicit requirements to assess changes to the environment that affect aboriginal peoples (Kirchhoff et al., 2013). However, the Brazilian EIA is not different from Nigeria's EIA which is a clear indication of lack of resources, political and economic pressures, characteristic of developing countries. No wonder the Amazon River and rainforest in Brazil is similar in devastation to the Niger Delta in Nigeria. According to Noble (2000), the Canadian Environmental Assessment and Review Council argues that three concerns remain central in enhancing the environmental assessment process: (a) the accuracy of predicting, (b) the degree to which mitigatory and compensatory measures actually reduce impacts and (c) the efficiency and fairness with which the assessment process itself accommodates the needs, concerns, and values of interested parties. Historically, the Nigerian Government has relied on a command-and-control regulation as its primary method for environmental management instead of an EIA regulatory system which is self-regulatory or market based system (Eweje, 2006; Wifa, 2012).

There should be inclusion of Strategic and Cumulative Impact Assessment in addition to EIA as the EIA only focuses on a particular project and its environmental effects. The operating companies should also adopt the environmental and social safeguard policies of the International Finance Corporation arm of World Bank which should lead to the issuance of "social license" in order to improve public participation, social equity, reduction of environmental injustice and improve intergenerational justice. There should be concern for intergenerational equity which requires attention to the normative relationship between present and future generations that will foster commitment to future generations in the context of environmentally sustainable development (Weiss, 1990) through enactment and adequate enforcement of environmental laws.

3.5. Valued Ecosystem Components for Oil and Gas Development

A Valued Ecosystem Component (VEC) is an element of the environment with physical, economic, social, biological, archeological or cultural significance that may be affected by project activities which are included in environmental assessments. People are more concerned with the elements of the environment during a project execution and

VEC may be determined by scientific concern or cultural ideals. During impact analysis, a detailed field study should be carried on VECs to predict/forecast impacts, determine the VECs futures without the project, VECs futures with the project and state any significant differences before designing mitigation measures.

According to Duinker and Beanland (1986), an EIA should be required to briefly identify a set of VECs as a focus for the assessment studies and define a context with which the significance of changes in the VECs can be determined. The science used in EIA for assessing impacts to VECs is largely stressor-based, where the focus is on anticipated impacts from introduced environmental stress (Ball, 2011).

3.5.1. VECs for Biophysical Environment

The VECs for biophysical environment are the physical part of the environment (water, soil and air) together with the biological activities within it. In a VEC-based approach to EIA, impacts to biophysical components are assessed first.

3.5.1.1. Water

According to Nwidi et al. (2008), over 50,000 people die daily due to water borne diseases and the mortality in children under five years from water related diseases annually is estimated to be about 4 million in developing countries. The health of the inhabitants of a community depends solely on the quality and quantity of water available. Water pollution has direct relationships with civilization, industrialization and standard of living of the people (Goel, 2006). When all these are affected by the pollution, the local economy of the people is seriously affected.

Freshwater supplies and fishes have been severely contaminated by the oil and gas activities happening in its environment. Oil and gas activities release vast number of harmful pollutants into the water bodies. These pollutants when present have deleterious effects to public and ecological health. Though freshwaters have their natural way of self-purification, many of them have lost this power owing to the daily loads of untreated petroleum hydrocarbons. According to Martinez et al. (2007), the Corrientes River in Peru, which is oil production receiving water, contains high concentrations of oils and mercury despite its capacity for dilution. The marine biota is significantly affected by this

pollution including the aesthetics of the waters and the people who depend on them for various forms of livelihood. The petroleum hydrocarbons on the surface affect the activities and distribution of phytoplankton which is very important in the aquatic food chain.

Water pollution by oil and gas activities also pose great danger to wildlife especially seabirds. Prestige oil spill in the Atlantic coast of Spain killed or harmed 200,000 birds, caused significant phytoplankton biomass reduction, hampered fish reproduction and caused stranding of many sea mammals and turtles (Haapasaari and Tahvonon (2013). Kingston (2002) reported that 35,000 seabird carcasses were recovered after the Exxon Valdez spill. When petroleum hydrocarbons are released directly into water accidentally, the light fractions float in water and form thin surface films limiting the dissolved oxygen while the heavier fractions accumulate in the sediment at the bottom of the water body affecting benthic organisms (Okoye and Okunrobo, 2014).

Some surface water supplies which the local people use domestically for drinking and cooking also serve as receiving waters for oil and gas effluents. The majority of these water bodies have high concentrations of total petroleum hydrocarbons and heavy metals above maximum permissible limits set by World Health Organization. For instance, Corrientes River used by Achuar communities in Peru for drinking, contained lead levels higher than accepted levels in 2005 (Martinez et al., 2007). Accidental oil spills from Texaco pipelines in Ecuadorian Amazon have sent an estimated 16.8 million gallons of crude oil into the headwaters of the Amazon river (Kimerling, 1994). This river and other water bodies in the area supply water and fish for the local population.

Oil spills foul recreational beaches. According to King (1995), there is a loss of consumptive benefit from recreational beaches when closed as a result of petroleum hydrocarbons fouling. People use the beaches for their enjoyment and there is always unquantifiable loss of non-consumptive benefits from the beaches too if closed owing to oil contamination. For example, after the Amoco Cadiz oil spill disaster in March 1978, 245,000 visitors avoided Brittany's Beach in 1978 tourist year (Lumley, 1983).

3.5.1.2. Soil

Crude oil pollution has deleterious effects to soil characteristics, soil organisms and plants. According to Carls et al. (1995) and Osuji et al. (2005), the soil ecosystem is usually contaminated by crude oil when it is incidentally discharged into the environment, due to various reasons including failure of production equipment, operational mishaps, corrosion of equipment, spill from drilling equipment, oil spillages, produced water disposal, gas flaring, waste discharges and other chemical disposals, dredging activities, pipeline corrosion, effluent water and drilling mud disposal and flow station power generation as well as from intentional damage known as sabotage. Crude oil contaminated soils also have high concentrations of heavy metals including cadmium and vanadium.

Soil is a valuable natural resource regulating biogeochemical cycles, filtering and remediating pollutants and enables food production. However, soils polluted with petroleum hydrocarbons are low in fertility and hence do not support growth and development and have adverse effects on soil biota (Bisht et al., 2010; Chibuiké and Obiora, 2013). Oil spills and other pollutants from oil and gas activities affect the soil fertility and the degradation of soil leads to reduced soil structure, aeration, water holding capacity and biological activities all of which lead to low crop output. There is also an increased chance of soil erosion from explosives and bush clearing for drilling platforms. The soil is an intermediary between aquatic and terrestrial ecosystems and the members of the public are exposed to the contamination.

When petroleum hydrocarbons are present in high concentrations in the soil, they pose imminent danger to food chains and potential health risks to children and adults owing to their toxicity and carcinogenicity. The phyto-availability of metals is determined by the nature of the metal species, their interaction with soil colloids, the soil characteristics and duration of contact with surface binding (Iwegbue et al., 2006). According to Bamforth and Singleton (2005), presence of co-pollutants like heavy metals and other organic compounds prolong the residence time of petroleum hydrocarbons in the soil thereby limiting their biodegradation.

Soils around oil production installation areas are always contaminated with total petroleum hydrocarbons and heavy metals. The natural microbial communities and the

chemical and physical properties of soil are influenced by these petroleum hydrocarbons which have been considered among the strongest soil pollutants (Ijah and Antai, 2003; Zhang et al. 2009 and Marinescu et al. 2012). According to Martinez (2007), soils around oil installation areas in Achuar territory in Northern Peruvian Amazon have been reported to contain total petroleum hydrocarbons and barium (from unprotected dumping of drilling muds) above maximum permissible limits. There was an observed decline in the health and well being of the people during the period of petroleum development projects in the Peruvian rainforest. Carls et al. (1995) reported a widespread and persistent soil contamination from oil drilling and production activities in Padre Island National Seashore in Texas. These discharges of drilling fluids and petroleum hydrocarbons to the soil have chronic, acute or sub lethal effects on humans, plants, microflora, animals and food chains.

3.5.1.3. Air

Clean air is a basic requirement of human health and wellbeing (WHO, 2006). Air quality is a sub-component of the atmospheric environment and air pollution continually pose a great threat to public health. Humans and plants are directly affected by air emissions from oil and gas activities. Webb et al. (2016) stated that oil and gas operations emit air pollutants having adverse respiratory effects throughout their lifecycle. The uncontrolled gas flaring and emissions from refineries are the major source of sulfur dioxide, nitrous oxide, methane, carbon dioxide and particulate matter. Emissions of oxides of nitrogen (NO_x), particulate matter (PM) and volatile organic compounds (VOC) are always associated with combustions from drilling rigs, compressors, generator engines, heaters and pumps (Field and Murphy, 2014). The VOCs (especially Benzene, Toluene, Ethylbenzene and Xylene (BTEX) which are often referred to as air toxics) are very harmful to public health.

Field and Murphy (2014) stated that air quality is a primary consideration and potential impacts should be estimated by a modeled influence of predicted emissions on ambient air quality. Emitted pollutants from oil and gas activities are seen in ambient air and majority of them are carcinogenic and cause many respiratory disorders (Webb et al., 2016). Many developed countries regulate the air quality of their environment through

Clean Air Acts. They measure emissions using emission inventories and give sanctions for polluters. But in developing countries, stringent measures against harmful air emissions are absent.

The local people suffer the health impacts of the air toxics from petroleum activities including ozone smog and Ultraviolet radiation due to destruction of ozone layer (Perrotta, 1999). Chaaban (2008) attributed sulfur dioxide as the main air pollutant in Riyadh Saudi Arabia which emanates from petroleum refining processes. Martinez et al. (2007) reported hydrogen sulphide (from gas flaring) concentration in Achuar territory in Northern Peruvian Amazon to be 4 times the maximum permissible level.

In areas of highly concentrated oil and gas development in U.S.A such as Wyoming, Utah, Texas, and Colorado, there have been numerous studies on atmospheric concentrations of ozone. The Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) have studied respirable crystalline silica for workers safety and hydraulic fracturing operations (Webb et al., 2016). Oltmans et al. (2014) studied and measured winter time ozone associated with oil and gas extraction in Upper Green River Basin, Wyoming and Uintah Basin, Utah. They observed that in Upper Green River Basin, Wyoming, early March has the strongest and uncharacteristic ozone event of the season with hourly values exceeding 150 ppb (parts per billion) and a maximum daily 8-h average (MDA8) over 120 ppb.

3.5.2. VECs for Social Environment

Importance of VECs for social environment led to the introduction of social impact assessment. Social impact assessment is the process of identifying the future consequences of a current or proposed action which are related to individuals, organizations and social macro-systems and it involves managing, monitoring and analyzing social effects of the project (Becker, 2001). Impacts on VECs for social environment always arise as a resultant effect from impacts on the biophysical environment because the socio-economic and biophysical effects of a project are connected. Any change in one aspect should affect the other. The social costs, cultural, environmental and public health concerns of oil productions are largely absent from government policy deliberations while the economic and political benefits are given top

priority (O'Rourke and Connolly, 2003). However, social impact assessment makes sure a more ecologically, social-culturally and economically sustainable and equitable environment are achieved (Vanclay, 2003).

Oil productions have great effect on sensitive ecosystems and threaten the life of the people who live in them. Building of access roads, for example cause, deforestation and leads to displacement of the local people. Social impact assessment done with the involvement of the community can help to reduce local resistance to projects and cost. Considerable social impact of oil developments in the Western Amazon made the indigenous people in Ecuador and their Peruvian Amazon counterpart oppose new oil and gas developments (Finer et al., 2008). The VECs for social environment include: poverty and loss of livelihood, conflict and social tension and public health concerns.

3.5.2.1. Poverty and Loss of Livelihood

Most of the oil and gas developments are done in coastal areas and the local population depend heavily on the wetlands resources. With the exploration and production of oil and gas, the indigenous people lose their means of livelihood owing to the environmental contamination from the petro business activities. According to Baptiste and Nordenstam (2009), the importance of mangroves and wetland resources to rural communities has been overshadowed by the dedication of these vulnerable coastal areas to the energy sector and this has led to loss of livelihood. The local occupations of the indigenous people are hunting, farming, fishing, gathering and logging which are connected to their land, water and mangrove forests. Farming and hunting occupation are impacted by right of way of oil pipelines. Darkwah (2010) stated that the Chad-Cameroon oil pipelines affected the hunting and farming occupation of Bagyeli people in Cameroon. The project left a 30 meter wide gap in the forests and this local population is known for their hunting, crop cultivation and gathering.

Baptiste and Nordenstam (2009) stated that the continued expansion of the proposed oil and gas development in Nariva swamp area of south eastern coast of Trinidad threatens livelihoods, aesthetics and life of the people living within the surrounding villages. The swamp area is very important to Trinidad as it is the home for many fauna and flora and many of them are endangered and threatened species.

Kimerling (1994) reported that the indigenous Cofan community in Oriente (the Ecuadorian Amazon) lost their subsistence base (fishing, hunting, gathering and gardening) due to Texaco oil and gas operation in the area, noise and chemical pollution. The environmental degradation depleted the foraging areas and only small portions of land are left unpolluted. There was widespread poverty and the people substituted fish and wildlife proteins for carbohydrates. These environmental pollution caused by oil drilling result in destruction of livelihoods in local communities making it difficult for the present and future generations to make a living off of their land (Darkwah, 2010).

Oil and gas developments and pollution, not only jeopardize livelihoods for the indigenous population, but can lead to their resettlements. South central Sudan and Tetetes in Oriente (Ecuadorian Amazon) resettled and left their local occupations owing to oil and gas developments and pollutions (Kimerling, 1994; Darkwah, 2010). After the resettlements, farming and other occupations were lost. The families who are now food and cash-trapped looked for other livelihood in order to survive.

3.5.2.2. Conflicts and Social Tensions

Discovery and exploration of oil and other high valued natural resources have plunged oil-producing countries especially the developing countries into anarchy and conflict (Darkwah, 2010). These conflicts and tensions make some authors to refer to oil mineral deposit as a resource curse. Often time than not, the conflicts are brewed by divide and rule tactics by the Transnational Corporation (TNCs) operating in the developing countries. Patey (2007) reported that the mineral exploiting activities of Transnational Corporation (TNCs) significantly played a role in causing civil wars in Azerbaijan, Colombia, Angola and other developing countries. The conflicts may be intra-state (always caused by distribution and allocation of oil revenue) or inter-state (when the oil deposit lies at the border of two countries). Oil discovered at Lake Albert has caused many conflicts and tensions between Uganda and Democratic republic of Congo (Katshung and Yav, 2008).

When peoples' livelihoods are lost, the situation brings conflicts, insecurity and tension. According to O'Rourke and Connolly (2003), conflict over oil resources arises when oil production impacts interact with peoples' way of life and livelihood. The

conflicts may be in the form of: (a) conflict with the indigenous people (as experienced in Ogoni in Nigeria and Gwichin people in Alaska), (b) superpower geopolitics (as seen in the control of Middle East oil reserves), (c) civil unrest which disrupts oil production and (d) vandalism of oil installations and facilities (as being experienced in Nigeria right now). Darkwah (2010) stated that oil exploration has caused conflicts in Cambodia, Democratic republic of Congo, Angola, Darfur in Sudan and many other countries especially in the Middle East.

Ross (2003) stated five ways that oil wealth can hurt the poor: (a) by causing economic volatility, (b) by crowding out the manufacturing and agriculture sectors creating the “Dutch Disease” (crowding out of manufacturing and agricultural industries), (c) by heightening inequality, (d) by inducing violent conflict and (e) by undermining democracy. The secessionist movements by Cabinda in Angola, Biafra in Nigeria and South Sudan in Sudan are all necessitated by oil deposits and its production impacts.

3.5.2.3. Public Health Concerns

The impact of oil discovery and exploration in developing countries which has direct relationship with the dwindling health status of the people in communities near oil reserves are well documented (Darkwah (2010)). Oil and gas developments pose great risk to public health especially in developing countries as a result of the unsustainable manner used to harness the oil and the lack of information of health risks of petroleum hydrocarbon contamination to the local population. Petroleum hydrocarbons contaminate sources of water, food chains and are always present in the ambient air.

Exposure to oil exploration and exploitation has caused cancer to population under 10 years in Ecuador (Darkwah, 2010). According to Kimerling (1994), significant amounts of poly aromatic hydrocarbons and other harmful chemicals from oil and gas developments are found in water supply to Cofan community in Ecuadorian Amazon. These contaminants cause irreversible ailments from cancer, skin rashes, gastro-intestinal disorders, reproductive and neurological problems. Darkwah (2010) also reported birth defects among communities living close to oil reserves in Ecuadorian Amazon and deaths of people in Sudan who consumed contaminated water from oil fields. Women living

close to oil fields have higher risk of spontaneous abortion and delivering of children with birth defects (Hurtig and Sebastian (2005).

In addition to contamination of water supply and land, oil and gas activities release much quantity of volatile organic compounds (VOCs) and other priority pollutants like heavy metals to the environments. Many of them are hazardous air pollutants and have caused respiratory disorders in humans and damaged plants. Ozone not only causes irreversible damage to the lungs but has similarly caused damages to conifers, aspen, forage, alfalfa, and other crops commonly grown in the Western United States (Colborn et al., 2011).

3.6. Environmental Management

Owing to the increasing risk of environmental legislative sanctions and the need to maintain environmental stewardship, the role of environmental management is becoming very important (Tinsley, 2001). There has been increased pressure for companies to implement ecological sustainability because of the rising environmental issues. Companies adopt environmental management as a linkage between environmental protection and economic performance. According to Melnyk et al. (2003), environmental management systems tend to develop, implement, manage, coordinate and monitor corporate environmental activities for environmental compliance and waste reduction. With the application of environmental management, firms are able to reduce environmental impacts of their actions in order to comply with legal and regulatory standards for pollution control and avoid sanctions and/or external intervention with their day-to-day operations. The environmental management includes: (a) environmental management plan, (b) environmental mitigation plan, (c) environmental monitoring plan and (d) post decision follow-up.

3.6.1. Environmental Management Plan

In order to translate EIA prescriptions into actions, environmental management plan (EMP) was developed and integrated into project design for implementation (Khadka and Khanal, 2008). Commitments are made in projects' EIS documents. According to Ingelson and Nwapi (2014), an EMP is a detailed plan and schedule of

measures necessary to address the potential impacts identified through the EIA. The environmental management plan tends to ensure those commitments are comprehensively followed in an acceptable manner in order to maintain the control over the project implementation.

According to Modak and Biswas (1999), EIA is adopted as an environmental accounting and management tool for planning, assisting policy-makers and the general public in identifying, predicting and evaluating the environmental impact and consequences of proposed development projects, plans and policies, and implementation of specific environmental management measures and the need for their constant monitoring. Figure 18 shows the role of an EIA in EMP. Therefore, the environmental management plan contains all measures to be taken to ensure preservation and protection of the natural environment after the assessment of environmental impacts has been made.

The environmental management main objective in the oil and gas sector is to provide operational control documentation for the management of environmental impacts associated with the operations of oil companies. It also seeks to incorporate environmental and social management measures detailed in the EIS and identify the various institutional responsibilities to manage environmental components of the project putting into considerations the guidelines provided by International Organization for Standardization (ISO) and World Bank Environmental Management Stipulations. For an effective and efficient environmental management plan, the operating companies should:

- (a) define their social and environmental performance objectives for all the phases of their activities,
- (b) describe the standards they will adopt to meet the set objectives and criteria to measure its performance,
- (c) assign and describe roles and responsibilities of their staff and contractors,
- (d) present management measures and commitments by which they will fulfill the stated social and environmental performance objectives,
- (e) present emergency and contingency protocols in case of an accident and
- (f) present detailed monitoring and auditing procedures that intend to reduce mitigate environmental impacts.

3.6.2. Environmental Mitigation Plan

According to Antunes et al. (2001), impact mitigation and compensation, and design of monitoring systems is one of the identified several stages that need to be

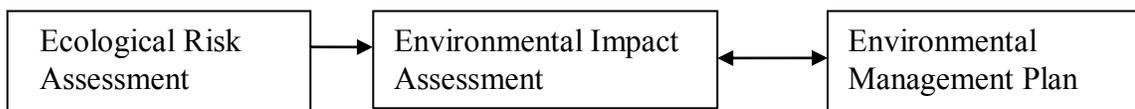


Figure 18. Role of EIA in EMP (Clark, 1980).

completed in an EIA process. Mitigation measures in an EIA process are introduced to avoid and/ or reduce social and environmental impacts of a proposed action. The environmental mitigation plan tends to describe the minimization measures or proposals for compensation with details.

The environmental mitigation plan provides evidence of proponent's commitment and capacity to implement mitigation measures and proposes a monitoring program whenever uncertainty exists about the practical results of a minimization measure to allow for future adjustment if needed (Pinho et al., 2007). Relating proposed mitigation measures to stated ecological impact as contained in the EIS measures the extent of the mitigation.

According to Treweek and Thompson (1997), to know the extent to which mitigation can be relied on for amelioration of ecological impacts, evaluating the effectiveness of the ecological mitigation becomes essential to the pursuance of sustainability objectives through the EIA process. Measures to avoid impacts should be emphasized, followed by a description of how impacts that cannot be avoided will be minimized to the extent possible.

To mitigate the impacts of the oil and gas activities in the Niger Delta on the biophysical and social environments, the measures shown in Table 7 are used. Omofonmwan and Odia (2009) also recommended providing a regular supply of potable/safe drinking water, health care facilities, accessible paved roads, educational facilities, (scholarships, vocational and skill acquisition centers), electricity, sporting facilities, micro credit facilities, town hall and agricultural development.

3.6.3. Environmental Monitoring Plan

Environmental monitoring is a tangible link between the proposal and the mitigation measures in an EIA (Gunn and Noble, 2009). Beanlands and Duinker (1983) refer to the environmental monitoring plan as the measurement of environmental variables after a development proposal has been initiated. The importance and benefits of monitoring and auditing in an EIA process has been repeatedly highlighted in a wide range of literatures (Ahammed and Nixon, 2006). According to Art et al. (2001), monitoring usually consists of a program of repetitive observation, measurement and

Table 7. Mitigation measures for oil and gas activities (Rua 2010; Skogdalen et al., 2011).

| Hazard | VEC | Receptors | Source | Mitigation measure |
|--------------------------------|------------------------|------------------|--------------------------------|--|
| Oil, chemical, fuel and spills | Soil | | Well blow out | Well control training programs for workers |
| | Water | | Potential Escape | Use of blowout preventers |
| | Mangrove | | Waste Oil | Modeling kick behavior |
| | Wildlife | | Vessel collisions | Comprehensive understanding of their wells' hydrocarbon formation, oil characteristics and reservoir pressures |
| | Socio-economic | | Equipment failure | Use of certified industry standard drilling practice and equipment |
| | Human safety | | Corroded pipes | Abnormal pressure monitoring Scaring away of wildlife from affected area Exclusion zone established around the drillship |
| | Drilling Emissions | Soil | | Discharge of drilling cuttings |
| | Water quality and | | Discharge of bulk drilling mud | Use of water based mud |
| | Marine biota | | Displacement fluids | Onboard recovery of mud |
| | Vegetation | | Produced water | Storage tank venting Water column turbidity should be minimized by maintaining the cutting shaker equipment. Produced water re-injection Wastewater treatment facilities Manned operations |
| Atmospheric Emissions | Air quality | | Exhaust emissions | Use gas burners |
| | Human Health | | Gas flaring and | Gas-to-liquid technology |
| | Noise and Biodiversity | | Ozone depleting Substances | Re-injection Hydration of natural gas Use of smart automation systems Installation of fire and gas detection and shutdown systems Maintaining and recording of flared gas |

Table 7. continued.

| Hazard | VEC Receptors | Source | Mitigation measure |
|---|---|---------------------------|--|
| Seismic testing | Forest | Exploration activities | Use of remote sensing |
| Explosives | Protected wetland | Bush clearing | Locating stationary sound-generating facilities away from residences |
| Vibrating trucks | Sensitive marine areas | Access road construction | Notification of residences about noisy activities |
| Noise | Heritage sites | Exploration activities | Stakeholders consultations Informing the Ministry of Culture, the elders and youths for discovery of any site or fossil of heritage and archeological importance |
| | Air quality | | Dust abatement techniques for unvegetated surfaces |
| Tanker accidents | Soil | Transportation | Use of double hulls technology for oil tankers |
| Pipeline explosions and Vessel spills | Mangrove | | Pipeline mapping Excavation damage prevention |
| | Water quality | | Use of double wall piping with automatic cut off valves Emergency response planning |
| | Human safety, Heritage and Socio-economic | | Pipeline community awareness Use of Underground pipelines |
| Refinery effluents | Air quality | Refinery operations | Monitory of fugitive emissions |
| Refinery emissions, Accidental fires and Explosions | Land and Water quality | | Minimization of pollutant releases Health survey of the residents Air pollution data collection |
| Chemical and gas leaks and Noise | Marine biota, Human Health, Wildlife and Vegetation | | Stakeholders meetings Wastewater treatment facilities Revegetation Leachate collection and treatment H ₂ S utilization Noise suppression devices |
| Recovered solvents | Land | Solid and hazardous waste | Waste management plan |
| Waste oil, Oil contaminated materials | Water quality, Human health and Vegetation | | All hazard materials should be stored and disposed appropriately. |

recording of environmental variables and operational parameters over a period of time for a defined purpose.

Monitoring tends to be focused on the most important VECs recognized in the initial studies using a feedback loop that provides information about potential consequences on the environment from the proposed action (Kilgour et al., 2007). Monitoring will help test the impact predictions and guide the proponents towards proper mitigation measures and the monitoring results can be used as an indicator to reassess and modify the proposal design (Beanlands and Duinker, 1983; Kilgour et al., 2007).

An environmental assessment plan should provide an equivalent amount of technical detail for the monitoring processes as they do for the preliminary VEC identification (Beanlands and Duinker, 1983). It is important to include a public review of the monitoring procedure (Gunn and Noble, 2009). Kilgour et al. (2007) recommend the stressor-based method when regarding physical/chemical habitats and environmental effects-based method for biological indicator performance. Simulation monitoring is a commonly used resource used in the follow-up component of an EA (Duinker and Greig, 2006). Table 8 presents the operational monitoring program that should be implanted in their operations.

3.6.4. Post Decision Follow-up

Post decision follow-up are those activities undertaken to monitor, evaluate, manage and communicate the environmental outcomes. According to environmental assessment legislation, follow-up programs are intended to verify the accuracy of environmental impact predictions and to determine the effectiveness of the assessment and the mitigation measures stated. The impacts of a project need to be monitored on a regular basis during the entire project life cycle and such monitoring should provide descriptions of EIA performance, regulatory compliance, mitigation performance evaluation, validation of impact-prediction techniques (Ramos et al., 2004). The result from follow-up activities is useful for the improvement of the EIA system for the project, for implementing adaptive management measures and for helping to improve the quality of future environmental assessments.

Table 8. Operational monitoring program for oil and gas operations (Ajibade and Ademuti 2009; Rua, 2010).

| Operation | Environmental Effects/criteria for monitoring | Monitoring period |
|-----------------------------------|---|------------------------------|
| Exploration Activities | Destruction of forest, farmlands, heritage and vegetation Noise and light pollution from seismic testing and vibration trucks Wildlife disturbance/ destruction of flora Effects on fisheries and socio-economic impacts Abstraction of groundwater Dust | During all the operation |
| Gas flaring | Air pollution Heat production that damages vegetation and reduces agricultural yields Volume flared Public health effects | Ongoing during flaring |
| Drilling chemicals | Ecotoxicity Accumulation potential Biodegradability | Prior to drilling |
| Refining | Air pollution Wastewater impacts on human health, water quality and ecological health | During all its operation |
| Production operations | Water pollution Destruction of farmlands, aquatic biota and mangrove ecosystem Socio-economic effects Oil spillage and fires Nuisance odors | During all the operations |
| Transportation and tanker loading | Air and water pollution Destruction of sensitive environment Erosion Sedimentation caused by pipeline routes Destruction of farmlands Deck drainages and spills Socio-economic effects Pigging waste | During the operation |
| Chemicals and hazardous materials | Impacts on VECs Volume stored and volume consumed | Daily operational inspection |

Post decision follow-up activities (auditing and compliance) can be effected through environmental effects monitoring, evaluation and performance auditing. According to Marshall (2005), a regulator's motivation for follow-up will be bound up with the desire to control compliance, reduce uncertainty, verify predictions and ultimately improve decision management in future EIA processes.

3.6.4.1. Environmental Effects Monitoring and Evaluation

An impacting project has both biophysical and social effects. To protect the environment better, the effects have to be monitored. The monitoring may be on ecological effects, health, wildlife, air quality or any other VECs affected by the project. Bio-physical (environmental) effects monitoring is always done using a structured scientific approach. Storey (2002) compared approaches used in both effects in an oilfield development in Canada and discovered the social effects monitoring approach was unsuccessful owing to absence of a scientific approach. Post environmental effects monitoring is one of the important tool of an EIA system (Morrison-Saunders et al., 2007). With it, an EIA becomes a continuous assessment of impacts and makes it easier for comparing actual and predicted impacts of the project (Carpenter, 1997).

Many countries have legislative requirement for environmental effects monitoring in their environmental regulations. They include Czech, Portugal, Canada, Australia, Netherlands and Hong Kong. But having it in the regulation is far from it being actually implemented. Wood (2000) and Carpenter (1997) stated that most of the countries have ambiguous procedures for impacts monitoring and some fear self-incrimination between the regulators and the proponents. As a result, despite the existence of the legislative requirements, some projects go on without a proper environmental effects monitoring as a follow-up program.

3.6.4.2. Environmental Auditing and Performance

Environmental auditing has been used in two different ways: (a) environmental management auditing and (b) EIA auditing (Dipper, 1998). It is a management tool comprising systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing, with the aim of

helping to safeguard the environment by facilitating management control of environmental practices and assessing compliance with company policies, which would include meeting regulatory requirements (Sinclair-Desgagné and Gabel, 1997).

Proper auditing program as a management tool is used to minimize corporate liability of impacting projects. According to Tomlinson and Atkinson (1987), auditing encompasses a periodic activity that involves comparing monitoring observations with a set of criteria such as standards, predictions or expectations, and reporting of results. Rigby (1985) stated that post development audit tends to compare the predicted impacts prior to the project implementation and the actual impacts during the project's operation phases with the help of post environmental effects monitoring. Implementation of environmental audits is compulsory in some countries. Governments undertake it in order to improve and strengthen the protection of their environment. Netherlands employs auditing as a form of follow-up activity outside the EIA framework (Morrison-Saunders et al., 2003). Through environmental auditing, robust environmental data are obtained for better decision making and also help the governments to evaluate their environmental protection performance.

CHAPTER 4. ASSESSMENT OF EIA LEGAL FRAMEWORK FOR THE OIL AND GAS INDUSTRY IN NIGERIA.

The importance of law in imposing responsible attitudes and behaviors towards the environment cannot be over-emphasized (Anaejionu et al., 2015). The Second Proclamation of the Stockholm Conference says: “the protection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world”. In order to incorporate economic, environment and social changes (sustainability) into development, there is a need to minimize adverse effects and ensure long term sustainable benefits of developments.

Legal and institutional frameworks are always employed by governments to regulate the activities of the oil and gas industry in order to minimize the health and environmental effects, protect and conserve the environment. With these frameworks, the ecological, environmental, socio-economic and health effects of the life cycle of oil industry (exploration, exploitation, transport, refining and usage) can be evaluated and assessed properly. When these frameworks are absent, the environment and the inhabitants will be vulnerable to environmental degradation and adverse impacts of climate change. In a bid to predict the environmental impacts of a developmental activity and provide measures to mitigate the negative impacts and enhance positive impacts, Environmental Impact Assessment (EIA) was adopted in Nigeria (Dougherty and Hall, 1995).

The development of EIA was in response to oil and gas development in Nigeria when the Federal Government concluded that the oil and gas industry was the only industry that called for close environmental scrutiny in accordance with **Principle 17** of Rio Declaration of 1992 (Ingelson and Nwapi, 2014). Petroleum exploration in Africa started at Iho-Dimeze Ikeduru, in Owerri Nigeria by Shell D’arcy in the 1930, and production started in the 1950s at Oloibiri, but it was not until 1992 that EIAs became a part of the decision-making process in the development of Nigeria’s oil and gas resources. This is to say that the oil and gas activities in Nigeria went on for 34 years before a national instrument for activities that have a significant adverse impact on the environment was institutionalized. According to Ingelson and Nwapi (2014), the

companies that operated without EIA guidelines for oil and gas activities in Nigeria were operators carrying out EIAs in their home countries and other developed countries to avoid or mitigate the adverse environmental impacts of their operations.

Some of the legal and regulatory frameworks in the control of oil and gas sector in Nigeria are: (a) the Petroleum Act, (b) the Petroleum Drilling and Production Regulations, (c) the Environmental Guidelines and Standards for the Petroleum Industry, (d) the Associated Gas Re-injection Act and Regulations, (e) the National Oil Spill Detection and Response Agency Act and (f) the Oil Pipelines Act and the EIA Act.

The Nigerian State has the obligation to protect and improve the environment as seen in **Section 16** (Economic Objectives) **Subsection (2)**, **Section 17** (Social Objectives) **and Section 20** (Environmental Objectives) in Chapter II of the 1999 Constitution in response to the Proclamation 2 of the Stockholm Conference and in accordance with customary International Law. But the environmental provisions in the constitution are mere fundamental objectives rather than an enforceable obligations (Okon, 2003).

The effective enforcement of environmental standards, regulations, rules, laws, policies and guidelines is being given to National Environmental Standards and Regulations Enforcement Agency (NESREA). NESREA Establishment Act 2007 repealed the Federal Environmental Protection Agency Act Cap F 10 LFN 2004. This is a swift action by the Federal Government to address the lapses of enforcement issues in the **Section 20** (Environmental Objectives) of the 1999 Constitution, but not in the oil and gas sector. If the extant laws were promulgated earlier, adequately and judiciously implemented, the problems associated with oil and gas exploration and exploitation in the Niger Delta could have been controlled or abated to a reasonable extent. The environmental regulatory issues in oil and gas sector is the oversight of Department of Petroleum Resources (DPR) which sets also Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) for environmental protection as well as fostering oil and gas development which has constituted conflict of interest leading to a widespread environmental degradation in the Niger Delta. This situation violates **Article 13** of Rio Declaration of 1992 which says: “states shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage, that States shall also cooperate in an expeditious and more determined manner to develop

further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction”.

Section 15 (EIA Exempted Projects), in Subsection (b), mentioned projects carried out during national emergency and the temporary measures without having a section to define such projects or measures. The EIA Act is not sector specific at least for oil and gas in order to tackle oil pollution in the Niger Delta. The only provision for this Act to capture oil and gas activities and other impacting activities is seen in **Section 12** (Mandatory Study Activities) and **Section 62** (Short Title) **Schedule 12**. Department of Petroleum Resources (DPR) saw this inadequacy and the scanty provision of this Act to tackle oil and gas pollution, used the power in **Section 59** (Power to Make Regulations) **Subsection (1a)** of the Act to issue Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) specifically for the oil and gas sector. Similarly in U.K, Offshore Petroleum Production Pipeline (Assessment of Environmental Effects) Regulations 1999, The Offshore Production and Pipelines (Assessment of Environmental Effects) (Amendments) Regulations of 2007 are all sector specific EIA regulation for UK oil and gas projects. But despite the swift action of the DPR to control oil and gas activities with the EGASPIN, there is no legal backing because the regulation is just guidance as the name implies (Wifa, 2012).

4.1. Resource Control and Regulation

The oil and gas activities have wrecked the Nigerian environment and it has become paramount and urgent to protect the environment owing to deleterious effects of oil pollutions in the petroliferous Niger Delta region. Several laws and regulations have been enacted in pursuant of the provisions of **Section 20** (Environmental Objectives) of Chapter II of the Nigerian Constitution in accordance with Stockholm Conference to protect and improve the environment in Nigeria. According to Hunter (2015), the Petroleum Ordinance of 1889 followed by the Mineral Regulation (Oil) Ordinance of 1907 laid down the framework for petroleum and other natural resources development. Environmental agencies such as the Federal Ministry of Environment (FME), the Department of Petroleum Resources (DPR), the National Environmental Standards and

Regulations Enforcement Agency (NESREA) and States' Environmental Protection Agencies like (Lagos State Environmental Protection Agency (LASEPA) are charged with the responsibilities of regulating, monitoring and enforcing environmental legislations.

However, in spite of these promulgated laws and regulators, the petroleum industry continues to devastate and degrade the environment owing to weak laws, inadequate monitoring and enforcement, and the rendering of fundamental objectives and directive principles of state policy contained in **Chapter II** (Fundamental Objectives and Directive Principles of State Policy) of the Constitution non-enforceable or non-justiciable by **Section 6** (Judicial Powers) **subsection (6) (c)** of the same constitution (Okeke and Okeke, 2013). By neglecting to enforce the **Section 20 of Chapter II** of the Constitution, the Federal Government of Nigeria violates **Article 24** of the African Commission on Human and Peoples' Rights (African Commission) which requires the State to take reasonable and other measures to prevent pollution and ecological degradation and to promote conservation and secure an ecologically sustainable development and use of natural resources (Shelton, 2010).

4.2. The Petroleum Act

The Petroleum Act is one of the primary legislations of the Nigerian Government and was enacted to govern Nigeria's oil and gas industry according to the provisions of **Section 44** (Compulsory Acquisition of Properties) **Subsection (3)** of the Constitution which says: "the entire property in and control of all minerals, mineral oils and natural gas under or upon any land in Nigeria or under or upon the territorial waters and the exclusive economic zone of Nigeria shall vest in the Government of the Federation and shall be managed in such manner as may be prescribed by the National Assembly". It repealed the Mineral Oil Ordinance of 1914 and reduced the oil leases term to 20 years for onshore and offshore (Hunter, 2015). The Act provides for the exploration of petroleum from the territorial waters and the continental shelf of Nigeria and to vest the ownership of, and all on-shore and off-shore revenue from petroleum resources derivable there from in the Federal Government and for all other matters incidental thereto.

According to Anaejionu et al. (2015), the Petroleum Act's sole interest is to grant oil mining licenses, control and distribution of the petroleum products to operators. **Section 2** (Oil Exploration License, Oil Prospecting License and Oil Mining License) **Subsection (1)** of the Act empowers the Minister of Petroleum who is empowered by **Section 8** (Power and Duties of Public Officers) **Subsection (1) (a)** to issue (a) an oil exploration licence to explore for petroleum, (b) an oil prospecting licence to prospect for petroleum and (c) an oil mining lease, to search for, win, work, carry away and dispose of petroleum. Nigeria's Petroleum Act of 1969 **Schedule 1** (Oil Prospecting Licenses) **Paragraph 6** prescribes an initial period of three years for oil prospecting license in inland basins with option of maximum of two years renewal. Deep water blocks and frontier basins have ten years broken into two five year periods. But if a commercial discovery of hydrocarbon is made, then the licensee can be converted into an oil mining lease (not more than half of the area) for a maximum period of 20 years and for another renewable period of 20 years (Adegbe, 2012).

The Petroleum Act primary objective is the ownership and management of oil and gas resources without necessarily making provisions that will protect the environment during operations. The Act is being criticized for its failure to cater for the welfare of the inhabitants of the region either in the form of protecting the environment or in terms of human/capital development or infrastructural development despite the establishment of Oil Minerals Producing Areas Development Commission (OMPADEC) (Anaejionu et al., 2015). The only attempt to provide for environmental protection was in **Section 9** (Regulations) **Subsection (1) (b) (III)** of the Petroleum Act which empowers the Minister of Petroleum to make regulations for the prevention of pollution of the environment but fails to prescribe penalties for failing to comply with those provisions nor address oil pollutions.

Further, pursuant to **Section 9 (1) (c)** of the Petroleum Act, Petroleum (Drilling and Production) Regulations (PDPR) were enacted in 1969. As one of the environmental laws enacted before FEPA Decree 58 (1988), these regulations are ad hoc and deficient, and lack certainty (Yalaju, 1999). From the provisions of **Section 25 of** the PDPR (Prevention of Pollution), "the licensee or leasee shall adopt all practicable precautions, including the provision of up-to-date equipment approved by the Director of Petroleum

Resources to prevent the pollution of inland waters, (rivers and watercourses), the territorial waters of Nigeria or high seas by oil, mud or other fluids or substances which might contaminate the water, banks or shorelines or which might cause harm or destruction to freshwater or marine life, and where any such pollution occurs or has occurred, shall take prompt steps to control and, if possible, end it”. This provision fails to define and measure practicable precautions, including the provision to define up-to-date equipment. Yalaju (1999) argued that there is no obligation in ‘control and, if possible, end it’ because the operators can always say it has not been easy to end it for them to avoid sanctions.

Section 21 (Discharge of Hazardous Substances) **subsection (4)** of FEPA Decree 58 of 1988 also allows the polluter to avoid sanctions if they prove that the offence was committed without their knowledge nor deterred all efforts to prevent it even when it was due to their negligence and recklessness (Eaton, 1997). **Section 25** of PDPR (Prevention of Pollution) and **Section 45** (Compliance with Safety Regulations and Instructions) requires sanctions and enforcement for non-compliance. However, the regulation did not provide sanctions and prosecutions whatsoever for non-compliance. If compensation is paid in violation of **Section 23** (Fishing Right), the local communities will not cry and lament they have lost livelihood through fishing.

Section 37 of the PDPR (Maintenance of Apparatus and Conduct of Operation), says that: “the licensee or leasee shall maintain all apparatus and appliances in use in his operations, and all boreholes and wells capable of producing petroleum, in good repair and condition, and shall carry out all his operations in a proper and workmanlike manner in accordance with these and other regulations and methods and practices accepted by the Director of Petroleum Resources as good oilfield practice, and without prejudice to the foregoing, he shall in accordance with those practices, take all step practicable”. This section fails to define workmanlike manner and the clause ‘practices accepted by the Director of Petroleum Resources (DPR) as good oilfield practice’ makes this section discretionary rather than making it liable for DPR to protect the environment and nowhere in the Act “good oilfield practice” is defined.

A discretionary obligation by the Director of Petroleum Resources is seen also in **Section 38** (Field Development Program), **Section 39** (Production of Crude Oil and

Natural Gas) and **Section 40** (Confinement of Petroleum) where “field development program” and “approved methods and practices acceptable” to the Director are used without defining those terms. Contrary to this Act is a similar USA law, Oil Pollution Act (1990) where they provided a section (**Section 1001**) for definitions. This Act fails also to capture decommissioning of offshore installations. **Section 46** (Termination) **Subsection (3)** says that: “on the termination of his license or lease shall, subject to the rights of the owners of the surface or other persons having a legal interest in the relevant area or any part of it, remove all buildings, installations, works, chattels and effects erected or brought by the licensee or leasee upon the relevant area for or in connection with his operations”. This part of the regulation only made provisions for onshore installations since it was promulgated in 1969, 36 years before the first offshore production.

The first offshore exploration well was drilled by Shell in 2002 though production started in 2005. The Minister of Petroleum is also empowered by the regulation to take over installations at a bearing price without stating any condition of the takeover. Contrary to this provision, OSPAR (Oslo-Paris) Decision 98/3 made in Sintra Portugal, prohibits dumping, and the leaving wholly or partly in place, of disused offshore installations within the North East Atlantic Maritime Area of 15 European States but gave permissions to leave installations or parts of installations for certain categories including weight, exceptional cases from significant environmental, technical or safety reasons and subject to an assessment (OSPAR, 2009).

Section 35 (Drilling Rigs) of the regulation only mentioned licensing of drilling rigs without taking in recognition the impacts of drilling rigs and accidents, rigs that are not subject to Nigerian law or the use of flags of convenience by drilling rig owners to evade taxes since the regulator is fond of revenue. **Section 35** (Drilling Rigs) **and Section 46** (Termination) **Subsection (3)** of the regulation indicate that the regulator (DPR) is only concerned with revenue not environmental impacts and there is a need for separation of regulations from revenue collection. Eweje (2006) observed that apart from the general power vested in the Minister for Petroleum to revoke a license for non-compliance or for breach of the Petroleum Act or any regulations made there under, there is no specific

sanction against violation of the regulations and there is no provision for indigenous peoples' right.

4.3. Environmental Guidelines and Standards (EGAS)

The Nigeria Oil Industry did not have specific and well defined guidelines and standards for the control, regulation and monitoring of environmental performance of oil and gas activities in the early days of its existence (Agha et al. 2004). There is a significant gap between policy and practice as evidenced in the United Nation Environmental Programme (UNEP) EIA Report on Ogoni which shows that for 50 years of oil and gas exploration in Nigeria, no single EIA has been carried out (UNEP, 2011). One of the statutory functions of the Department of Petroleum Resources (an arm of the Federal Ministry of Petroleum Resources) is to protect the environment from oil and gas activities through environmental guidelines and standards. According to Ingelson and Nwapi (2014), DPR has the power to issue licenses/permits for oil and gas operations as well as to establish environmental guidelines and standards for oil and gas operations as required by the Petroleum Act of 1969.

However, **Section 20** (Environmental Objectives) of **1999** Nigerian Constitution lays the basis for enactment of environmental laws in accordance with Stockholm Conference and **Article 24** of African Charter on Human and People's Right. This section of the constitution is supported and backed by **FEPA Decree 58 of 1988** and EIA Act of 1992 which requires environmental impact assessment for all major industries, and requires approval of Environment Ministry.

Specifically for oil and gas industry, Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) are produced by Department of Petroleum Resources (DPR) as a comprehensive regulatory tool aimed at monitoring programmes and schedules, ensuring environmental quality control and protection for the Nigerian oil and gas industry as no specific section in the EIA Act of 1992 is dedicated to oil and gas activities. According to Ingelson and Nwapi (2014), the DPR in 1992 issued the 'Environmental Guidelines and Standards for Petroleum Industry in Nigeria' (which was revised in 2002) that form the basis for most environmental regulation of the oil and gas industry in Nigeria. EIA studies for oil and gas operations are approved by the Federal

Ministry of Environment but EGASPIN makes EIA studies mandatory otherwise stated for oil and gas activities and sets out the process.

EGASPIN states that “if an activity of an operator results in a spill which impacts the environment, such an operator shall monitor the impacted environment and its restorative activities”. This is in accordance with “polluter pays principle” of environmental law. Furtherance of this law is **Section 4** (Defense to Liability) that says: “an operator will be responsible for the containment, recovery and clean-up of any spill discovered within his operational area, whether or not its source is known, and where it is proven beyond reasonable doubt that the operator is not responsible for the spill, he shall be compensated for the cleaning up through established government fund”. This provision is contradictory because it gave the oil companies chance to allege that 70% of oil spill in Niger Delta is caused by sabotage and theft. Independent Newspapers of June 18, 2013, reported that Shell's persistent claims that theft and sabotage are responsible for almost all the oil spills at its operation in Nigeria could have been exaggerated (Bawden, 2013). This is surely a calculated attempt to avoid sanctions and fines. Contrary to this section, is item 5 of Norwegian Pollution Control Act which says: “the costs of preventing or limiting pollution are to be met by the person responsible for the pollution” (Zeldin, 2010).

Section 4 of EGASPIN (Defense to Liability) gives impunity liability on the oil and gas companies for an oil spill caused by a third party and subsequent compensation if it is proved beyond reasonable doubt that his action or inaction did not cause the spill. Similar to this law is **Section 1003** (Defenses to Liability) **Subsection A** (Complete Defenses) of USA Oil Pollution Act of 1990 which uses an establishment by a preponderance of evidence (civil lawsuit involved) for a complete defense to liability for oil pollution caused by act of God, act of war or a third party. This has more legal process stipulation. The USA Oil Pollution Act stipulates monetary damages up to US \$75 million for property damage, losses to private parties or lost of profits from businesses affected by the spill and the operator culpable is still liable for cleanup costs (Hunter, 2015).

UNEP (2011) consider this regulation as a very important one, but review of it shows no sanctions for non-compliance seen also in PDPR. It only gives the operator the

liability of contamination, bearing the cost of remediation, investigation and monitoring and payment of adequate compensation which is also contained in **Section 22** (Spiller's Liability) **Subsection (1) of FEPA Decree of 1988**. From the National Environmental Policy Act (1969) which brought about the EIA, stipulates EIA requiring environmental consideration in large scale operations such as oil and gas activities would be enforced as legislation not guidance as seen in EGASPIN.

However, the Nigerian EIA process in the oil and gas sector (EGASPIN) contains a number of major deficiencies with regard to the environmental effects and sustainability in general. Oil development has had a significant impact on the mangrove forests, biodiversity of plants and animals and ethno-diversity of the Niger Delta (Eweje, 2006; Ingelson and Nwapi, 2014). The Niger Delta region is the most diverse part of Nigeria with huge ethno-diversity (60 tribal communities out of 250 in Nigeria), endowed ecosystem, rich culture and intense spiritual attachment to their land and forests. The failure of the EIA regime to incorporate ethno-diversity and biodiversity is the major cause of civil unrest and conflicts always experienced between operating companies and the indigenous people. Contrarily, the Canadian EIA Act has provisions for the Aboriginals.

According to Nwoko (2013), there is no legal framework that gives a basis for public involvement and access to environmental information in oil and gas related environmental issues in Nigeria. Though there is 21 days provision for publication of EIA reports at the local government headquarters. This 21 days is not sufficient enough if the host community is situated many miles away from the headquarters and if they don't have means of transportation. The literacy level was not taken into account and since aboriginal communities are remote, fly-in communities, this poses an added logistical challenge to meaningful public participation (Kirchhoff et al., 2013). Hartley and Wood (2005) strongly recommend the EIA newsletter and site visitation methods of engagement and the use of lay man's terms in the EIA. More often than not, the public are poorly informed of the potential adverse effects of oil and gas developments and their long-term impacts on them and the ecosystem.

The implementation of this guideline is so weakened by poor enforcement and conflict of interest. Having an independent body required to approve a project's EIS helps

to reduce the conflicts of interest that occur when the proponent and the approval agency are the same (Stampe, 2009). The DPR has the mandate to issue licenses/permits for oil and gas operations and protection of the environment through issuance of EGASPIN. There is a possible room for bias, making them to have more interest on maximum oil and gas recovery and revenue than environmental protection (Wifa, 2012). Nigeria should take a note of the current European Union Directive on Health and Safety Environment which indicates that there should be a clear separation between regulatory functions relating to offshore safety, environment and regulatory functions relating to the economic development of natural resources including licensing and revenue management (The European Parliament and the Council, 2013).

Since the EIA regime is non-specific in Nigeria, EGASPIN should improve its sectorized guidelines for oil and gas developments to ensure and produce EIA reports of high quality with definitive timeline which is lacking now. More importantly also, as a developing country, the DPR lacks expertise and trained staff to conduct and review EIAs. They should make sure they understand all the technology of the sector it controls.

4.4. The Associated Gas Re-injection Act

Gas flaring is one the major cause of environmental degradation in Nigeria and it has led to waste of non-renewable source of energy and revenue for Nigeria. The Associated Gas Re-injection Act was enacted to stop gas flaring and enforce its utilization and re-injection. **Section 3** (Flaring to Cease) **Subsection 1** says that: subject to **Subsection (2)** of this section, no company engaged in the production of oil or gas shall after 1 January, 1984 flare gas produced in association with oil without the permission in writing from the Minister of Petroleum”. According to Ayoola (2011), Nigeria is ranked 2nd (after Russia) in gas flaring in the world with about 23.0 billion m³ gas flared which is sufficient to meet substantial portion of Africa energy needs. In spite the 1984 deadline, associated gas and reduction in emission of greenhouse gases have been shifted to 2004 and 2008 (Ukoli, 2005). Another bill was passed also to end gas flaring by 2012. These deadlines are far from reality; just symbolic and a mere political response. The **PIB Draft Section 275** (Prohibition and Punishment) authorizes the

Minister of Petroleum to prescribe a flare-out date in another bid to end gas flaring in Nigeria.

Section 1(Duty to submit Preliminary Programme for Gas Re-injection) and **Section 2** (Duty to Submit Detailed Plans for Implementation of Gas Re-injection) of the Associated Gas Re-injection Act and (**AGRA**) mandate every company producing oil and gas in Nigeria to submit not later than October 1 1980, a detailed programme and schemes for viable utilization of all produced associated gas or re-injection with forfeiture of concessions and entitlements as penalty (Section 4). According to Aghalino (2009), the Associated Gas Re-injection Act Amendment Decree 7 of 1985 made provision of 2kobo/1000 SCF of gas flared. This was increased to 50kobo/1000 SCF of gas flared in 1990 with enactment of Associated Gas Re-Injection (Amendment) Regulations of 1990 and N10/1000 SCF of gas flared penalty in 1998. Currently, the fine for flaring is US\$3.50 for every 1000 SCF of gas flared under the National Domestic Gas Pricing and Supply Regulations (NDGPSR). This fine regime was provided after enactment of Associated Gas Re-injection (Continued Flaring of Gas) Regulations of 1984 (AGRCFGR) in pursuant of **Section 5 of AGRA** (Power to Make Regulations) as stipulated in **Section 3 (b)**.

Many stakeholders criticized the fines to be too insignificant to deter companies that engage in gas flaring compared with the cost of a barrel of oil because it is more economical to flare the gas than to utilize or re-inject. Yalaju (1999) stated that Chevron says that while gas flaring would cost the company \$ 1 million, the cost of switching from water to gas injection would cost \$56 million. Shell on the other hand, continues to flare gas and has been unable to provide a certificate from the Petroleum Minister, pursuant to the Re-injection Act, to show that it is not feasible to engage in gas re-injection (Ukale, 2010).

The host communities are helpless as the enacted laws against gas flaring and the Nigerian courts cannot help them. The Nigerian courts cannot be used as a tool for social change because they are bias and partial to implement and administer their constitutional functions (Frynas, 2000). But **Section 201**(Gas Flaring Penalties) of the Drafted PIB sets a stiffer gas flaring penalty for offenders after the date has been set and mandates the operator to install measurement equipment for proper measurement of the amount of gas

being flared with exception of those with permits granted under **Subsection (1)** of **Section 277** (Prohibition of Flaring) of the **PIB**. However, EIA laws stipulate mitigation measures against the adverse effects of projects not collection of fines and measurement of flared gas is not a mitigation measure.

Texas is the largest oil and gas producing state in USA, contributing only 4.2% of the total gas flared in USA (Miller, 2015). The Railroad Commission (RRC) of Texas regulates gas flaring and venting in Texas while Texas Commission on Environmental Quality (TCEQ) enforces EPA air quality regulation and administers Federal Operating Permits for certain major pollution sources. Railroad Commission (RRC) only gives permit for flaring of casinghead gas for 45 days at a time for a maximum of 180 days. According to Rule 32 of RRC, the companies may flare for ten days after well completion to allow for well testing potential. Permits to flare is given only for some reasons and seeking additional 45 days after the initial 45 days must be accompanied by documentation that progress has been made towards establishing the necessary infrastructure to produce gas rather than flare it (Miller, 2015).

The AGRA is inconsistent and insufficient to stop gas flaring in order to protect the people and the environment. It is very illogical and vague to ban gas flaring and at the same time empower the minister to grant exceptions and collect fines for non-compliance. Nigerian Constitution, **Section 1** (Supremacy of Constitution) **subsection 3** says: “If any other law is inconsistent with the provisions of this Constitution, this Constitution shall prevail, and that other law shall, to the extent of the inconsistency, be void”. Since **Section 20** of the Constitution says: “The State shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria” then, AGRA needs serious amendment or be voided according to the provisions of the Constitution because enacting a law that stipulates only penalty to stop gas flaring and permit continuous flaring without considering the environmental effects, violates the Nigeria’s Constitution, **Article 4** (Right to Life), **Article 16** (Right to Health) and **Article 24** (Right to a General Satisfactory Environment) of African Charter on Human and Peoples' Rights (ACHPR). The negligence and unsustainable activities by the operating companies, insensitivity and connivance by the Nigeria State and the environmental

regulators, are all considered liable to crimes against humanity and intergenerational injustice.

4.5. Problems with Nigerian Oil and Gas Industry Regulations.

There are several problems with the current oil and gas industry regulations in Nigeria. These include: (a) inadequacy of guidelines, (b) weak enforcement, (c) multiplicity of roles, (d) lack of expertise and (e) corruption.

4.5.1. Inadequate Regulations and Guidelines

The majority of the environmental laws enacted in Nigeria are obsolete and inadequate to protect the Nigerian's environment and lack ingredients for enforcement. They were made when the energy demand was low and there were no comprehensive information of the adverse effects of petroleum production. These laws were made after the petroleum industry had started operations, and there was no provision for cleaning of the oil pollution already occurred before the laws were promulgated. One shocking discovery is that the Nigerian Constitution did not define the word "environment" and other environmental legislations which have been considered inconsistent with the constitution (Uyigwe and Agho, 2007). The confusion now is: **Section 1** (Supremacy of Constitution) **subsection (3)** of the constitution says the constitution shall prevail if any other law is inconsistent with it. It is not clear which one is adequate and which one should stand.

Anaejionu et al. (2015) criticized the Petroleum Act for its failure to cater for the welfare of the inhabitants of the region either in the form of protecting the environment or in terms of human/capital development or infrastructural development. Oil Mineral Producing Areas Development Commission (OMPADEC) and Niger Delta Development Commission (NDDC) were established but they are not proactive. According to Ebeku (2003), the laws and regulations focused more on ways to ensure that oil reserves in Nigeria are produced unhindered with less attention on the need to protect the environment because they were enacted during the military regime, a period of political pressure and judicial 'rascalism' and impunity. Reading through the laws indicates only

economic and political gains are considered rather than balancing them with socio-environmental aspects.

For example, the perpetual flaring of gas as seen in Associated Gas Re-Injection Act of 1979 (as amended), stipulates a penalty of \$3.50 per 1000 standard cubic feet of gas flared. First, this fine does not cover the effect that will be caused by 1000 standard cubic feet of gas flared. Second, the regulator does not use the fines to cushion the effects of gas flaring. In fact, the regulator takes the fine as government revenue while the people and the environment suffer from the effects of the gas flaring. These companies prefer to pay the insignificant fines instead of using some technologies for re-injection or utilization of the gas. Furthermore, Section 21 (3) of FEPA Decree 58 of 1988 imposes just N500, 000 (\$2, 500) fine for accidental discharge of harmful substances into the environment and N1, 000 (\$5)/day if the offense subsists.

Therefore, reducing liberal economic policies, enacting better laws, reducing the number and complexity of regulations will help to fight corruption in the sector and the environment would be better protected (Klitgaard, 1998). All existing environmental laws and regulations should be reviewed with the aim of filling existing legal inadequacies, lacuna and loopholes which the oil producing companies capitalize to continue to perpetuate the continued environmental degradation unhindered.

4.5.2. Weak Enforcement Mechanism

To enforce an environmental law in order to achieve a better environmental protection, the regulator should have strong will power with stiff sanctions for non-compliance because voluntary compliance to laws is a major problem in Nigeria. The principles of Environmental Compliance and Enforcement should describe enforceable commitments and make it clear who is responsible, for what, by when, and how compliance would be determined (Wasserman, 2011). According to Ambituuni et al. (2014), effective monitoring and enforcement by a regulator is crucial to the effectiveness of any regulatory regime, and this is facilitated and necessitated by the laws being sufficiently robust, comprehensive and consistent. Provision for a range of sanctions, including but not limited to criminal sanctions should be included. For example, the Canadian Environmental Assessment Agency (CEAA) imposed a fine up to \$400,000 for

non-compliance and violation of the EIA regime in Canada. In Nigeria, DPR fears sanctions to oil and gas companies may affect their operations and the government will lose revenue from their activities (Neo-classical sustainability in practice).

Lack of enforcement of environmental regulations has led to substantial damage to Nigeria's environment, especially in the Niger Delta region (Nwilo and Badejo, 2006). According to Mayda (1984), legislation is really not the critical factor in environmental improvement rather the difficulty to set up a control and enforcement mechanism to apply the legal provisions. Some of the provisions of the environmental regulations are ambiguous and this limits its enforcement and implementation. Because of this, the courts do not have good interpretation of them in order to prosecute offenders. An example is seen in **Section 21**(Spiller's Liability) **subsection (1)** of **FEPA Decree 58** and **Section 4** (Defense to Liability) **of EGASPIN** which allow the polluter to avoid sanctions if they prove the offence was neither committed without their knowledge nor deterred all efforts. As a result, enforcement of the laws is rendered impossible because enforcement provisions are weak and the institutions are ill-equipped and avenues exist for corruption (Emoyan, 2008).

Aluko (2004) is of the opinion that government agencies such as the Federal Environmental Protection agency (FEPA) and the Department of Petroleum Resources (DPR) are not monitoring and enforcing environmental standards and laws in order to enhance sustainable development in the oil and gas industry. Therefore, the regulatory agency in the oil and sector should use its enforcement arm and take steps to eliminate bribery and corruption by pursuing prosecutions and imposing sanctions for non-compliance of environmental laws. Emoyan (2008) recommended granting an unrestricted right of enforcement of environmental laws to communities and citizen for effective environmental protection.

4.5.3. Multiplicity of Roles

Critical review of environmental regulations in Nigeria reveals multiple involvements and duplication of functions. Conflict and overlapping functions can be seen in the Federal Ministry of Environment (FME) which has National Environmental Standards and Regulations Enforcement Agency (NESREA) and National Oil Spill

Detection and Response Agency (NOSDRA) and DPR in matters concerning the conservation of natural resources and environmental protection. According to Ingelson and Nwapi (2014), a multiplicity of regulatory bodies with similar or identical roles in the EIA process is one of the factors militating against the conduct of effective EIAs in Nigeria. For instance, NESREA is charged with upholding and ensuring sustainable development of the oil and gas sector but not being involved in the environmental aspect of oil and gas sector. While the DPR takes charge of the environmental pollution aspect, NESREA takes care of the tension in the social environment.

Section 7 (Functions of the Agency) of NESREA Act 2007 mandates NESREA to enforce compliance with laws, guidelines, policies and standards on environmental matters in Nigeria. However, the provisions of the NESREA Act 2007 exclude enforcement of environmental protection within the Nigerian's oil and gas. Extant laws are never considered before enacting a new one.

The overlapping mandates and jurisdiction between these regulatory bodies frequently contribute to counter productivity which could be seen easily in environmental devastation in the Niger Delta. Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) is under DPR (under Ministry of Petroleum Resources) jurisdiction but the cleaning of the environment caused by third party under **Section 4** (Defense to Liability) is cleaned by NOSDRA (under FME). The prospective firms waste time and resources trying to certify each of the regulatory bodies.

Therefore, there should be clear separation of powers between regulatory functions regarding economic development of offshore natural resources, licensing and revenue management, and regulatory functions with associated decisions relating to offshore safety/environment as contained in **Paragraph 20** of the EU directive on health, safety and the environment. DPR should be saddled only with revenue management and economic development of oil and gas sector in order to reduce conflict of interests and bias for better environmental protection and economic development of the sector.

4.5.4. Lack of Expertise on the part of Regulatory Agencies

For effective regulation and implementation of policies and laws, the regulator should have adequate expertise in the environmental field. Expertise is always needed to

enforce, supervise and monitor environmental standards and compliance. As a developing country, environmental regulators in Nigeria lack the expertise to regulate the oil and gas sector. The environmental regulations were all promulgated between 1960 and 1999 during the military regimes.

According to Eweje (2006), the inadequacy of laws to regulate petroleum pollution has been blamed on the military governments in Nigeria who lacked the expertise to deal with such important and sensitive issues. DPR lacks expertise and trained staff to conduct and review EIAs. Staff at DPR should make sure they understand all the technology of the sector it controls. As a result of this, most of the technical work or operations in the oil and gas sector are done by expatriates and this undermines the local content policy in Nigeria (Hoff, 1993).

4.5.5. Corruption

Nigeria has a reputation as one of the world's most corrupt country, a reputation which is gained by oil-related scandals (Ross, 2003). Corruption has become a debilitating bane in the oil and gas sector and Nigeria at large. According to Holloway (2002), there is no direct estimate of the cost of corruption on the economy since it is an illegal activity. Bribery and corruption risk in the oil sector is an increasing concern for businesses because company executives and firms operating in the oil and gas sector would be among those that should incur the most significant penalties and sanctions owing to their role and contribution in environmental degradation.

As a developing country, corruption undermine the Nigerian Government from protecting the environment and this has resulted in impoverishing the indigenous people and caused soil infertility, wildlife and heritage destruction, air pollution, water pollution, loss of biodiversity and destruction of fish and breeding sites which lead to people's struggle for survival and self determination. The various government programmes aimed at ameliorating their plight have failed due to corruption (Onwuka, 2005). According to Aluko (2004), the institutionalization of corruption has meant that government agencies and officials are easily settled whenever operating companies breach environmental laws. Corruption has a major effect on a state's rule of law; the more the corruption the weaker the rule of law (Daniel, 2015).

Revenues from the oil boom of the 1970s and during the Gulf war caused the Dutch Disease and the wealth accrued is either stolen or misappropriated by the government, instead of using part of it for environmental stewardship. The elections in the core Niger Delta States are so problematic because of who will control the oil money and royalties. Deadly elections have been held recently in Akwa Ibom, Rivers, Delta and Bayelsa States. The oil deposit in the region has been a resource curse; a black gold. The corruption in the oil and gas industry manifests through political and bureaucratic incompetence of the regulators, the exercise of monopoly and discretion necessitated by the environmental laws, and lack of accountability. Discretionary stipulations like defense to liability for third party spills will definitely brew corruption by the regulator. The Halliburton bribery scandal (1994) which involved payment of \$180 million is a clear and unattended case of corruption in the oil and gas sector. Albert Jack Stanley has already admitted a guilty plea and jailed by the Houston Texas Federal High Court for bribing the Nigerian Government to win a natural gas plant contract but no court in Nigeria has invited the receivers of that bribe. After receiving such bribe, no environmental guideline or EIA will be relevant.

Ken Saro Wiwa and other environmentalists were executed in 1995 by the then Nigerian military government when they called for a halt in Shell's activities in Ogoniland and for them to pay compensation and clean the environment. Both the Federal government and the courts are sympathetic to the oil and gas companies and have not risen to the occasion of effective enforcement and implementation of existing environmental laws and policies. Those men were executed in 1995 for Shell to continue their unhindered production and devastation of Ogoniland. The government forgot that the social and economic needs of Nigeria must be balanced with environmental needs and proper enactment and implementation of environmental laws.

Militancy erupted owing to the environmental degradation and injustice but their leaders like Ateke Tom, Tompolo and Asari Dokubo are being 'settled' to keep quiet and to soft pedal. The Amnesty given to the militants could only solve social tension, but the environmental devastation continues. The village chiefs and traditional rulers are being paid money also to keep quiet and ignore oil pollution. Corruption through kickbacks and bribes has ensured that any effort geared towards effective environmental regulation in

Nigeria is stifled and the pollution situation which needed crucial attention by regulatory agencies is shelved.

CHAPTER 5. ASSESSMENT OF VALUED ECOSYSTEM COMPONENTS AFFECTED BY OIL AND GAS INDUSTRY IN NIGERIA.

Any impacting activity such as oil and gas industry can cause change to biophysical components (water, soil, air, biodiversity and vegetation), socio-economic conditions and health, political environment and cultural heritage. Scoping and cumulative effects assessment main goal is valued ecosystem components (biophysical and social) and their protection. Therefore, it is important to evaluate the negative effects of the industry on the biophysical components.

5.1. Assessment of Affected Biophysical VECs.

Owing to the lack of the use of a value-based framework in the assessment of potential effects on biophysical VECs in the oil and gas sector in Nigeria, the identification and selection of the biophysical components have been inappropriately done leading to massive contamination of all the biophysical VECs in the Niger Delta region.

5.1.1. Contamination of Nigerian Waters.

Oil producing communities in Nigeria are located at the coastal region. Incidences of oil spill pose serious threats to fresh water and marine environments, affecting surface resources and a wide range of subsurface organisms that are linked in a complex food chain that includes human food resources (Iduk and Samson, 2015). The increased oil and gas activities in Niger Delta Region of Nigeria have deposited vast amounts of deleterious pollutants into the coastal environment causing great effects to aquatic life. Water pollution by petroleum products constitutes one of the most pressing problems in the Niger Delta region where the effects have been catastrophic (Eaton, 1997).

Aghalino and Eyinla (2009) stated that even in the best oil field practice, oil spillage cannot be completely eliminated or avoided. Nigerian waters consequently are mainly polluted from well blowouts, indiscriminate discharge of production wastes, refinery effluents and leaks from pipelines and storage tanks (Ekpu, 1995). Sabotage is

alleged to be the major source of oil spill in the Niger Delta region. This may be as a consequence of incessant acrimony between the host communities and the oil companies due to ecological damage, inadequate and improper compensations. The local communities sometimes damage oil installations and cause spillage in order to trigger compensation. The marine environment, the freshwater supplies and the aquatic life suffer greatly the adverse effects of the oil pollutions in the Niger Delta Region leading to many social concerns.

5.1.1.1. Contamination of Marine Environment: Marine pollution is any introduction by man directly or indirectly of substances or energy into the marine (estuarine) environment resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities including fishing, impairment of quality for the use of sea water and reduction of amenities (Akankali and Elenwo, 2015). In spite the economic significance of the petroleum industry in Nigeria, marine pollution has become one of its greatest adverse effects from incessant oil spills. Environmental problems in the seas resulting from oil pollution have been of great concern because unlike other forms of pollution, control is very difficult and extremely expensive and the social and economic costs are great (Ogri, 2001). Accidental discharges of crude oil during operations, water generated during the activities and other chemicals are dumped into these water bodies with little or no treatments.

Oil enters also the marine environment from land runoff, natural seeps, vessels, pipelines and offshore exploration, production platforms and oil tanker accidents. Memorable tanker accidents have spilled thousands of tons of crude oil into the marine environment. Major oil spills have occurred in the coastal areas of Nigeria, polluting the marine environment. Escravos spill in 1978 released about 300,000 barrels while Royal Dutch Shell's Forcados Terminal tank failure in 1978 released about 580,000 barrels into the marine ecosystem (Nwilo and Badejo, 2006). Funiwa-5 oil blow out of January 17th 1980, involving Texaco spilled 421, 000 barrels of crude oil into the marine environment and destroyed 836 acres of mangrove forest (Tolutope, 2004). According to Aroh et al. (2010), it is one of the worst environmental disasters in record which spread oil through

the Niger Delta Region polluting an area covering 1,200 km², affecting 321 villages with a population of 320,000.

Bonga oil field accounts for 10% of total oil exports by Nigeria. The Bonga oil spill (Figure 19) has become one of the biggest environmental disasters in recent time in Africa, spilling around 40,000 barrels of oil into the ocean by Shell Petroleum (Premium times, 2014). The incident happened in December 2011 while an oil tanker was being loaded as operational spills always occur when a ship is loading bunker oil. According to Iduk and Samson (2015), the malfunctioning of pumps and valves, rupture of pipes or operational errors can cause oil spillage during loading and discharge of crude oil at an offshore oil terminal. The spill affected 950 square kilometers of water surface and a great number of sensitive environmental resources. The oil and other chemicals spilled into the Atlantic Ocean killed lots of aquatic life and affected fishing occupation for the people from Bayelsa and Delta states especially.

Mobil Qua Iboe disaster of 1998 is another spill that caused great impact to the marine environment. It released about 40,000 barrels of crude oil into the marine environment that spread from Akwa Ibom state to Lagos destroying fishing nets, boats and fishponds (Aroh et al., 2010). According to Nwilo and Badejo (2006), sheen of oil was seen on the coastal areas of Cross river state, Akwa Ibom state, Rivers state, Bayelsa state, Delta state, Ondo state and Lagos state (Figure 20).

Oil pollution can have profound negative impacts on the marine environment either directly through acute mortality or indirectly via ecosystem perturbation (Votier et al., 2005). Elenwo and Akankali (2015) stated that the effects of marine pollution on coastal resources are extensive, impacting the flora, fauna and entire ecology of the coastal environment. Oil spills impact on aquatic wildlife. Seabirds are the most conspicuous marine organisms and have been used as monitors of the marine environment and of the incidence of oil pollution for decades (Wiese and Ryan, 2003). The feathers of the seabirds and the fur of seals are covered after an oil spill causing their deaths in great numbers.

Marine pollution affects the economy of the local people through its effects on fishing and tourist industries. Large number of fish die when covered in oil, get poisoned



(a) Marine water covered by oil



(b) Marine resources destroyed by oil pollution

Figure 19. Bonga oil spill pollution of Marine environment (Premium times, 2014).



Figure 20. Sheen of oil on water bodies in the coastal region (Okeowo, 2014).

by swallowing oil or oil clogging their gills following an oil spill (Iduk and Samson, 2015). Depleted dissolved oxygen causes deaths of many aquatic lives including fishes. The number of fish that could have possibly been caught decreased owing to their deaths (Figure 21). Shorelines have been eroded because of deep-sea activities. The shorelines are eroded from the offshore exploration and production activities while the beaches have been polluted with tar balls which have reduced their potential for recreational purposes (Asuquo et al., 1995). The beaches and the Gulf of Guinea have been contaminated through offshore oil and gas activities in Nigeria. The waters lost their aesthetic value too and usage for navigation. When an oil spill reaches the shore, the beaches are contaminated and the aesthetic beauties of the sea shores which attract tourists are lost due to oil slick (Iduk and Samson, 2015). Also, when fish and other marine animals die, they produce foul smell and discolor the beaches thereby reducing their recreational activity potential.

5.1.1.2. Contamination of Freshwaters: Before the oil and gas activities in the Niger Delta, the region was known with its healthy freshwater supply with blooming water lettuce that added beauty. The oil and gas activities in the Niger Delta have posed great danger to the quality of the fresh water supplies in the region. The fresh surface water used by the local people has been significantly impacted by the oil spills and other chemicals used in oil and gas activities. Villages in the Niger Delta Region where oil and gas activities are ongoing rely on surface freshwater for fishing, recreation, drinking and other domestic purposes.

According to Ereagha and Irughe (2009), poor people are vulnerable to environmental dynamics because social, political and economic exclusion indicates they are left with few choices about where they live. An appraisal by Ndubuisi and Asia (2007) on the local people perception of oil and gas activities in the Niger Delta identified freshwater contamination as the most impacting environmental component and environmental contamination. Members of the public became very concerned with the change in quality of their groundwater and surface water supplies. The quality of these water bodies has a positive correlation with the health of aquatic organisms and the



Figure 21. Destruction of fishes by oil pollution (BusinessNews, December 21, 2011).

people who use them (Eregha and Irughe, 2009). This oil and gas activities in the area have resulted in situations whereby complete polluted waters are bequeathed to the children leading to an intergenerational injustice which environmental economics is against.

Pollution from oil fields usually takes the form of oil spills (Figure 22) which affect sources of drinking water and contaminate fishing creeks with mass destruction of fish and other aquatic life (Ogri, 2001). Figure 23 shows a girl fishing at oil polluted Nun River in Bayelsa State. According to Aluko (2004), fishing which is a means of livelihood for the women has been denied them since their waters have been polluted and fishes have died due to pollution. When an oil spill occurs on a water body, fish ponds and fishing occupation are destroyed (Figure 24). The destruction of fishing creeks (Figures 25 and 26) has serious impact on the socio-economic activity of the local people.

Leaks and ruptures from surface pipelines that have been corroded spill petroleum products into surface waters (Figure 27) and contaminate groundwater supplies through leaks from subsurface pipelines which can go undetected. Freshwater can also be contaminated by oil through oil theft, bunkering activities and sabotage (Figure 28). When Shell's Trans Niger pipeline was attacked in 2010 causing the Ibeno spill, thousands of barrels of oil were spilled leading to large oil slick seen at Lake Adibawa in Bayelsa state (Vidal, 2010). Akinbami and Abiona (2014) stated that from Warri to Ibeno, the people cannot farm, fish or drink portable water because of oil spillage and pollution. The local people resort to oil theft and illegal refining, at least to get their fair share of the oil wealth. The resultant effect will be exacerbating of the already environmental degradation that needs urgent attention.

Refinery effluents are discharged into natural water bodies and no one checks if the concentrations of the toxicants contained therein conform to regulated discharge limits. Due to the ineffectiveness of purification systems, wastewaters may become seriously dangerous, leading to the accumulation of toxic products in the receiving water bodies with potentially serious consequences on the aquatic ecosystem (Otokunfor and Obiukwu, 2005). The untreated effluent discharges from the oil companies and the refineries channeled to water bodies have profound change on physico-chemical properties of the water which include pH, temperature, electrical conductivity, biological



(a) Oil polluted river (SDN communications, 2014).



(b) Oil-contaminated River (Owolabi, 2013).

Figure 22 . Contamination of rivers.



Figure 23. A young woman fishing at polluted Nun River, Bayelsa (Akinleye, 2013b).



(a) Oil soaked fish farm of Pastor Lekoya in Bodo Rivers state (Vidal, 2014).



(b) Fishermen sort their net without fish in a polluted river (Ghogomu, 2015).

Figure 24. Destruction of fishing occupation by oil spills.



(a) Oil polluted Azuzuoma creek in Southern Ijaw, Bayelsa (02-09-15)



(b) Gbaraun Southern Ijaw Bayelsa state (02-09-15).

Figure 25. Oil polluted streams and creeks.



Figure 26. Oil-filled creek near Bodo spill (Ruth, 2015).



Figure 27. Surface pipeline spill contamination of a stream (Checkoutmagazine, 2014).



(a) Ferrying of stolen oil (Okafor, 2015)



(b) at Bolo creek (Querouil, 2011).

Figure 28. Contamination of a stream by stolen oil.

oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), turbidity, cations, anions, total petroleum hydrocarbon (TPH) and heavy metals such as nickel, lead and zinc. An impact assessment of the 1983 Oshika oil spill confirmed the death of floating and submerged aquatic vegetations especially water lettuce; crabs, fish and birds owing to changes in water qualities (Emoyan, 2008).

Aghalino and Eyinla (2009) reported that about 300 people got different illnesses from polluted water and food while 180 people died following the Funiwa-5 oil disaster. Texaco, the operator only responded after the well had already caught fire. There is no environmental regime and sanctions during the period and this must have caused their lukewarm and lackadaisical response. These water bodies after oil contaminations have elevated total petroleum hydrocarbons and heavy metals levels above the stipulated guideline by WHO and other regulatory bodies for drinking water. Nwilo and Badejo reported that when the freshwater supply used by Luawii village in Ogoni was analyzed, it contained hydrocarbons levels 360 times higher than the level allowed by the European Union for drinking water even when there was no oil production in the village for four years prior to the sampling.

5.1.2. Soil Contamination

Over 28 soil types from various soil zones of the Niger Delta have been identified and they are derived from sedimentary bedded sandstones (Osuji and Adesiyun, 2005; Olawoyin et al., 2102). Soil is an environmental component that supports farming and forest. The oil exploration and exploitation activities in the Niger Delta have led to the release of various pollutants, including trace elements and PAHs into the soil, air, and water and these pollutants pose threat to the Nigerian ecosystem and the inhabitants. The Niger Delta environment is continually degraded by frequent oil spills (Uyigwe and Agho, 2007). According to Ikporukpo (2004), 40 % of Shell's world-wide spills between 1982 and 1992 occurred in Nigeria.

5.1.2.1. Destruction of Farmlands: Frequent oil spills and acid rain from gas flaring in the Niger Delta Region by oil and gas activities have rendered the farmlands infertile and unproductive. About 2,369,470.40 barrels of oil were spilled onto farmlands and/in rivers

that provide irrigation water for farmlands in the Niger Delta Region between 1976 and 1996 and approximately, 77% of the spills are neither recovered nor cleaned (Ikporukpo, 2004; Kadafa, 2012). Farming and fishing is the economic mainstay of the local people living in the oil and gas producing region in Nigeria.

Oil spill consequently impact the economy by destroying the vegetation, mangrove forest, vegetal density, food crops and soil fertility which leads to decline in food productivity. As these oil spill incidents are improperly cleaned or not cleaned at all, total recovery impacted land can only take place through natural attenuation requiring between 10 to 15 years (Baghebo et al., 2012). Figure 29 shows a cassava farm in Ogoni destroyed by oil spill. The effect and the induced fire from an oil spill cause destruction of land and deforestation. According to Aluko (2004), some lands are lost with no possibility of them being ever redeemed to forest and agricultural purposes. The Bomu (Gokana LGA) oil spillage still leaves most part of the land desolate, infertile and unproductive and a leak at Shell Producing Development Company's Ejamah-Ebubu oil well in Eleme (Rivers State) during the Civil War degraded farmlands (Gabriel, 2004).

The Jesse spill and fire incident killed over 1000 people and destroyed lots of farmlands (Eregha and Irughe, 2009). According to Osuji and Ukale (2005), the oil spill and the fire that followed in Ugbomro community in Effurun Delta state impoverished the soil and rendered it unsuitable for farming. When spills occur, farmlands, forests and water bodies are rendered useless. The top soil which supports the crops are contaminated and its suitability for agriculture is reduced, either by reduction of nutrients, killing of soil organisms that improves soil fertility or introduction of toxic elements (Ibaba and Olumati, 2009).

The excruciating effect of the oil spill is always aggravated by the delay in clean-up and the public health effects of its frequent occurrence. It takes several months or years before spills are cleaned. For example, it took a year to clean the oil spill at Epubu community that occurred in December 1998 and six months to clean the spill that occurred in March 1997 at Aleibiri community (Ibaba and Olumati, 2009). The delay in part is attributed to the cause of the spill. Spills as a result of sabotage suffer delays compared with those caused by operational or equipment failures. There is a provision in



Figure 29. A destroyed cassava farm in Ogoni by oil spill in 2001 (Sott, 2014).

the legislation for cleanup of spills caused by sabotage or third party. But there has always been inefficiency in cleaning the spills owing to lack of funds and technical know-how of the mandated agency.

Destruction of farmlands (Figure 30) by oil has direct impact on the livelihood of the local community as they are all farmers. Farming in Ogoniland now has become an exercise in futility because the land has been damaged and deprived of its fertility by oil and gas exploitation and exploitation activities (Idowu, 1999). According to Dung et al. (2008), fishing and food crop cultivation is the mainstay of the economy and provide the basic necessities of life to the people in the petroliferous region. Therefore, destruction of their farmlands by oil spill altered their social structure and caused public health concerns, social-cultural desecration and poverty which induced population displacement.

5.1.2.2. Deforestation and Loss of Biodiversity: Biodiversity is the variation among living organisms, which encompasses species diversity, genetic diversity and ecosystem diversity (Zabbey, 2004). According to Mmom and Arokogu, (2010), the tropical rainforest is known to be rich in biodiversity where over 60% of the world's biodiversity are found. Niger Delta is blessed in biodiversity, which is naturally distributed in the four ecological zones (coastal barrier islands, mangroves, fresh water swamp forests and lowland rainforests). Because of its extensive forests, the region has various diversity of wildlife and some invertebrates to be endemic to the region. This high biodiversity is characteristic of extensive swamp and forest areas, with many unique diverse species of plants and animals (Eweje, 2006). Niger Delta freshwater has 197 fish species more than any other coastal system in West Africa and 16 species out of them are endemic to the region (Ugochukwu and Ertel, 2008).

Nigeria has the largest mangrove forest in Africa covering an area of 11, 134 square kilometer and is the third in the world (Ohimain, 2003). The mangroves are coastal wetland forests mainly found at the intertidal zones of estuaries, backwaters, creeks, deltas, lagoons, marshes and mudflats of tropical and subtropical latitudes which remain very important to the indigenous people of Nigeria as well as to the various organisms that inhabit these most productive ecosystems in the world (Zabbey, 2004; Eregha and Irughe, 2009; Sahoo and Dhal, 2009). It is the most economically rich among



Figure 30. Polluted Ikarama community land in Bayelsa state (Sahara Reporters, 2014).

the four main zones and accommodates the most important flora and fauna (Ugochukwu and Ertel, 2008). According to Pegg and Zabbey (2013), the estimated economic value of mangrove forests to the Bodo local community is in the range of US\$27,264–35,921 per hectare (ha) per year.

The change in vegetation from altered hydrology and topography and caused heavy metals contamination and acidification which have strong implication on the biological production and led to impoverishment of biodiversity and loss of many plant species. According to Ajibade and Awomuti (2009), the extinction of biodiversity (flora and fauna), destruction and contamination of soil and the much obvious air/atmospheric pollution in the Niger Delta have not only deteriorated the environment, but have also brought hopelessness to the inhabitants of the land. Deforestation and environmental degradation continued to create unpleasant challenges for health and economic development in Niger Delta Region. Therefore, deforestation and subsequent loss of biodiversity in the Niger Delta region of Nigeria are some of the high priority environmental issues ranked by the World Bank.

According to Aghalino (2009), acid rain has caused destruction of the mangrove and rainforest vegetation with its consequent loss of numerous trees and plants with their potential economic and pharmaceutical values. The World Commission on Environment and Development in 1992 had reported mangrove deforestation in the Niger Delta to be the greatest factor in the next 50 years for many species extinction (Bisong, 2001).

The cumulative effects of oil spill on the ecosystems and biota are enormous and cannot be overemphasized. Petroleum exploration and exploitation activities together with the related canalization (Figure 31) have caused loss of biodiversity, deforestation, alteration of habitats and have polluted freshwater supplies with sea water (Emoyan, 2008). Building of access roads, gas flaring, pipeline installations, seismic testing, geological excavations using dynamites, tanker accidents and refinery discharges expose the forest to illegal logging, biodiversity depletion, conflagrations, habitats reduction and destruction, and the impact on breeding behavior of the animals.

A lot of land degradation and forest deforestation (Figure 32) were caused by oil induced fire and pollution on the environment (Eregha and Irughe, 2009) leading to unprecedented biodiversity loss. Funiwa and Etiama oil spills caught fire and destroyed



Figure 31. A network of artificial canal as a result of oil mining (Ohimain, 2003).



(a) Oil spill fire (Null, 2010).



(b) Mangrove in Ogoni damaged by oil spill fire (Coastal care, 2011).

Figure 32. Deforestation induced by oil spill fires.

many acres of mangrove. Periwinkles, slugs, mussels, clams, oysters and barnacles are slow in movement and therefore always get burnt together with the mangrove forests following an oil spill. Ibaba and Olumati (2009) stated that oil spills in the Niger Delta Region have contaminated and destroyed mangrove forests that are important for sustaining the local communities and have caused deforestation and the subsequent loss of biodiversity. Most of the reported oil spill incidents in the Niger Delta occur in the mangrove swamp forests and the effects are much devastating, no wonder Ken Saro Wiwa poetically pointed that oil production in the Niger Delta “is an ecological war in which no blood is (apparently) spilled, no bones are broken, no one is (assumedly) maimed, so few are alarmed but men, women and children die, flora, fauna and fish perish, air, soil and water are poisoned; and finally, the land and its inhabitants die” (Eweje, 2006; Saliu et al., 2007).

5.1.3. Air Pollution

Air pollution may be defined as the presence in the outdoor or indoor atmosphere of one or more gaseous or particulate contaminants in quantities, characteristics and of duration such as to be injurious to human, plant or animal life, cause damage to property, or which unreasonably interferes with the comfortable enjoyment of life and property (Abdulkareem, 2005).

5.1.3.1. Air Contaminants: Air pollution has been identified as one of the most critical and impacting environmental problems confronting and ravaging the Niger Delta region especially from industrial activities, vehicular emissions, and gas flaring (Tse and Oguama, 2014). According to Nwachukwu et al. (2013), the problem of air pollution became a problem to be addressed with in Nigeria following the environmental adverse effects of the rapid industrialization that accompanied the 1973 to 1980 oil booms in Nigeria.

Air pollution (Figure 33) is one of the major environmental problems confronting the Niger Delta, yet information regarding this is very scanty and an empirical database on the magnitude of the hazard and its deleterious effects on the cultures, ecosystems and



(a) Pipeline explosion (Okparaocha, 2015).



(b) Illegal refinery pollution in Niger Delta (Cunliffe-Jones, 2010).

Figure 33. Air pollution.

people in the region is lacking (Tawari and Abowei, 2012). The unethical and uncontrolled gas flaring, acid rain and disposal of untreated wastes, refinery operations, pipeline explosions and illegal or artisan refineries are the major causes of air pollution in the Niger Delta part of Nigeria.

A comprehensive air quality assessment of the Niger Delta shows that the levels of concentration of volatile oxides of carbon, nitrogen, sulfur oxide and total particulates exceeded existing Federal Environmental Protection Agency's standards (Emoyan, 2008). According to Ana et al. (2009), incomplete combustion of gas flares emit hazardous air pollutants that are lethal to human health which includes cancer, developmental, neurological and reproductive effects. According to Nwachukwu et al. (2013), evidences from various governmental organizations and international bodies have proven that air pollution is a major risk to the environment, quality of life, and health of the population.

Burning has been one of the ways to deal with oil spills in Niger Delta. The data gathered by Tawari and Abowei (2012) shows that heavy metals, dioxins, CH₄, SO₂, N₂O, NO₂, H₂S, CO₂, NH₃, PAHs, VOCs, PM_{2.5} and PM₁₀ are the major air pollutants in the Niger Delta region. Carcinogenic polycyclic aromatic hydrocarbons (PAHs) concentrations in the region are amongst the highest in the world and the people are already suffering from respiratory disorders (Marais et al., 2014). It is not surprising to see these pollutants in the region where oil and gas activities are going on. They are released from all drilling operations or oil spills in addition to those from gas flaring.

5.1.3.1.1. Gas flaring: Gas flaring (Figure 34) is one the hottest environmental issues in Nigeria (Abdulkareem, 2005) and the major source of sulfur dioxide, nitrous oxide, methane, carbon dioxide and particulate matter (Ndubuisi and Asia, 2007). The oil and gas sector is a large source of air pollution due to flaring, illegal oil refining, gas leakage and venting, and frequent pipeline explosions (Marais et al., 2014). These emissions have public health implications, cause acid rain, greenhouse effect and corrosion of roofing sheets.

Ede (1995) monitored the air quality at Agbada, Bonny, Bomu, Tebidaba and Obagi in vicinity of gas flaring. Results showed high concentrations of nitrogen dioxide



Figure 34. Gas flare scene in Ebocha-Egbema community (Anejionu et al., 2015).

(NO₂), sulfur dioxide (SO₂), carbon monoxide (CO) and suspended particulate matter above international standards and CO and suspended particulate matter were the greatest pollutants. This result supported by the increasing cases of respiratory and skin disorders in the Region. Other cumulative impacts of these emissions include acid rain, reduction of soil fertility and global warming. Smoke density in most of the flow station sites exceeds the DPR regulated limit of 80 decibel. The cumulative effects of the build-up of these emissions in the atmosphere and groundwater supplies are detrimental to human existence. Flares in the Region too have negative effects on vegetation growth, animal life and have caused ecological disequilibrium and thermal pollution (Emoyan, 2008).

According to Nwaugo et al. (2006), about 75 percent of the total daily production of about 22 billion Standard Cubic Feet (SCF) of gas is flared. Table 9 shows the amount of gas produced, utilized and flared between 1970 and 1995 in Nigeria. According to Awosika (1994), 125.5 cubic meters of gas was produced between 1970 and 1986 in the Niger delta region but 81.7% (102.3 cubic meters) of the total gas produced were flared, 2.6 million cubic meters used locally by the oil companies and only 14.6 million cubic meters sold to end users. Much of this gas can be converted for domestic use and power generation and boost the power generation in the country with gas turbines (Ajugwo, 2013).

Nigeria has become the highest emitter of greenhouse gases in Africa and carbon dioxide emissions in the Niger Delta area are among the highest in the world. Nigeria has the highest rate of gas flaring in any member nation of OPEC (Uyigue and Agho, 2007; Abdulkadir, 2014). Carbon dioxide and methane are the major greenhouse gases emitted in flaring and they make up to 80% of global warming. Flaring of natural gas in Nigeria adds approximately 1% to the worldwide CO₂ emissions which poses extensive issues for the environment. Gas flaring and venting practice release these gases into the environment leading to greenhouse effect. It amounts to waste of a non-renewable source of energy, loss of revenue from the sales and environmental costs.

Owing to the environmental concerns of gas flaring and venting, international consensus and summits like Kyoto Protocol 1997, Bali Declaration, 2007 and Global initiative for Gas Flaring Reduction for emission reduction targets and some developed countries added environmental accounting to this agreement voluntarily (Ayoola, 2011).

Table 9. Gas production and utilization in Nigeria (1970-1995) (Ologunorisa, 2001).

| Year | Produced (million m ³) | Utilized % | Flared % |
|------|---------------------------------------|---------------|-------------|
| 1970 | 8039 | 1.02 | 98.98 |
| 1971 | 12975 | 1.43 | 98.57 |
| 1972 | 17122 | 1.60 | 98.40 |
| 1973 | 21882 | 1.81 | 98.19 |
| 1974 | 27170 | 1.45 | 98.55 |
| 1975 | 18656 | 1.73 | 98.27 |
| 1976 | 21276 | 3.10 | 96.90 |
| 1977 | 21924 | 4.43 | 95.57 |
| 1978 | 21306 | 8.76 | 91.24 |
| 1979 | 27619 | 5.60 | 94.40 |
| 1980 | 24551 | 6.71 | 93.29 |
| 1981 | 17113 | 17.24 | 82.76 |
| 1982 | 15382 | 22.38 | 77.62 |
| 1983 | 15192 | 21.35 | 78.65 |
| 1984 | 16255 | 21.15 | 78.85 |
| 1985 | 18569 | 20.05 | 79.95 |
| 1986 | 18739 | 25.73 | 74.27 |
| 1987 | 17085 | 28.06 | 71.94 |
| 1988 | 20253 | 27.23 | 72.76 |
| 1989 | 25053 | 25.24 | 74.76 |
| 1990 | 28163 | 22.52 | 77.48 |
| 1991 | 31587 | 22.16 | 77.84 |
| 1992 | 32465 | 21.74 | 78.26 |
| 1993 | 33445 | 22.50 | 77.50 |
| 1994 | 32793 | 20.06 | 79.94 |
| 1995 | 32980 | 20.95 | 79.05 |

The operating oil companies in the Niger Delta Region are expected to comply with a policy of complete utilization of produced associated gas and reduction in emission of greenhouse gases by 2004 but still, up to 86.6% are flared and only 13.4% is used locally (Ukoli, 2005).

Ukaegbu and Okeke (1987) studied the effect of gas flare on the yield and productivity of selected crops grown up to 200m from Izombe flow station in Imo state. They reported almost 100% loss in yield of the crops grown in that range, 45% for those grown within 600m and 10% for those grown within 1000m. Many other crops yield like maize will be affected as they do not thrive in an acidic soil condition. Gas flaring affects fruiting of okra and palm fruits evident in Owaza (Abia state) and Otu-Jeremi (Delta state).

The public health effects posed by gas flaring and the resultant air pollution cannot be over emphasized. Gas flare contains recognized toxins which are confirmed carcinogens like benzene, benzopyrene, toluene, mercury and arsenic. The USA Environmental Protection Agency has stated the link between benzene exposure and leukemia in humans. According to Ismail and Umuokoro (2012), local people in the region complain of respiratory problems such as asthma and bronchitis, premature deaths, cancer and skin rashes. Figure 35 shows placards carried by demonstrating Ogoni people on the effects of gas flaring.

Information from World Bank indicated that on a yearly basis, particulate matter emission from gas flaring in Bayelsa alone would cause 49 premature deaths, 4960 respiratory illness among children and 120 asthma attacks (Collins and Oshodi, 2010). Ajugwo (2013) reported that pollutants emitted by gas flaring are associated with a variety of adverse health impacts, including cancer, neurological, reproductive, hematological and developmental effects, deformities like congenital cleft palate in children, lung damage and skin problems. Carcinogenicity, asthma, pulmonary tuberculosis, cerebrospinal meningitis, bronchitis, pneumonia, whooping cough and measles are the numerous human health effects due to air pollutants while global warming is the environmental effect (Ugwuanyi and Obi, 2002).



Figure 35. Demonstrating Ogoni people on the effects of gas flaring (Nnadozie, 1995).

5.1.3.1.2. Acid rain: This unethical practice of gas flaring releases sulfur dioxide, carbon dioxide and nitrous oxide which are the major cause of acid rain. Not only that gas flaring degrades the air quality with the acid rain, but it also causes smoke, heat stress, soil bacteria reduction, destruction of forests and wildlife, deterioration of infrastructure and poor agricultural harvests (Anejionu et al., 2015).

During rainfall, these gaseous oxides react with water to form sulfuric, carbonic and nitric acids respectively which gets to the soil thereafter. The effect of this can be seen in plants succession where only acidic soil-adapted plants can grow in the area. The areas close to flare sites are now inhabited by grasses that can adapt the heat generated and acidic soil from the acid anhydrides, VOCs and hydrogen sulfide gas. This situation has shown biodiversity loss. The soil is no longer fertile for cultivation as the nutrients are depleted. Yams, cassava and other tuber crops are the major crops grown in the Niger Delta and studies have shown low yield of cassava and yams planted 2 km radius of a flare site in the region (Odjugo Osemwenkhae, 2009). These crops do not thrive in acidic soils.

There is an additional economic consequence of acid rain as it causes corrosion to corrugated roofing sheets such as zinc plated sheets and consequently reduces their life span. The sheets usually last for over 20 years before but now last for 5 years. These sheets are commonly used in housing developments within the Niger Delta region. The house owners change the rusted and damaged sheets more often than expected and the aluminum roofing sheets which are highly resistant to acid rain are very expensive.

5.1.3.1.3. Thermal pollution: About 45.8 billion kilo watts of heat is discharged into the atmosphere from 1.8 billion cubic feet of gas everyday in the Niger Delta region, leading to temperatures that render large areas inhabitable (Uyigue and Agho, 2007; Kadafa, 2012). According to Ologunorisa (2001), the total gas flared in Nigeria in 1986 from over 30 oil fields yielded a wasted heat equivalent to about 60×10^9 kWh which is approximately equal to all power generation from all sources in Nigeria in the same year.

Ajugwo (2013) reported that Nigeria flares 17.2 billion m³ of natural gas per year in oil and gas exploration activities in the Niger Delta and this high level of gas flaring is approximately one quarter of the current power consumption of the African continent.

Nigerian government is only interested in the income accruable from the oil and gas activities and pays less attention to socio-environmental aspect of the development. Apart from the environmental cost, Nigeria loses an estimated of \$2.5 billion on revenue annually to gas flaring (Dung et al., 2008; Orimoogunje et al., 2010; Ajugwo, 2013).

They impose little fines as deterrent for flaring and the oil companies who have inadequate facilities to utilize the gas or re-inject it back into the oil wells, prefer paying the insignificant fines. The Nigerian government accepts the fine without considering the environmental cost and this affirms the neo-classical type of sustainability in most oil producing regions of less developed countries where the economic and political gains from impacting developments are given significant consideration by the government than the resulting impacts to the environment, local culture, food production, fauna, flora and the human health.

Osuji and Avwiri (2005) stated that gas flaring causes elevated temperature in the vicinity of the flares, killing vegetation, reducing agricultural yield, suppressing growth and flowering of some plants and driving away nocturnal animals. The warmth from the flares damages the soil, crops, cause discomfort to humans and animals and favors the metamorphosis of insects that destroy food crops. Ologunorisa (2001) reported a situation where insects are seen at nights enjoying the warmth from gas flaring in Ogba in Egbema area in Rivers state. The farmers recorded low crop productivity which was attributed to the continued increase in population of the insects and their destruction on crops. This created a socio-economic damage to them.

5.1.3.2. Noise Pollution: Noise pollution from explosives and vibration caused by seismographic blasting affect buildings, fence walls and wooden bridges and destroy fish and fauna (Afinotan and Ojakorotu, 2009). Abdulkareem and Odigure, (2006) reported that one of the major pollutants from gas flaring is the noise dispersion emanating from gas flaring stations in the Niger Delta area of Nigeria which is producing many adverse effects on man and animals. Many children in the Region have suffered from hearing losses from the noise made by gas flaring. These noise levels are regulated by the Department of Petroleum Resources (DPR) of the NNPC but the noise levels in Sapele West, Egwa I, Odidi I, and Jones Creek exceeded the DPR's limit (Gabriel, 2004).

Refinery noise caused displacement of the Ekpan villagers (Delta State) and drove animals into other parts of the forest.

Shipping and other offshore operations produce significant amount of noise. Iduk and Samson (2015) reported that the noise produced by ships can travel long distances. Marine species that may rely on sound for their orientation, communication, and feeding can be harmed by this sound pollution. The noise pollution poses threats to the migratory species and the other marine life.

5.2. Assessment of VECs for Social Environment

According to **Principle 1 of 1992 Rio Declaration**, “Human beings are at the centre of concerns for sustainable development and they are entitled to a healthy and productive life in harmony with nature”. The evolution of the oil industry in Nigeria and its subsequent social, political and economic impacts on the Nigerian State as well as on state–society relationship in general has been well addressed (Idemudia and Ite, 2006).

The social impact assessment of oil and gas development in Niger Delta Region is based on evaluating the overall acceptability of the activities which includes identifying all kinds of changes, who will be affected and in what ways and for how long. The local people in the Niger Delta depend exclusively on their natural environment for their livelihood and have exclusive farming, gathering, hunting, fishing, logging and trapping rights on these lands and waters where oil and gas exploration and exploitation are going on. Social environment impacts of developments precede biophysical impacts. The oil and gas industry in the Niger Delta though has some social benefit, it has also many social costs that outweigh the economic benefits.

According to Odoemene (2011), owing to government complacency, insensitivity and, most importantly, connivance, there has been a total disregard for the social, political, economic and environmental sensibilities of the Niger Delta peoples by petro businesses operating in the region including Shell, Chevron, AGIP, Total, Elf and Mobil. These host communities have been enduring the socio-economic impacts of oil and gas exploration and exploitation activities. Between 1986 and the end of the 1990s, distress associated with environmental damage was exacerbated by a deep economic crisis that has led to a rise in unemployment and poverty from 44% to 59% (Mähler, 2012). Poverty

is a form of disempowerment which can be seen in the form of political, socio-economic or psychological. According to Saliu et al. (2007), socio-economic disempowerment refers to the relative lack of access to the resources essential for the self production of livelihood.

5.2.1. Social-economic and Human Health Risks

The unsustainable activities in the Niger Delta and the ensued environmental degradation have made the people lose means of livelihood leading to many socio-cultural impacts that can be seen in increasing cost of living, poverty, poor social welfare performance, unemployment, increase in social vices (mainly prostitution and crimes), state violence and suppression, communal conflict and wars and, youth militancy and hostage takings which are the major social concern. The violent elections experienced in the Niger Delta in 2015 and 2016 are also a social cost of oil and gas developments. The people jostle for political positions in order to control the oil wealth.

The economic implication of oil pollution abatement is great and there are insufficient funds available for the pollution control. The government gives only more priority to providing 'little' of the basic needs of the people confirming the neo-classical sustainability always practiced by developing countries where the impacts of federal actions on socio-environment are neglected because of corruption, weak laws, regulations and monitoring, and the environmental movements have not been well developed despite the existence of FEPA (Ogri, 2001).

This environmental effect of oil pollutions and exploitation activities on soils, farmlands, forests and water bodies have made the local community lose farmlands and fishing occupation which are their major means of livelihood. Large area of the mangrove ecosystem has been destroyed and this mangrove forest was in the past a major source of wood and income for the indigenous people. Land degradation is the major socio-economic impact as it affects enormously crop yields, land productivity and income. Incessant oil spills in the past prompted resettlements of some local communities that are seriously affected. This alteration to the normalcy and state of the environment forced the locals to new ways of life and adaptations.

According to Nwilo and Badejo (2005), loss of agricultural land, for example, translates into loss of livelihood for farmers while the psychological and social problems associated with displacements include loss of ancestral homes, familiar surroundings, religious and other cultural artifacts. This socio-cultural desecration effect still violates **Article 22 of the Universal Declaration of Human Rights** which says: “All people shall have the right to their economic, social and cultural development with due regards to their freedom and identity and in the equal enjoyment of the common heritage of mankind” (Idowu, 1999). The unpalatable environmental injustice and degradation have made the people resort to defending their environmental and human rights for civil struggle in accordance with **Principle 2** of 1992 Rio Declaration, but becoming violent in many of their agitations leading to many social consequences.

5.2.1.1. Poverty and Destruction of Means of Livelihood: The Niger Delta Region is known for fertile agricultural lands, rivers, lakes, creeks and forests. The local communities depend solely on this environment which makes them farmers, fishermen, hunters and forest gatherers. Land supports farming while rivers are indispensable resource for fishing and recreation. However, environmental abuse, in the form of seismographic blasting from the oil companies, petroleum fires, oil spillages and gas flaring damages the fertility of the soil, destroys wildlife and the breeding grounds for marine fish because of the toxicity of oil and gas (Onwuka, 2005).

Criss-crossing of surface oil pipelines makes the lands economically useless for farming and irrigation and then makes it impossible and dangerous for people to undertake economic activities on it. Many of the pipelines pass few meters from homes (Figures 36 and 37). Many companies have dragged NNPC to court for disruption of economic activities with laying of oil pipelines. Food and Feed Farms (Nigeria) Limited dragged NNPC to court (Suit No: SC.244/2003) in 2009 for constructing pipelines on and adjoining factory premises (Chosen, 2014). Owing to the intensive oil and gas activities in the Region, the environment has been severely devastated leading to loss of livelihood from farming, fishing, hunting, gathering and logging.

Human survival and sustenance is based on the environment and the productivity of that environment depends solely on its quality. Owing to the dependence of local



Figure 36. Criss-cross surface pipelines laid few meters from homes (Udo, 2014).



(a) at Okrika (Platformlondon, 2012).



(b) at Olomoro Isoko (Yoopya, 2012).

Figure 37. Children playing with surface pipelines.

livelihood systems on natural resources, almost 60% of the people in the Niger Delta depend on the natural environment for their livelihood (Francis et al. 2011). Before the discovery of oil and gas in the Niger Delta, farming, fishing, hunting, gathering and logging were the mainstay of the Region's local economy.

Destruction of farmlands, surface water and the mangrove forests by oil spills and conflagrations have destroyed the livelihood of the local communities of the Region. There is a paradigm shift of means of livelihood from natural environment to non-natural sectors owing to environmental devastation. This demands stringent enforcement of environmental laws to reduce poverty and improve the livelihood of the local populations. Emmanuel and Gordon (2006) stated that oil spills have degraded most agricultural lands in the region and have turned most productive areas into wastelands. With increasing soil infertility, due to the destruction of soil organisms, and low agricultural outputs, farmers have decided to abandon their land to look for non-existent alternative means of livelihood causing socio-cultural desecration.

According to Aaron (2005), it is argued that the ecologically unfriendly activities of oil companies and the State's Petroleum Development Regulations led to poverty in the Niger Delta, and poverty in turn led to environmental degradation from the senseless actions of the local people in attempt to survive. Poverty incidence in Niger Delta as a resultant effect of environmental degradation, unemployment and other social deprivations is shown in Table 10. Poverty and hunger are exacerbated by destruction of fishing grounds, the mangrove swamps and forests by incessant oil spills and fires. According to Odoemena (2011), these impaired economic activities of the people due to the degraded and devastated environment is one of the major causes of poverty in the region.

Brundtland's report (Broad, 1994) carries the inseparability between poverty and environmental degradation that the poor are agents, perpetrators and victims of environmental degradation, has been confirmed in the Niger Delta. Despite the huge resource potentials and earnings, still 70% of the people of the Niger Delta region live below the poverty line, less than \$1 a day with a clear absence of the basic amenities (Balouga, 2009). The World Bank reported that despite the vast oil resources in the Niger Delta, the region remains poor with GNP per capita below the national average of \$280

Table 10. Incidence of poverty in the Niger Delta from 1980-2004 (Eregha and Irughe, 2009).

| States | 1980 | 1985 | 1992 | 1996 | 2004 |
|----------------|-------|-------|-------|-------|--------|
| Edo/Delta | 19.8% | 52.4% | 33.9% | 56.1% | 98.44% |
| Cross-River | 10.2% | 41.9% | 45.5% | 68.9% | 41.61% |
| Imo/Abia | 14.4% | 33.1% | 49.9% | 56.2% | 49.66% |
| Ondo | 24.9% | 47.3% | 46.6% | 71.6% | 42.15% |
| Rivers/Bayelsa | 7.2% | 44.4% | 43.4% | 44.3% | 49.07% |

U.S dollars (Uyigue and Agho, 2007). Poverty in the region is acute and has been exacerbated by environmental and ecological degradation which results from the intensive and unsustainable oil production and gas flaring. According to Eregha and Irughe (2009), poor people are vulnerable to environmental dynamics since social, political and economic exclusion indicates they are left with few choices about where they live.

5.2.1.2. Communal Conflicts and Destruction of Cultural Value: According to Karl (2007), natural resources and war are linked and economists have found that high levels of primary commodity export dependence are associated with civil war, but petroleum dependence is more likely to be associated with conflict compared to any other commodity. Conflicts of various scopes and natures have been a recurring factor in Nigeria's historical development before and after the attainment of independence in 1960 in all forms (communal, religious, political and social) (Emuedo, 2010). Most of the inter- and intra-ethnic clashes are caused by the struggle for the ownership of resources (usually land) and the sharing of largesse and the spoils of oil from either the State or petro businesses and their divide and rule tactics (Odoemena, 2011). Such conflicts can either be among oil bearing communities, intra or ethnic violence. For example, recently, the monarch of Peremabiri community in Southern Ijaw local, Bayelsa State was shot on January 10th 2016 in a violence that involved his supporters. Southern Ijaw is the largest local government in Nigeria by landscape and the largest oil producing local government in Bayelsa State (Daniel, 2015).

Oil extraction and distribution, as well as oil revenue politics, no doubt, inform most contemporary conflicts in the Delta but these by no means occlude the existence of some extra-oil frontiers of conflict in the region (Omeje, 2004). According to Akpan (2010), the oil revenue sharing formula has frequently generated disagreement between the oil region and the Federal Government. The oil communities themselves are also perpetually locked in clashes and conflicts as to who should have the highest share of oil revenue. The conception of political and economic factors as the root causes of the Niger Delta conflict is supported by the assertion that the remote cause of the friction between

oil companies and their host communities can be traced to be deep-seated historical discontent with the governance in Nigeria (Idemudia and Ite, 2006).

The community that produces more oil than the others always demands more revenue. For instance, between 2002 and 2003, a fight brokered between Ibeno and Eket communities both in Akwa Ibom State when Ibeno community asserted they should have more of the oil revenue than other communities since the oil is derived in their domain. A similar incessant clash between Ibaji community in Kogi State and Aguleri in Anambra State is caused by the ownership tussle of the oil wells situated in Anambra East local government which is operated by Orient Petroleum. Many people have been killed, beheaded or displaced.

Most communities in the Niger Delta are very traditional in their ways of life in that their cultures are central to their lives and guide their everyday activities and interactions (Odoemena, 2011). An oil spill which is a serious ecological and environmental perturbation in the region has necessitated loss of ancestral homes and cultural artifacts. According to Ukeje (2001), culture describes the ‘maps of meaning’ that sharpen the cognitive political awareness of a group, ensuring that they are able to make intelligible decisions germane to the protection and survival of their socio-cultural identities and space. The legendary ‘respect for elders’ in African societies has been largely discontinued in most Niger Delta communities and a typical Niger Delta youth sees the elders as corrupt, inept and epitome of colossal failure (Odoemena, 2011). A typical of this case was seen in Irri, Isoko South local council when a traditional ruler allegedly sold the rights of the community to Agip Oil and fled when violence erupted in 2003.

5.2.1.3. Health and Safety of the Community: Environmental health which has a direct relationship with human health issues and it is a transition VEC between social and biophysical environments. The human health effects of oil pollution can come either through accidental ingestion of contaminated soil, inhalation of soil dust particulates and dermal absorption, air pollutions and consumption of contaminated water and foods. According to Ordinioha and Brisibe (2013), animal studies indicate that contact with Nigerian crude oil could be hemotoxic and hepatotoxic and could cause infertility and

cancer. Higher prevalence of cancer types in Port Harcourt compared with Ibadan has been attributed to the difference in the concentration of PAHs in the ambient air in the two cities (Ana et al., 2010).

Section 4 of EGASPIN was enacted for defense to liability for oil companies and to discourage third party sabotage by the host community to force compensation from oil spillage. When such spill occurs, it takes a longer time for clean up and some helpless and desperate members of the community eat the fishes killed by the spills without considering the health implications.

As far as humans are concerned, an air pollutant may cause or contribute to an increase in mortality or serious illness or may pose a potential hazard to human health (Kampa and Castanas, 2008). Owing to the gas flaring, other oil and gas activities and emission of priority pollutants, there is high possibility of cardiopulmonary morbidity among the inhabitants of Niger Delta. Thirty nine children with congenital cleft palate deformities over the period 1984-1987 at the University of Port Harcourt Teaching Hospital were studied by Datubo-Brown and Kejeh (1989). Investigations showed that 69% of them came from areas with high concentration of oil wells, petroleum refineries and gas flares; linking the deformities to oil and gas activities.

Cumulative effects of acid aerosols and ozone has been fingered in the decrements of lungs functions in children in the region and has been confirmed by a Canadian study on animals. Okoji (2002) reported that there is a wide range of health hazards associated with air pollutants mostly due to gas flaring in the Niger Delta that includes aggravation of asthma, increased hospital admission for respiratory conditions, long term responses such as chronic lung diseases, bronchitis and accelerated aging of the lungs.

The review by Ordinioha and Brisibe (2013) shows that crude oil spill could cause a 45% increase in the normal background radiation level which is another carcinogenic danger that could manifest as increased prevalence of certain cancers years after an oil spill. Petroleum hydrocarbons are toxic to all forms of life and environmentalists have pronounced Nigeria as the oil pollution headquarters of the world. There have been complaints of respiratory illnesses, eye diseases, all forms of cancer, chronic and acute central nervous system effects, skin rashes and other disorders from

petroleum contamination. Therefore, time will only tell the emergence of different illness and cancer in Niger Delta owing to the oil contaminated environment.

According to UNEP (2009) on Ogoni, Nsisioken Ogale inhabitants were consuming water containing benzene at concentration 900 times higher than the WHO guidelines. Many of them must have died from the contamination and many will have leukemia as a long term effect of benzene. Worst among the long term effect is reproductive effect on women.

Article 12 (1) of the International Covenant on Economic Social and Cultural Rights recommended that the States Parties to the present Covenant to recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. In order to achieve the full realization of this right, the State Parties shall include those that make the improvement of all aspects of environmental and industrial hygiene. Nigeria is a State Party to this Covenant and should be held accountable for any non implementation. The petro-businesses in the Niger Delta Region have made the host communities vulnerable to many health hazards both from oil spillage and gas flaring. The local people depend on untreated surface water and well water for drinking and other domestic purposes and they have experienced many outbreaks of water borne diseases and deaths.

There have been complaints of respiratory illnesses, eye diseases, all forms of cancer, chronic and acute central nervous system effects, skin rashes and many other disorders from petroleum contamination. Figure 38 shows the effect of oil contamination on the feet of a local resident who depend on the waters for livelihood. More so, the prevalence of HIV/AIDS in the region is among the highest in the country; higher than the average for Nigeria (Eregha and Irughe, 2009).

This effect of HIV/AIDS pandemic is felt greatly where there is poverty and social inequality. This is a clear indication of sex exchange for money as a result of poverty or for a position or employment. Many of the oil workers and security agents live in the Region without their families which makes them more likely to seek paid sex and the Region has been known for sexual violations which have some socio-cultural implications to the victim and the community at large. Prostitution and unemployment in the oil cities like Port Harcourt are at an alarming rate. These cities have become sex



Figure 38. Health effect of oil pollution on local residents (Vidal, 2013).

haunts for the rich oil workers and those that are deprived of their means of livelihood and not gainfully employed by the oil companies making the unemployment rate in the Region owing to low skill syndrome to be about 30% (Uyigüe and Agho, 2007).

5.2.1.4. Youth Militancy and Hostage Taking: Denial of benefits accrued from the oil wealth of the Niger Delta and the destruction of its endowed ecosystem have made the people advocate for self-determination, resource ownership and control, an off-shoot of the earlier agitations led by Isaac Adaka Boro and later by Kenule Saro-Wiwa (Odoemena, 2011). The communities, due to political, developmental and resource control agitation have transformed into militia and violent perspectives. Militancy according to Inokoba and Imbua (2010) could be an aggressive and active behavior geared towards the defense and support of a cause (mainly politically), often to the point of extremism. These militia groups wage wars among themselves and mount hostilities against the operating multinational oil companies and the federal government which has led to disruption of oil and gas operations in the region.

Youth activism and militancy, a typical sign of social disequilibrium has become associated with a dangerous tide of abductions of expatriates and indigenous staff, hostage and ransom taking and economic crimes such as sea piracy, pipeline vandalism and oil pilferage (Ikelegbe, 2006). The abduction of oil workers started in 2006 and had disrupted global oil supply. According to Hanson (2007), militants' attacks on oil installations have hurt Nigeria's oil exports, costing at least eight hundred thousand barrels per day, or over 25 percent of the country's oil output. Figure 39 shows militants in operation. They force their collective admittance into the system they had hitherto been eliminated from through criminal activities from hostage takings and negotiations, and oil bunkering though some oil companies pay them to provide security to oil installations (Odoemena, 2011).

According to Duru and Ogbonnaya (2012), a non-governmental organization shows that between 1999 and 2007, a total of 308 hostage taking incidents occurred in the region. In addition, the activities of the criminal elements of the Niger Delta militancy have created a state of insecurity, anomie and distortion of the value system of the communities of the region with the increasing spate of blood-letting, the recurrent



(a) Militant group and their hostages (Kobani, 2006).



(b) Militants in agitation operation (The Economist, 2009).

Figure 39. Militants.

hostage-taking, the sporadic shut-down of production facilities and the panicky withdrawal of some foreign oil firms from the region (Inokoba and Imbua, 2010). The disturbing part of it is that no law or jurisdiction has termed their activities illegal and criminal or provide avenue for prosecutions. The Nigeria government loses billions of dollars through insecurity created by oil bunkering, damage to oil installations and pipelines, and the environmental cost which has not been assessed properly. According to Saliu et al. (2007), no region of the country best exhibits and bears the deplorable nature of Nigeria's human security than the Niger Delta and this state of human insecurity is aptly illustrated by the flagrant environmental degradation occasioned by oil exploration, severe and visible poverty and social discontents pervading and ravaging this oil-producing region. The youth restiveness and social unrest is a direct effect from poverty, unemployment and pain of loss of livelihood through loss of biodiversity, ecological damage, loss of arable farmlands and reduction in fish stock. Consequently, the line between militancy and criminality has become increasingly overlooked, as activities such as oil bunkering and kidnapping are not only a method of protest and agitation but also an attractive means of earning an income (Francis et al., 2011).

5.2.1.5. State Violence and Suppression: The unsustainable oil and gas activities in the Niger Delta have brewed corruption in government officials of successive governments and the executives of the oil companies. This socio-environmental injustice agitated the militants group. Regrettably, the official response of the government has been more repression of the agitators through the deployment of military troops and Mobile Police units with mortal instructions (Odoemena, 2011). According to Ikelegbe (2013), after the Ogoni crises with Shell in 1993, there has been deployment of the military and military operations like HAKURI 1 and 2 and Operation Restore Hope in the region which has been accompanied with state repressions and human rights abuses.

In 2006, Joint Military Task Force was deployed to Bayelsa, Delta and Rivers States to secure oil and gas activities. The military operations led to the deaths of many activists, destruction of the communities and many sexual abuses. According to Odoemena (2011), in 1999, the military was sent to Odi town in Bayelsa State and thousands of people were killed, while livestock, farms, public utilities and houses in the

town were deliberately destroyed and set ablaze by the rampaging Nigerian Army. Only a First Bank branch building, a health care centre and a church were neither razed nor looted and about a population of 60,000 was displaced or killed. It was alleged the soldiers came to avenge the death of kidnapped policemen and arrest the perpetrators but in actual sense the community was razed because the perpetrators posed oil production risks.

In January 2003, indigenes of Ohoror-Uwheru community in Ugbelli North local council, Delta State were attacked by a detachment of soldiers from the Joint Security Task Force Operation Restore Hope (Eregha and Irughe, 2009). In a related situation, February 22nd and 23rd of 2016, saw the Nigerian soldiers invade Yeghe and other communities in Ogoni shooting indiscriminately, killing innocent citizens in cold blood and destroying properties worth millions of Naira. The oil and gas activities have caused series of violence in the oil rich region emanating from conflicts between youths and community leaders, between youths and government agencies, youths and multinational companies as well as among themselves.

5.2.1.6. Employment and Social Equity: In spite the magnanimous contributions of the Niger Delta region to the economic sustenance of Nigeria, the people of the region remain unemployed, impoverished, underdeveloped and blighted by environmental and health hazards as a result of unabated oil pollution (Inyang, 2012). Owing to corruption in Nigeria and the gross misappropriation of the oil wealth, there has not been profitable re-investment and other sustainable developments that benefit the host communities economically. In absence of this, the local inhabitants have been bedeviled with unemployment and the subsequent poverty which has hit the people so hard leading to the spate of insecurity, tension and self-determination. The unemployment has made the people to be violent and resort to creative destruction of oil installations exacerbating the oil pollution situation, waste of non-renewable natural resources and loss of revenue to the government.

According to Francis et al. (2011), rates of unemployment and underemployment are particularly high in states with large oil revenues and are correlated with youth restiveness. Nigeria operates a mono-economy, depending solely on oil revenue. The oil

and gas operations require skilled workers which cannot be obtained locally from the host communities. This inadequacy of skilled laborers is one of the major causes of unemployment in the region. Destruction of their means of livelihood is another major cause of unemployment situation in the region. Therefore, youth restiveness, kidnapping and social unrest have all been identified as direct causes of poverty, unemployment and of loss of livelihood through oil pollutions. These social turmoil, violence and destructions are clear consequences of economic hardship, malaise and underdevelopment.

Resource management and sustainable developments always have issues with equity. According to UNDP (1996), development progress both nationally and internationally must be equitably distributed, people-oriented, environmentally and socially sustainable. Recently, sustainability has become the keyword with respect to intragenerational, intergenerational and distributional equities and a striking balance between projects and environmental stewardship (Akpabio and Akpan, 2010). The Brundtland Commission of 1987 while trying to solve the problem of equity defined sustainable development as development which meets the needs of the present (intragenerational equity) without compromising the ability of future generations to meet their own needs (intergenerational equity) (Mensah and Castro, 2004). This intergenerational equity is reechoed in **Principle 3** of Rio Declaration which says: “The right to development must be fulfilled so as to be equitable and meet developmental and environmental needs of present and future generations”.

According to Okoji (2002), the Nigerian Petroleum Industry has grown so with the awareness and discontent of the host communities, fostered by manifestation of inequity in the distribution of petroleum-derived wealth and social neglect. The exploitation of the natural resources in the Niger Delta, the distribution of the wealth and the lack of readiness to clean the environment is a clear case of intergenerational and environmental injustice and this should be looked into because environmental asset and social capital should be left to the unborn generation.

5.2.1.7. Basic Social Amenities: Operating oil companies in the Niger Delta embark on a developmental project for their host community as their way of public participation.

Unfortunately, these projects such as boreholes, health clinics and rural electrification become unusable and abandoned after some years owing to neglect, lack of maintenance and funding. Some host communities do not receive such projects at all as community service by the companies. According to Okoji (2002), Ogoni and Beten-Tai Villages in South-Eastern Port Harcourt, have 96 oil installations, a fertilizer plant, two refineries and a petrochemical plant operating nearby but have no public services available including electricity, telephones, pipe-borne water or health services. Housing, infrastructural facilities and transportation have been inadequate. The people live in shanties and slums with dilapidated infrastructures (Figure 40). The only road (East-West road) that connects the coastal communities in the Region has not been constructed completely. There has been loss of lives on that road. Recently, police officers who were going for election re-run in the River State from Ondo State had an accident with a truck carrying cows.

In summary, this region has been blighted with inadequate social development indicators such as health and health services delivery, transportation, water supply, education, telecommunication and electricity. Therefore, there is an urgent attention needed for underdevelopment and environmental crises in the region to save the inhabitants from extinction.

5.2.1.8. Political Ecology: Political ecology is the study of the relationship between political, economic and social factors with environmental issues and changes (Al Chukwuma, 2013). It encompasses issues with clash of individual interests and ecology's concern with our biophysical environment. Oil extraction and distribution, as well as oil revenue politics, no doubt, inform most contemporary conflicts in the Niger Delta but these by no means occlude the existence of some extra-oil frontiers of conflict in the Region (Omeje, 2004).

Nigeria is a capitalist dependent state and the exploitation of petroleum has been surplus extraction process which brews environmental degradation and the distribution of the wealth among states is not based on derivative which violates law of equity and true federalism. Ingelson and Nwapi (2014) stated that economically and politically, many of the corporations operating in the Niger Delta have grown into entities of such astonishing



(a) A primary school in the Niger Delta Region



(b) Coastal settlement in the creeks of Niger Delta (Murdock, 2012).

Figure 40. Dilapidated social amenities in the Niger Delta Region.

magnitude that they match the power of individual countries. They indiscriminately abuse their corporate power on a developing country like Nigeria and the vulnerable indigenous people of the Niger Delta Region.

For the fact that Niger Delta belongs to a political minority in the Nigerian polity, this in one way has facilitated the environmental injustice meted on them. One of the major political attractions of the oil revenue in Nigeria is that it brings huge advantages and opportunities to those who hold the reins of political power and through its hostility to those excluded from it and systematically strip them their basic human rights (Afinotan and Ojatorotu, 2009). There exists selective victimization where the Niger Delta Region is losing resources and facing the impacts of oil and gas developments while non-oil producing regions get lion shares of the revenue and are free to live in a healthy environment (Agbola and Alabi, 2003).

The Nigerian State has been committing such environmental racism and marginalization against the Niger Delta Region since the inception of the oil and gas developments. This raises many questions. How could the Niger Delta Region which suffer the impacts of oil pollutions and gas flaring gets its share from the fines collected as government revenue and the effects on the people be mitigated? How could the Nigerian revenue be shared among states with respect to equality of state, population or landmass?

CHAPTER 6. ASSESSMENT OF ENVIRONMENTAL MANAGEMENT SYSTEM FOR OIL AND GAS INDUSTRY IN NIGERIA

This environmental management is achieved using policies, laws with fines for violations, reviews, procedures, plans and in collaboration with the local people to address the havoc meted on the Niger Delta sensitive ecosystem by the oil and gas activities. **Principle 10** and **22** of Rio Declaration of 1992 stipulate the relevance of the local people in environmental protection and management. Environmental management commitments are contained in submitted environmental impact statements (EIS). However, environmental management commitment is not a requirement for EIA in the oil and gas sector in Nigeria. In order to foster a better protection and management of the Niger Delta environment, the following measures must be put in practice and followed adequately. These measures include: (a) an environmental management plan, (b) an environmental mitigation plan, (c) an environmental monitoring plan (d) a post decision follow-up, (e) scoping, (f) public participation and consultation, (g) cumulative effects assessment and (h) a holistic impact assessment.

6.1. Environmental Management Plan

Environmental management plan is an important environmental management tool that comprises schedules, planning activities, assigning responsibilities, measures, procedures, actions, processes, awareness and implementation to mitigate or eliminate the identified effects (through EIA process) of proposed actions on the environment. According to Holland et al. (2013), the environmental management plan is a widely accepted management tool that allows an organization to strategically and comprehensively address its environmental issues related to public and ecological health and safety.

However, the Nigerian EIA Act does not contain an EMP requirement, meaning that at the conclusion of an EIA, there is no mechanism for implementing the measures necessary to manage the adverse impacts of projects especially the oil and gas sector (Ingelson and Nwapi, 2014). As there is no legislated environmental management plan in Nigeria or a mechanism that encompass people, policies, plans, reviews, and procedures

used to manage environmental issues caused by the oil and gas activities, make the environment keep getting devastated and degraded with the activities, the environment continue to be devastated and degraded with the oil and gas exploration activities.

Section 3 (Duties of Heads of Agencies) **Subsection b** of USA Executive Order 13423 makes it mandatory to implement within the agency, environmental management plans (EMP) at all appropriate organizational levels and cover all environmental activities and programs (Holland et al., 2013). Therefore, in order for the environmental regulators in the oil and gas sector in Nigeria to reduce impacts on the environment, foster compliance, increase public participation in environmental management, reduce operating costs and implement environmental programs, adequate environmental management plan and mechanisms should be legislated and adopted in order to achieve an increased environmental protection from oil and gas impacting activities. The DPR should make submission of an environmental management commitment mandatory for all operations in the region and it should be consistent with sustainable development.

6.2. Environmental Mitigation Plan

One of the basic aims of applying EIA process in a project that has significant effects on the environment is to identify the impacts and put in place measures and plans to mitigate them, totally eliminate them and highlight any positive impacts. However, EIA regulations require identification and description of the mitigation measures. After the approval of an EIA, it is necessary to monitor whether the proposed mitigation measures are being implemented and, if they are in place, and how they are working (Ingelson and Nwapi, 2014). According to Tinker et al. (2005), impacts that require mitigation are frequently identified after preparation of environmental statements. Proposed mitigation plans often times facilitate the approval of EIA for projects that have adverse effects.

Environmental mitigation plan is required by EIA regulation in Nigeria which is set by the federal environmental protection agency (FEPA) and the proponent after the final EIA report has been submitted. The implementation of an environmental management plan, mitigation measures and post-decision monitoring are some of the weakest tools in Nigeria's EIA system (Nwoko, 2013). If the set mitigation plans are

followed, the widespread oil pollutions and social tension in the Niger Delta region could have been reduced. Echefu and Akpofure (2002) stated that the Department of Petroleum Resources and the State Environmental Protection Agencies have enabling instruments that permit them to conduct EIA without limitations.

The confusion as a result of the multiple regulators in the industry may have caused the inadequate implementation of mitigation plan as a follow-up program which could have been carried out through impact mitigation monitoring. The multiplicity of functions and multi-jurisdictional approaches to environmental regulations in Nigeria has caused more harm than good to the environment. The ostensible lack of enforcement mechanism and political will in the EIA process has continued to be a cost to the environment and the public health. To conduct an effective EIA in Nigeria, strong political will is essential (Ingelson and Nwapi, 2014). Therefore, the DPR who ineffectively oversees the EIA process in the oil and gas sector should implement mitigation monitoring exercises through facility inspections in order to ensure the mitigation checklist of an approved project is followed. When this mitigation plans are fully implemented, there would be always an economic benefit because negative impacts are reduced.

6.3. Environmental Monitoring Plan

Environmental effects monitoring programs are valuable tools for measuring the environmental effects of impacting activities, testing the predictions of the project environmental assessments, identifying emerging concerns and improve mitigation measures. It is a tangible link between the proposal and the mitigation measures in an EIA (Gunn and Noble, 2009).

According to CEAA (2012), the monitoring plan involves periodic or continuous surveillance of one or more environmental components according to a pre-determined schedule and conducted to determine the level of compliance with stated requirements. Nigeria has an impact monitoring plan more on paper than action while it is already a legislative requirement for some countries like Canada and Australia (Morrison-Saunders et al., 2003). Emoyan (2008) stated that there is a continued absence of environmental monitoring and surveillance systems in the Niger Delta region, even in the face of

overwhelming evidence of oil pollutions and environmental degradation. There is impact monitoring requirement in place for large projects but the regulatory agency monitors only 30% (Dayo et al., 2002). A detailed monitoring and auditing procedures for the oil and gas industry activities in the Niger Delta is therefore needed for better environmental protection. These procedures should be intended to reduce environmental risks and ensure environmental performance objectives.

Operating companies should make sure monitoring plans are in their operations and also include follow-up programs to track the requirements for mitigation measures. Morrison-Saunders and Arts (2012) stated that monitoring for approved projects should always be carried out to verify if: (a) the requirements are met, (b) systematic environmental effects monitoring programs to compare predicted impacts with the observed impacts are in place and (c) if there are programs to measure the impacts on species at risk by using the collection of data and comparison with standards, predictions or expectations.

The DPR should work in collaboration with the operators to improve the transparency, accessibility and utility of the environmental effects monitoring programs and documentation of the results. There is also need to facilitate continuous improvement, implementation and collaborative research studies involving industry, government, and university researchers with the aim of improving and understanding the effects of oil and gas activities on the Niger Delta sensitive environment. Regulatory officers and experts from the Federal Government and other agencies, who have environmental protection obligations, should endeavor to examine whether the operating companies have designed, implemented and incorporated their environmental effects monitoring and mitigation programs appropriately.

The local people should be involved in environmental monitoring plans. Wasserman (2011) stated that those close to a project site are often in the best positions to identify problems and pursue a redress and public complaint processes that are common to all environmental programs. The operating companies should make sure their monitoring programs are available and generally accessible to all, to ensure scientific credibility and promotion of public understanding of the actual impacts of oil and gas

operations in the region in a bid to improve the credence, accessibility, transparency and utility of the environmental effects monitoring and mitigation programs.

6.4. Post Decision Follow-up

Post decision follow-up is an environmental management tool aimed at post decision audit and compliance. Nigeria and other countries (Canada and Netherlands) has regulations for EIA follow-up (Morrison-Saunders et al., 2003). However, there is no structured and systematic follow-up exercise in practice in the environmental regulation set in EGASPIN for better environmental protection from oil and gas activities in Niger Delta. Having the follow-up requirement in regulation does not actually guarantee having it in practice because of the lack of enforcement mechanism. The department of Petroleum Resources (DPR) should design, or delegate the design of, the follow-up program and ensure its implementation, and that the elements of a follow-up program are defined in the proponent's environmental impact statements for all oil and gas activities in the Niger Delta.

When the follow-up program is appropriately carried out, it will be easier to: (a) verify predictions of environmental effects identified in the environmental assessment and (b) determine the effectiveness and efficiency of mitigation measures stated in the management plan. Furthermore, to know if the follow-up program needs modification or implementation of new measures, implementation of adaptive management procedures need to be undertaken to: (a) address previously unanticipated negative environmental effects of oil spillage and gas flaring and (b) provide information on the environmental effects. Then, the mitigation plans that can be used to improve and/or support future environmental assessments will now be put in place which should include cumulative environmental effects assessments of the oil and gas activities in the region.

6.4.1. Post Decision Audit

Post decision audit is one of the management tool arms of EIA used to assess the success of mitigation in reducing impacts, so that decisions made about future management actions can be more effective (Wilson, 1998). Environmental audits aim at

verifying the company's operating procedures and environmental management systems in order to achieve continuous compliance.

However, this requirement is not adequately incorporated in environmental legislations for the protection of Niger Delta environment from the oil and gas industry. If follow-up exercise is well structured and systematic, the goal of auditing will be adequately achieved. DPR should properly implement environmental auditing to see the performance of oil and gas companies, examine and assess the potential environmental impacts due to the oil and gas operations in the Niger Delta region. This calls to conduct inspections, involvement of a board officer during operations to confirm that regulatory requirements are met and to support audit findings. Nigeria, as a developing country with few resources and weak Environmental Ministry, does not have the helicopters and speed boats needed to bring inspectors and regulators to oil platforms. Consequently, operating companies provide the transport but then determine when inspections can take place which give them more time for background work and causes a bias judgment in audit reports by inspectors. The National Oil Spill Detection and Response Agency (NOSDRA) charged with oil spill response does not have working helicopters and boats to access oil spill sites.

Since some of the EIA in oil and gas sector are for just regulatory requirement and assumption of mitigation success, there is an urgent need for field protocols, audit methods and mitigation tracking technique for improving the effectiveness of future EIA work in the oil and gas sector. Audits should be performed by developing a checklist that includes the valued ecosystem components (biophysical and social), issues of concern and the warning indicators (oil spill, gas flaring, effluents disposal, drinking water standards, noise levels, air quality, oil installations safety, species population, human health and safety, biodiversity issues and mangrove devastation) and other social concerns.

6.4.2. Post Decision Compliance.

Post decision compliance monitoring is the monitoring and audit activities that are developed through environmental management frameworks to demonstrate how the collective body of consent conditions or voluntary mitigation measures will be enacted

and complied with (Marshall, 2005). According to Arts et al. (2001), environmental auditing may be carried out to facilitate management control and to assess compliance.

Compliance lays the foundation for investigations, inspections and enforcement actions. Echefu and Akpofure (2002) stated that the DPR adopted remedial enforcement tools which included compliance monitoring and the issuing of permits/licences are inadequate. Designated projects must meet the requirements and stipulations set in the EIA Act, EGASPIN and other environmental laws in Nigeria using compliance monitoring. But unfortunately, no systematic measure in this regard is required by law for the operating companies. The compliance to these laws and decision statements should therefore be a mandatory requirement for projects proponents and a large fine put in place for non-compliance. The proponents must submit an impact assessment compliance report to environmental regulators showing that projects will be developed in accordance with the original EIA decision and that the proposed mitigation measure plans will be incorporated into the operation design.

6.5. Scoping Process

Proposed action is associated with issues and determination of the extent of the issues to be considered in the assessment or reported in environmental statement. The process of identifying these issues and assigning priority and importance to them is called impact scoping (Ross, 1987). According to Ramjeawon and Beedassy (2004), the minimum scoping requirements for an EIA need to be elaborated so as to ensure that all the relevant information is taken into account in deciding whether or not to grant an EIA license.

According to Canter et al. (1996), public participation in an EIA process can be achieved through scoping process to determine the scope of issues to be addressed and to identify the significant issues related to a proposed action. Identification of VECs and actions that will affect them is determined through scoping by public and stakeholders consultations. The EIA process in Nigeria lacks efficient public participation thereby making identification of issues associated with the proposed action through scoping so cumbersome. Scoping helps in identifying the information necessary for decision making as well as identifying significant effects and factors to be studied in details. Therefore,

introducing scoping into EIA becomes one of the means of strengthening the role of EIA in achieving a better environmental protection.

The scoping stage in EIA practice is lacking in EGASPIN set by DPR in control of oil and gas projects. After screening and environmental screening report review is done, impact evaluation comes next in the EGASPIN set by the DPR (Tominiyi et al., 2014). However, in EIA steps by Weaver (2003), after screening comes scoping before impact analysis. This means that an early public participation is lacking in DPR guidelines and this contributes to the failures of EIA process in oil and gas sector in Nigeria. In USA EIA process, scoping precedes notice of intent which has already been published (Stampe, 2009). Therefore, an early public notice in the form of scoping calls for comments at the stage of initial conception of issues should be addressed in the oil and gas projects in the Niger Delta region and the potential for feasible alternative responses should be considered (Doelle and Sinclair 2006).

6.6. Public Participation and Consultation

The importance and relevance of public participation in EIAs is well established. According to Ingelson and Nwapi (2014), the sustainability of development interventions is believed to be achievable through the proper participation of stakeholders in the management of environmental resources. The UN Conference on Environment in Rio Janeiro in 1992 recognizes the importance of public participation in environmental protection as stated in **Principle 10** of the Declaration that: “environmental issues are best handled with the participation of all concerned citizens, at the relevant level, that at the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes” typically shown in Figure 41.

The indigenous people know their local environment better and will be able to identify some issues of concern that a project may impact on their environment. But if these issues are not identified at the earliest opportunity through scoping, they may arise at a later stage of the project and likely lead to a conflict (Ingelson and Nwapi, 2014).

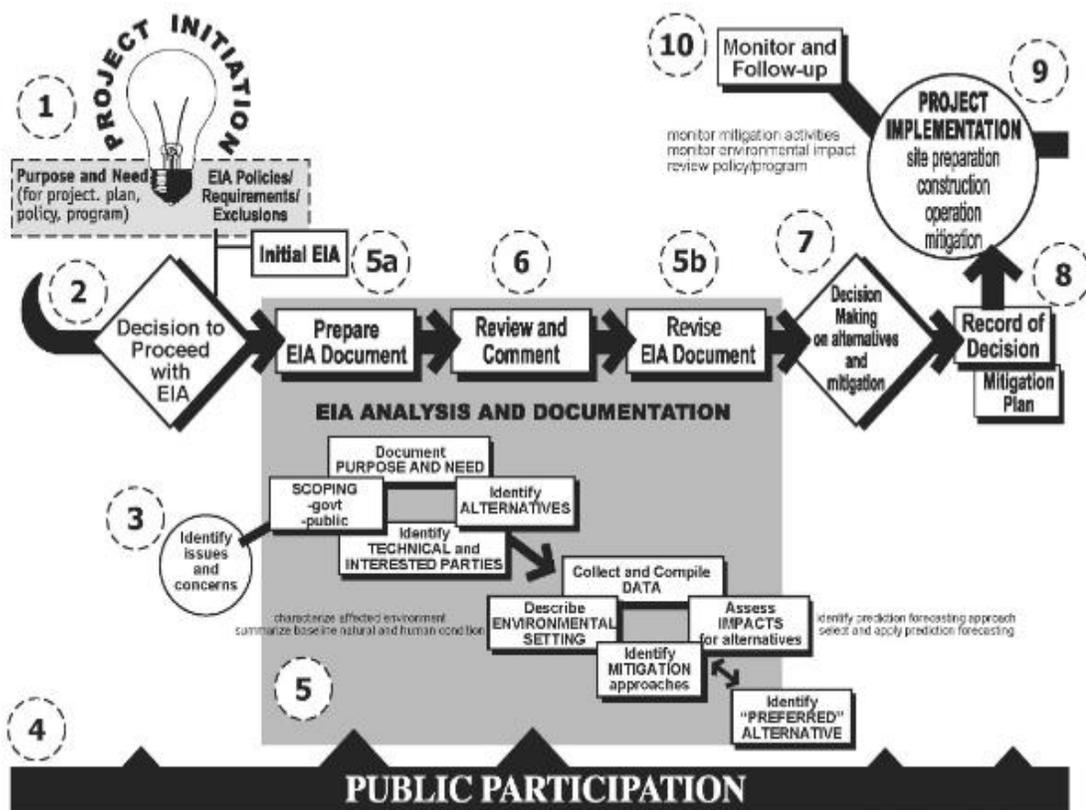


Figure 41. EIA stages that involve Public participation (Wasserman, 2011).

This explains why social tensions and conflicts experienced in the Niger Delta region persist.

Public participation is generally recognized as a vital tool in enhancing the sustainability of projects (Doelle and Sinclair, 2006). According to Nwoko (2013), there is no legal framework that gives basis for public involvement and access to environmental information in oil and gas related environmental issues in Nigeria. The process and engagement of the local people has been deficient and ineffective. According to Morrison-Saunders et al. (2003), proper public participation facilitated the success of the EIA follow-up for a major hydroelectric power project in Canada by Hydro-Quebec. If EIA is a communication of environmental effects according to Sanko (1996), who then receives the information of environmental effects of the oil and gas in the Niger Delta? CEAA recognized the importance of public participation in sustainability in Paragraph **18(3) (b)** of the EIA Act, and refers to public participation as giving "the public an opportunity to examine and comment on the screening report and any record relating to the project". CEAA also made provision for Participant Funding Program to facilitate the participation of the public.

Principle 10 reiterated its importance by saying that "states shall facilitate and encourage public awareness and participation by making information widely available and effective access to judicial and administrative proceedings, including redress and remedy". In Nigeria only 21 days are given for public comments while in Canada and USA 45 days for comments and make available the Record of Decision (RoD) are made available. With the chance to participate in the environmental protection, the public will be ready, willing and able to step up and make constructive and convincing contributions and those contributions will be incorporated into project design and decision-making for improvement and effectiveness (Doelle and Sinclair, 2006). The Niger Delta people should be given an opportunity to: (a) hear (public disclosures), (b) be heard (public comments) and (c) be listened to (public responses) as required by public participation enforcement in EIA process (Wasserman, 2011).

6.7. Cumulative Effects Assessment

Cumulative effects are the combined impacts from all human-driven environmental stresses acting over time and space and the process of systematically analyzing and evaluating these cumulative environmental changes is cumulative effect assessment (Leibowitz et al., 1992; Ball, 2011). Cumulative effect assessment was first recognized officially in environmental assessment process where the environmental consequences of project development are considered prior to project approval in North America (Duinker, 1994). It demands a valued ecosystem component-centered approach to environmental impact assessment. According to Canter and Kamath (1995), cumulative effects should be referred to as the summation of the impacts of the proponent action across all relevant resources at a given point in time and also includes all existing projects or impact-causing factors in the geological areas of the proposed action.

If the environmental effects of a particular project are needed to be considered, it is essentially logical according to Ross (1998) to address the cumulative effects of that project. It becomes imperative to determine the cumulative impacts of the project on VECs and to predict the conditions of them with past and future human driven environmental perturbs. At this point, scoping is then required to identify the valued ecosystem components (VECs) and valued social components (VSCs) before a decision can be made about the project. In fact, cumulative effect assessment means “EIA that is done properly” (Ross, 1998).

There is a requirement for cumulative effects assessment in the EIA Act of 1992 in **Section 4** (Minimum Content of Environmental Impact Assessment) **Subsection (d)**, **Section 17** (Factors not Included) **Subsection (1) (a)** and **Section 20** (Use of Previously Conducted Screening) **Subsection (4)**. However, cumulative environmental effects from the oil and gas industry in Nigeria are inadequately addressed in the Environmental Assessment Process in EGASPIN. The guidelines lack emphasis for project proponents and government agencies and an absence of a structured methodology. Therefore, there is need for a multi-stakeholder initiative in the form of cumulative environmental management association to manage the cumulative environmental effects of industrial developments in the Niger Delta.

6.8. Holistic Environmental Assessment

Attempts to give an accurate account of the total environmental risk to society arising from all phases of a process designed for the manufacturing of a product and/or provision of service goal leads to the establishment of a goal oriented process called Holistic Environmental Assessment (Salter and Ford, 2001). Holistic environmental assessment focuses on prioritization and quantification of environmental effects from activities in each phase of a chosen process and ensures efforts to reduce pollution in that particular phase of the process do not lead to greater cross contamination. It involves using a multidisciplinary approach to risk assessment to evaluate health and ecological impacts.

There are many holistic approaches to analyzing environmental loadings and entire life cycle of a process. However, life cycle assessment does not consider accidental emissions and cumulative impacts of activities over a whole chain of activities. This multidisciplinary approach is also lacking in the current Nigeria's environmental legislations for better environmental protection. As the environmental effects of oil and gas activities in the Niger Delta worsens, the people's reaction with them is becoming increasingly seen as a liability for polluters and the government and a risk for those affected by the environmental degradation affect. Therefore, the proposal for a tool for integrating environmental concerns into planning and programming will be an important step towards a broader environmental appraisal that includes social and economic aspects (Salter and Ford, 2001).

Strategic Environmental Assessment (SEA) emerged as a structured proactive holistic process to strengthen the role of environmental issues in decision making through the assessment of the environmental effects of policies, plans and programs for developing countries and as an environmental sustainability assurance (Alshuwaikhat, 2005). As the public and stakeholders participation is lacking in the EIA process in Nigeria, SEA has the potential to facilitate greater transparency and more effective public involvement at the strategic level (Kirchhoff et al., 2013). With this approach, the indigenous people of the region can have influence on what happens to their environment in accordance with **Principle 10** of Rio Declaration of 1992.

CHAPTER 7. IMPACT ASSESSMENT OF OIL POLLUTION IN EGBEMATORO 1 COMMUNITY: A CASE STUDY

Ekpematoro 1 is one of the communities in Southern Ijaw local government in Bayelsa state, the host community of Agip and Shell. Southern Ijaw with headquarters at Oporoma is the largest local government in Nigeria in terms of landscape and the largest oil producing local government in Bayelsa state (Daniel, 2015). It has population of 319, 413 (from 2006 National Census) and lies within latitude 4°48'17"N and longitude 6°04'44"E with coastline of approximately 60 km on the Bight of Benin (Wikipedia). Ekpematoro 1 is one the communities devastated by oil bunkering and illegal refineries. The map of Southern Ijaw (yellow shaded part) is shown in Figure 42.

7.1. Assessment of Soil Contamination

Crude oil contaminated sites represent a major challenge in many communities in the Niger Delta Region of Nigeria (Okoro and Oviasogie, 2011). Ekpematoro 1 community has suffered soil contamination associated with petroleum activities of Shell, Agip and bunkering agents. The presence of crude oil and other inorganic pollutants in the soil have deleterious effects to public health. According to Olawoyin et al. (2012), crude oil contains trace amounts of heavy metals naturally or added to the environment during petroleum developmental processes. Heavy metals exposure from the soil may be chronic due to transfer to food chains. Natural microbial communities, chemical and physical properties of soils are influenced by oil spills and petroleum hydrocarbons have been considered among the strongest soil pollutants (Ijah and Antai, 2003; Zhang et al., 2009 and Marinescu et al., 2012).

Oil has been known to exert adverse effects on soil properties and plant community and more deleterious to soil biota and crop growth above 3% concentration (Osuji and Nwoye, 2007). The deleterious effect on the soil fertility is exacerbated after fire that will follow the spill. Soil pollution from oil spills and other pollutants from oil and gas activities in the Niger Delta have affected the soil fertility and the physical degradation has led to reduced soil structure, aeration, water holding capacity and

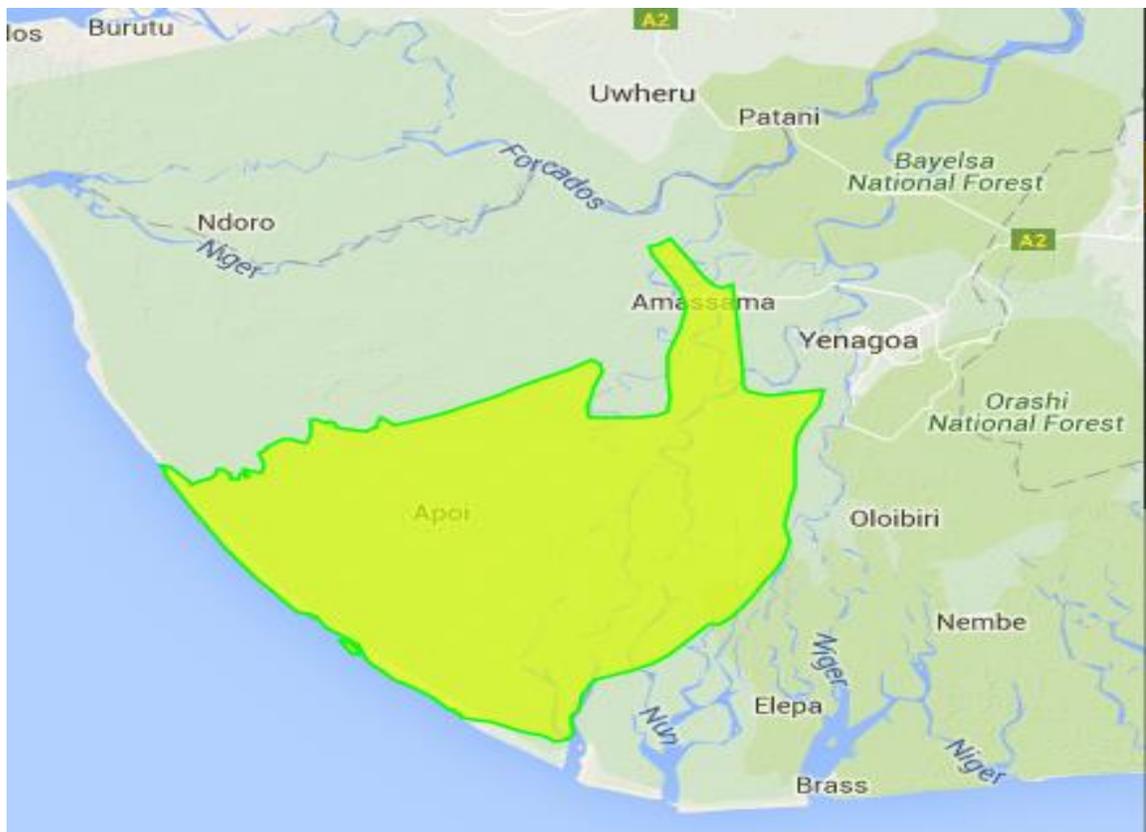


Figure 42. Map of Southern Ijaw (City population, 2011).

biological activities leading to low crop output. An impacted soil from oil spill and the ensued fire soil at Sangana is shown in Figure 43 and analyzed for total petroleum hydrocarbons (TPH) and heavy metals. According to Bada and Olarinre, Nigerian crude oil is known to have about 0.003 – 42.31 mg/kg of transition metals including vanadium, chromium, manganese, iron, cobalt, nickel and copper. Heavy metals analysis of the soil at Sangana creek and the concentration of total hydrocarbons in the soil were done by Najco Laboratory Limited in Ogba Lagos using Inductively Coupled Plasma Optical Emission Spectrometer (ICP OES) Optima 7300 V Model, Massachusetts, USA and Hewlett Packard 5890 gas chromatography. The result of the soil analysis for heavy metals is presented in Table 11. The fingerprint of the total petroleum hydrocarbon (TPH) contained in the contaminated soil is shown in Figure 44 and it shows the crude oil is a fresh one because the peak are seen more at more volatile fractions (<C₁₅).

7.2. Assessment of Groundwater and Freshwater Contamination

The oil and gas activities in the Niger Delta have posed great danger to the quality of the surface water supplies in the region which is used by the local inhabitants without treatment for drinking and other purposes. Deteriorated surface water quality is one of the environmental injustices that will be bequeathed to the unborn generation. Egbematoro 1 has lots of petro businesses and the generated surface runoff is discharged into the surface water untreated. The inhabitants use these water bodies for drinking, bathing and other domestic purposes. There have been reports of water born diseases and deaths in the community after consuming this water. According to Okorie (2015), Egbematoro1 is one of the communities in which deaths of people after consuming polluted water along the creeks and waterways has been reported by the Local Government Chairman in the council. The assessment and analysis result of the stream (Figure 45) in Egbematoro 1 was carried out and it is similar to the one obtained in Amassoma Niger Delta by Nwidu et al. (2008), only that the stream in Egbematoro 1 has more concentration of total petroleum hydrocarbon. The result of the analysis is shown in Table 12 and the chromatogram of the TPH in the stream is shown is Figure 46. All the analyses were carried out by Najco Laboratory Limited in Ogba Lagos. The fingerprints of the aliphatics fractions (C₆-C₃₅) show the crude oil found in the water body is fresh and



Figure 43. Oil and fire impacted soil at Sangana.

Table 11. Physiochemical content of the soil.

| Parameter | Concentration (ppm) | DPR target values (ppm) |
|-----------|---------------------|-------------------------|
| TPH | 7529.16 | 100 |
| Barium | 111.9 | 200 |
| Cadmium | ND | 0.8 |
| Lead | 31.7 | 85 |
| Arsenic | ND | 1.0 |
| Mercury | 0.0 | 0.3 |
| Nickel | 5.6 | 35 |
| Chromium | 10.6 | 100 |
| Copper | ND | 36 |
| Iron | 3212.9 | 47000 |
| Calcium | 21329.7 | - |
| Magnesium | 1880.1 | - |
| Zinc | 383.4 | 140 |

ND- Not Detected

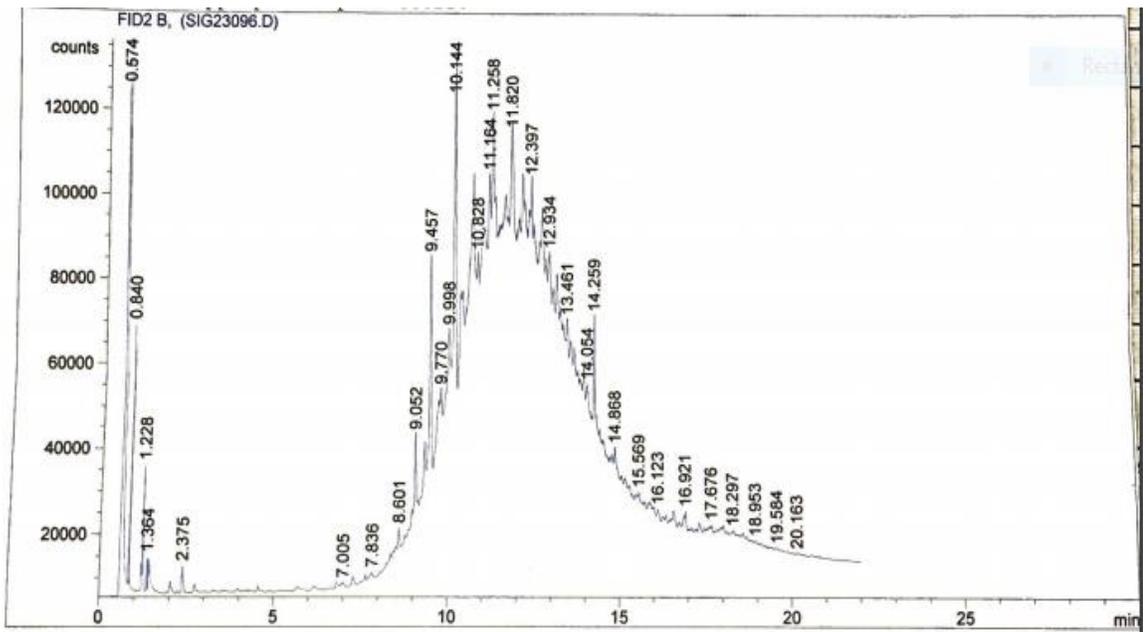


Figure 44. Chromatogram of the TPH in the soil showing a fresh contamination.



Figure 45. Contaminated stream at Bini Koko Egbematoro 1.

Table 12. Physiochemical contents of Egbematoro stream.

| Parameter | Concentration (ppm) | DPR target values |
|-----------|------------------------|-------------------|
| TPH | 6.3951x10 ⁴ | 10 |
| Barium | 13.7 | - |
| Cadmium | ND | 0.003 |
| Lead | ND | 0.05 |
| Arsenic | ND | |
| Mercury | 0.0 | - |
| Nickel | 4.4 | 0.07 |
| Chromium | 4.3 | 0.03 |
| Copper | ND | 1.0 |
| Iron | 854.1 | 1.5 |
| Calcium | 234.8 | - |
| Magnesium | 155.6 | - |
| Zinc | 6.0 | 1.0 |

ND-Not Detected

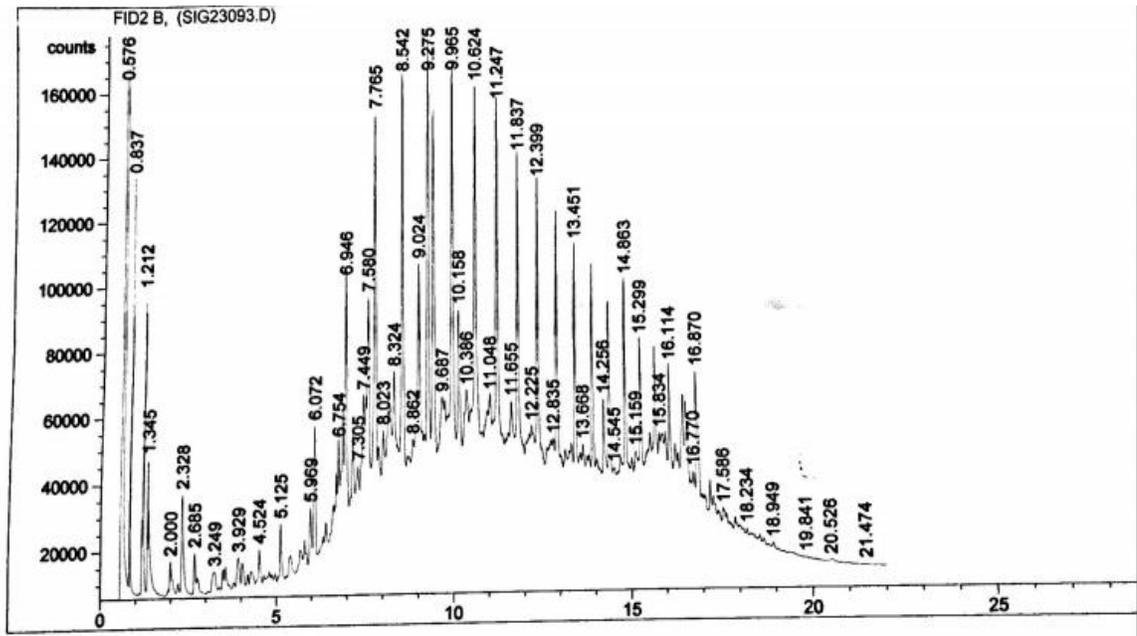


Figure 46. Chromatogram of TPH in contaminated stream at Bini Creek.

unweathered. The analogous series of the n-alkanes in the oil are visibly clear confirming its freshness. According to Carl et al. (1995), the more volatile hydrocarbons (<C15) are lost from freshly exposed petroleum in a matter of days, primarily through evaporation and dissolution. The quantity is big enough to impact on aquatic organisms in the water. However, EGASPIN legislation refers mineral oil analysis without any carbon range specification.

7.3 Assessment of Oil Contamination on Vegetation

The change in vegetation in the Niger Delta region can occur from altered hydrology, topography, heavy metals contamination and acidification. The conflagration that follows an oil spill incident has strong implication on biological production and has led to impoverishment of biodiversity and loss of many plant species, habitats reduction and destruction. After oil spill occurs on land, fires often break out, killing vegetation. Many fires that follow after pipeline vandalism in the region lead to destruction of vegetation. Impact on vegetation from oil and gas activities can also occur from seismographic survey, building of access roads, drilling, dredging and hazardous chemicals disposals. When this happens, protected species are exposed to illegal poaching and logging including loss of biodiversity and herbs with pharmaceutical properties. The damage on the vegetation of Egbematoro 1 community (Figure 47) was caused by a fire that followed an oil spill. The unique diverse species of plants and animals found in this extensive swamp and forest are lost due to oil spill fires. Deforestation and subsequent loss of biodiversity in this region of Nigeria are some of the high priority environmental issues ranked by the World Bank (WHO, 1995).

7.4. Assessment of Damage on Mangroves

The Niger Delta mangrove swamp spans about 1900sq/km and it is the largest mangrove swamp in Africa (Kadafa, 2012). Mangrove forests in the Niger Delta suffer mostly from the impact of the oil spills ravaging the region since inception of oil production. The mangroves are coastal wetland forests mainly found at the intertidal zones of estuaries, backwaters, creeks, deltas, lagoons, marshes and mudflats of tropical and subtropical latitudes which remain very important to the indigenous people of



Figure 47. Vegetation damage from oil spill fire at Egbematoro 1.

Nigeria as well as to the various organisms that inhabit these most productive ecosystems in the world (Zabbey, 2004; Eregha and Irughe, 2009; Sahoo and Dhal, 2009).

Oil pollution in many intertidal creeks has left mangroves denuded of leaves and stems, leaving roots coated in a bitumen-like substance sometimes more than 1 cm thick (UNEP, 2011). The mangrove forest is the most economically rich of the four forest zones in the Niger Delta. It harbors organisms like periwinkles, shellfish, oysters, clams, slugs and mussels. Unfortunately these organisms do not move fast and always get burnt with the mangrove during an oil spill fire.

Impact on mangrove can also come in the form of physical disturbance like right of way for pipelines, creating canals for navigation or dredging activities for exploration and production accessibilities. The mangrove supports the livelihood of the Egbematoro 1 community people and also a major habitat for the rich biodiversity. The oil spill toxicity on mangrove endangers these organisms that live there and this affects the local economy of the people because mangroves are not just ecologically significant but are critical and important to the livelihood and food security of the community (UNEP, 2011).

7.5. Assessment of Impacts on Public Health and Air Pollution

Together with the mangrove forests, the indigenous communities in the Niger Delta have been subjected to health effects from oil and gas activities through many routes including contaminated water, soil and food and air pollution including gas flaring. Assessment of the public health identifies increased frequency of respiratory and pulmonary disorders like broncho- and lobar pneumonia, bronchitis, upper respiratory tract infections, asthma, skin conditions and gastroenteritis. There is a reported death in Egbematoro 1 in 2012 from complications and diseases associated with the consumption of the polluted waters along the creeks and waterways of the area. Most of the hydrocarbon fractions seen in the contaminated water are of low solubility. Therefore, the most soluble fractions will be present in the greatest concentration. People breathe in some of the TPH compounds that evaporate from a spill or leak in the area where an accidental release has occurred or from the ones found in ambient air from crude oil fires (Figure 48) and artisan refineries. The artisan refineries are the major contributor of priority pollutants in Egbematoro 1. The people get sick often and children get exposed



Figure 48. Air pollution scene from oil fire at Egbematoro.

by playing in soil contaminated with TPH and consumption of vegetables that have bioaccumulated nitrates that come from acid rain.

CHAPTER 9. RECOMMENDATION

Aside of urging the United Nations to apply **Principle 6** of Rio Declaration of 1992 (Earth Summit) on Nigeria and the application of International Environmental Treaties since gas flaring in Nigeria contributes to global warming, the following are recommended to improve environmental protection from oil and gas activities in Niger Delta and quell social tension.

1. The Government and the operating companies should accept the responsibility of mandating environmental standards in the oil and gas industry that are adequately enough to achieve sustainable development. This irresponsibility though, has caused the host communities to now gasp for access to environmental, judicial and constitutional remedies to the environmental injustice meted on them in order to forestall inter generational equity because their children are being bequeathed with a degraded environment that is prone to annihilation. The region is now known for polluted waters and land, devastated mangrove forest and the seat of unhindered gas flaring as an OPEC member.
2. The polluters should clean up the environment according to the Amnesty International and “the polluters pay up” policy of Environmental Law. There is need for improvement of Nigeria’s environmental legislations and a sustainable manner of oil and gas exploration and exploitation activities in the Niger Delta Region to achieve socio-economic developments while promoting safe and healthy environment. The operating companies and the government should therefore clean all contaminated sites, imbibe and adopt proactive environmental management procedures and then discontinue their mere reactive environmental management practices which have caused numerous environmental devastations and public health concerns.
3. **Principle 16** of Rio Declaration of 1992 stipulates national authorities should endeavor to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment. The key challenge to energy companies should be practical demonstrations to enhance economic performance while maintaining the

highest standards of environmental sustainability, stewardship and social responsibility.

4. Comprehensive corruption risk assessment should be conducted in the industry periodically.
5. The multi-jurisdictional implementation of environmental regulations is always counter-productive. To enhance proper environmental management and reduce overlapping of regulation and conflict of interest, DPR should allow NESREA to handle environmental regulations in the oil and gas sector and focus only on economic development of the sector including licensing and revenue management according to international best practice.
 - (a) Submission of an environmental management commitment should be made mandatory for all operations in the Region and must be consistent with sustainable development.
 - (b) Adequate environmental management that encompasses monitoring and mitigation measures and involve the stakeholders and the public in its implementation should be included.
 - (c) An efficient post decision monitoring program and follow-up should be incorporated in every future EIAs to verify impacts predictions which is lacking presently.
6. Identification of VECs is lacking in the EIA process.
 - (a) Effective scoping, baseline information gathering and cumulative effects assessment practitioner's guide with a structured methodology should be introduced to the process.
 - (b) A multi-stakeholder initiative in the form of cumulative environmental management association to manage the cumulative environmental effects of industrial developments in the region should be implemented.
7. EIA is also a communication of environmental effects to the concerned public and stakeholders.
 - (a) Public and stakeholders' participation should be improved with a legal framework to enhance co-operation, sustainability of projects, proper identification of VECs and gathering of quality baseline information.

- (b) Ethno-diversity of the region should be recognized and an incorporation of Social Impact Assessment into EIA framework should be made.
 - (c) Participants' funding should be introduced to facilitate public and stakeholders participation so that they can be able to make incisive, constructive and convincing comments necessary for better decision making and environmental protection.
 - (d) SEA should be introduced as it has the potential to facilitate greater transparency and more efficient and effective public participation at strategic levels for a developing country like Nigeria.
 - (e) The 21 days giving for public comments is not enough to get a quality feedback for better decision making and should be increased to 60 days because of the literacy level in Nigeria.
 - (f) Final decisions on the project should be made public, together with the reasons for approval.
 - (g) Habitat Regulatory Assessment and Species at Risk Assessment should be part of EIA regulation in order to protect species at risk, wildlife, their breeding and survival. There should be proper monitoring of vegetation and mangrove fauna too.
 - (h) The independent consultants preparing EIAs for operators should be registered and external EIA experts and NGOs who will be gaining international training should review the prepared EIAs.
8. Local people should be empowered economically to be stakeholders responsible for consequences of environmental degradation.
- (a) Annual environmental reports should be published by the operators to demonstrate their environmental performance and stewardship to the local people and the stakeholders.
 - (b) The operating companies should adopt the environmental and social safeguard policies of the International Finance Corporation arm of World Bank which should lead to the issuance of a "social license" by the community in order to improve public participation, social equity, reduction of environmental injustice and improvement of intergenerational justice.

- (c) The local residents should always be enlightened with the deleterious effects of the pollutants emanating from the region in order to reduce the health effects and contaminations.
 - (d) There should be a section on public health monitoring to force the oil and gas operators into collecting and publishing data of public health effects. Social and health impact assessment should also be part of EIA regulation.
9. OMPADEC has no power to make regulations, enforcement and sanctions and the Federal Government even controls their funds.
- (a) It should be discontinued together with NDDC and replaced with Petroleum Host Communities' Fund (PHCF) as contained in Sections 116-118 of the drafted PIB and should be enhanced with good governance.
 - (b) PHCF should look into ways for capacity and skills developments of the local people and their employment.
10. OMPADEC and NDDC were established as a mere response to pollution and social tension in the Niger Delta.
- (a) The sections of the drafted PIB for PHCF should define host community because a community where oil production is going on is not only impacted by the operations.
 - (b) Some communities neighboring them are used for passing the pipelines or transporting the crude and gas and receive the harmful effects of gas flaring and must therefore, be considered as host communities though with a lesser entitlement.
11. NOSDRA should be enhanced with competent and adequate staff and equipment including funds to handle oil spill swiftly and efficiently.
- (a) It should be provided with helicopters and speed boats for effective monitoring and response to oil spill to reduce ecological damage and public health concerns, and accessibility of offshore facilities.
 - (b) It should have monitoring and surveillance programs and proper contingency planning for oil spill clean-ups.
12. Oil spill modeling should be included in operator's EIA reports so as to explore worse case scenarios and resources, and VECs most at risk.

13. With the \$1 billion (90% from Shell and 10% from Nigeria) already set aside to clean Ogoni as recommended by UNEP, funds should be made available also for other sites contaminated by oil spill.
14. The regulator should make sure oil companies strive towards the modernization of infrastructures and equipment, replacement of old and corroded pipes which has all exceeded the engineering lifetime of 15 years (in order to prevent further oil spillages) using the provision of **Section 25** of the PDPR (Prevention of Pollution) that says: “the licensee or leasee shall adopt all practicable precautions, including the provision of up-to-date equipment approved”.
15. Pipeline Vulnerability Assessment should be included in the regulation and the operators should have strict liability for pollution damage and remedial programs and measures.
16. The public health and ecological effect of gas flaring have been clearly established and flaring should not be allowed.
 - (a) A new deadline to stop gas flaring should be agreed on to reduce the harmful effects of the practice.
 - (b) Operators should measure and keep records of amounts of flared gas and also use air pollution abatement devices to reduce air pollution. There should be air quality monitoring too so that guideline for protecting public health can be established.
17. Refineries should put adequate measures to minimize pollutant releases to the environment.
 - (a) Proper safety measures should be practiced to reduce potentials for accidents and explosions.
 - (b) The illegal oil refineries should be dismantled because they may be the major contributor of priority pollutants to the environment.
 - (c) The fines given to operators for spills that subsist should be extended to equipment operators, oil tanker owners and mechanic workshops because all of them spill petroleum hydrocarbons to the environment.
18. The surface waters used domestically and other water bodies should be sampled periodically (monthly) to protect the people who use them and the aquatic life.

- (a) There should be monitoring of groundwater and surface water together with fishes, sediments and benthic organisms.
 - (b) There should be monitoring of the soil too because the PAHs in the ambient air eventually finds their way into the soil.
19. The environmental regulations in the oil and gas sector were made in periods when offshore developments were not in existence.
- (a) The regulation should recommend offshore decommissioning program to proceed with an EIA study.
 - (b) The program should also identify all materials and equipment installed or has accumulated at the facility.
 - (c) All offshore installations and oil-handling facilities must have an approval for oil pollution emergency and contingency plan setting out arrangements for responding to incidents that cause or may cause marine pollution.
20. Nigerian universities should start offering environmental accounting courses and all companies whose activities have effects on the environment should have an environmental accountant.
- (a) There is need to calculate environmental costs of business activities and environmental regulations. By analyzing and tracking the effects, the managers would be able to reduce or eliminate unnecessary costs.
 - (b) There should be a significant penalty of at least \$200 million and jail term for violation of EIA regulation in Nigeria.

CHAPTER 8. CONCLUSION

Crude oil has been the mainstay of Nigeria's economy since its commercial production in 1958. There have been unsustainable processes and obsolete equipment and laws involved in harnessing this natural resource and this has wrecked great havoc to the Niger Delta environment which is very sensitive and ecologically endowed. The Niger Delta people have suffered environmental racism and marginalization in the hands of the operating companies and the Nigerian State since the inception of oil and gas developments. This natural resource became a black gold, causing adverse effects to the environment and the people including poverty, corruption, political and social unrest. The oil boom actually turned into an oil doom where the crude oil became a resource curse to Nigeria. The oil wealth brews corruption and gross mismanagement to the extent there was scarcity (Figure 49) and high cost of refined products in the period of low global oil price. The following conclusions are drawn from the assessment of oil and gas industry in Niger Delta Region and the environmental legal framework promulgated by the Government of Nigeria.

1. Environmental Impact Assessment was adopted for environmental protection as stated in Principle 17 of Rio Declaration of 1992 to be a management tool that interfaces and balances developmental projects between the environment and communities in a society in order to enhance economic performance while maintaining the highest standards of environmental sustainability, stewardship and social responsibility.
 - (a) But this tool and other environmental legislations have not been adequately applied in Nigeria for environmental protection and achievement of sustainability owing to obsolete and inadequate laws which are ad hoc, ambiguous and the earliest developments went ahead without a formal EIA legislation process.
 - (b) A 260 km dual carriage way which passes through 185 communities in Cross River State and a National Park was constructed without a formal EIA process.
 - (c) Even with the existence of EIA guidelines and legislation, environmental degradation continues to be a major concern in Nigeria and there is need to



Figure 49. Queue and scrambling for gasoline in Nigeria during global low oil price in March 2016.

provide an environmental sustainability assurance and supporting tool for sustainable development.

2. The Nigeria's Environmental Legislations have been saddled with:
 - (a) Poor enforcement and sanctions for non-compliance to environmental management which are required for better protection of the environment and the people from adverse effects of an impacting activity.
 - (b) The much required parity between development, economic gains and environmental protection in the Niger Delta has not been well achieved and enhanced in such a complex and impacting oil and gas industry and enough resources have been wasted.
 - (c) The legal and institutional framework by which the problem of environmental degradation and devastation could be tackled is inefficient, leading to a legal lacuna through which the companies utilize its inefficiency to perpetrate the perpetual environmental devastation.
 - (d) The inadequate defense to liability of oil spill is the major cause of oil contaminated environment in the Niger Delta (Shell alleging in 2015 that 70% of their spills are caused by sabotage).
 - (e) NOSDRA which is mandated to respond to oil spills lacks the expertise and funds to tackle these spills by a third party.
 - (f) The inadequate and non-enforceable laws and inconsistent and overlapping of regulations led to environmental degradation, poverty of the communities, public health concerns, deaths, social tensions and the exacerbation of the pollution situation through oil bunkering, illegal refineries and blowing up of oil installations (by the Niger Delta Avengers and other newly erupted militant groups), all have impeded economic developments in the current dispensation.
 - (g) There is improper public and stakeholders' participation and co-operation in the environmental legislation regime in the Region.
 - (h) The unsustainable activities in the Region by the operators, their complacency and government connivance all violated lots of Principles stated at the Earth Summit at Rio Janeiro in 1992, the African Charter on Human and Peoples' Right (ACHPR) and even the Nigerian constitution.

3. The Region is termed the world's headquarters of oil pollution and there should be an adequate action and response to the oil pollutions and unsustainable developments to prevent the endowed ecological wetland from becoming a wasteland from oil spill, gas flaring, water pollution and loss of biodiversity and other ecological damages which have been occurred with the current legislation and activities.
4. The poor environmental management practices by the petroleum industries and the failure of Nigeria's Environmental Regulations contributed to environmental contamination and degradation with direct consequences on the surrounding populations' socio-economic wellbeing, human health and the environment at large.
 - (a) The laws are being left in the mercy of voluntary compliance instead of using a stiff enforcement and monitoring mechanism with large sanctions for non adherence and compliance.
 - (b) Environmental regulators in the oil and gas sector do not think that stiff and proper environmental control, regulation and management of impacting activities can be extremely important ways of averting or limiting the most pressing threats to health and the environment caused by oil and gas developments.
5. The social and environmental cost of oil production in the Niger Delta region has been extensive and unprecedented. The petro-businesses have caused destruction of wildlife and flora, loss of biodiversity and deforestation, loss of arable lands for agriculture, water and air pollution, damage to aquatic ecosystem and heritage, socio-cultural desecration and serious human and animal health effects.
6. In the Niger Delta Region, the environmental cost of the activities of the Multinational Oil Companies is borne only by the host communities because the enacted laws are less stringent in application. This situation urgently needs a new approach to the environment and development which meets the needs of the present without compromising the ability of future generations to meet their own needs as declared by "Brundtland Commission" in 1987. This conception of sustainability development brought together equity between generations and equity within generations ("our common future" concept).
7. Although the Nigerian constitution maps out 13% oil derivation to tackle the environmental cost but the agencies set to manage and execute this course

misappropriate the funds. Oil Minerals Producing Areas Development Commission (OMPADEC) and Niger Delta Development Commission (NNDC) are given the mandates to rehabilitate oil communities and to provide a solid foundation for the development of the oil producing states after years of criminal neglect by the Federal Government and the Multinational Oil Firms and liaise with oil companies for pollution control. These commissions are rendered ineffective and inadequate as the environmental degradation continues and social unrest and poverty were created. The inadequacy to implement the constitutional mandates is connected with political influences, endemic corruption and lack of technical know-how, inadequate representation, lack of funds, and other underlying structural problems that render them cosmetic.

8. The Niger Delta Ministry was recently created with the mandate “to facilitate rapid and sustainable development of the Niger Delta into a region that is economically prosperous, socially stable, ecologically regenerative and politically peaceful”. However, the road map towards environmental sustainability of the region is yet to be achieved.

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APPENDIX

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<http://www.legaloil.com/download%20file/ASSOCIATED-GAS-RE-INJECTION-ACT.pdf> (**Associated Gas-Injection Act**)

<http://laws-lois.justice.gc.ca/PDF/C-8.5.pdf> (**Canada Petroleum Resources Act**)

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F (Directive 2013/30 EU of European parliament and the council on safety of offshore oil and gas operations and amending Directive 2004/35/EC)

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<http://faolex.fao.org/docs/pdf/nig18376.pdf> (**FEPA Decree 58 1988**)

<http://faolex.fao.org/docs/pdf/nig120569.pdf> (**NESREA ACT, 2007**)

<http://faolex.fao.org/docs/pdf/nig120683.pdf> (**PDPR**)

[http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=32](http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=32) (**Texas Railroad Commission**)

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<http://www.nigerialaw.org/Environmental%20Impact%20Assessment%20Decree%20No.%2086%201992.htm> (**The Nigerian EIA ACT 1992**)

<http://www.placng.org/new/laws/P10.pdf> (**Nigerian Petroleum Act, 1969**)

<http://www.un.org/en/universal-declaration-human-rights/> (**Universal Declaration Human Rights**)

<http://www.epw.senate.gov/opa90.pdf> (**US Oil Pollution Act, 1990**)