

1.0 INTRODUCTION

Oil spillage is a global issue that has been occurring since the discovery of crude oil, which was part of the industrial revolution. The total spillage of petroleum into the oceans, seas and rivers through human activities is estimated to range 0.7-1.7 million tons per year (www.science.irank.org). Oil spills have posed a major threat to the environment of the oil producing areas, which if not effectively checked can lead to the total destruction of ecosystems. The Niger Delta is among the ten most important wetland and marine ecosystems in the world. The oil industry located within this region has contributed immensely to the growth and development of the country which is a fact that cannot be disputed but unsustainable oil exploration activities has rendered the Niger Delta region one of the five most severely petroleum damaged ecosystems in the world. Studies have shown that the quantity of oil spilled over 50 years was a least 9-13 million barrels, which is equivalent to 50 Exxon Valdez spills (FME *et al.*, 2006).

In 1956, Shell British Petroleum (now Royal Dutch Shell) discovered crude oil at a village Oloibiri in Bayelsa state located within the Niger Delta of Nigeria (Onuoha, 2008) and commercial production began in 1958. As of 2006, there are eleven (11) oil companies operating one hundred and fifty- nine (159) oil fields and one thousand four hundred and eighty-one (1,481) wells in the Niger Delta in Nigeria (The Guardian, 2006). Human activities and those of oil exploration and exploitation raise a number of issues such as depletion of biodiversity, coastal and riverbank erosion, flooding, oil spillage, gas flaring, noise pollution, sewage and wastewater pollution, land degradation and soil fertility loss and deforestation, which are all major environmental issues. Oil exploration and exploitation has been ongoing for several decades in the

Niger Delta. It has had disastrous impacts on the environment in the region and has adversely affected people inhabiting that region. Odeyumi and Ogunseitan (1985) wrote a paper on the growth and development of the oil and petrochemical industry in Nigeria with emphasis to the notable cases of pollution disturbances during the 25 years of its existence, highlighting causes and effects on the social, economic, agricultural and ecological characteristic on human and other biotic occupants of the oil region. Recommendations were given as guide, for the activities of the Nigerian National Petroleum Corporation (NNPC) in the prevention, control, treatment of oil and petrochemical pollution. Celestine (2003) discussed the effects of intensive oil resource extraction on the environment of the oil bearing Niger Delta communities and environmental problems such as resource degradation, pollution and poverty in the Niger Delta communities. Tolulope, (2004) wrote on the oil spillage incidences in Nigeria with its negative implication to the environment, emphasizing on the extent of hazards and the tendency of petroleum products to pollute the environment. Twumasi and Merem, (2006) explored the application of GIS and remote sensing in the tropical coastal zone environment with emphasis on the environmental impact of development in the Niger Delta region. The paper presented a vivid overview of issues, environmental effects and factors. The results showed decline in water bodies, mangrove forest and several cases of oil spills. Chukuezi, (2006) wrote a paper on the implications of oil exploration and environmental degradation to sustainable development in the Niger Delta. Explaining this has culminated into poverty, restiveness and human insecurity in the region.

2.0 HISTORY OF OIL EXPLORATION AND EXPLOITATION IN THE NIGER DELTA REGION

The British discovered oil in the Niger Delta in the late 1950s and crude oil was discovered in commercial quantity by the Shell British Petroleum, which is now called Royal Dutch Shell at Oloibiri. A village in the Niger Delta and in 1958 commercial production began with a production of about 6,000 barrels a day (Uyigüe and Ogbibu, 2007; Nwilo and Badejo 2005a). The region has huge oil and gas reserves, and ranks the sixth world's largest exporter of crude oil and ranked as the third world's largest producer of palm oil after Malaysia and Indonesia (Omofonmwa and Odi, 2009). Oil from the Niger Delta region accounts for more than 90% of Nigeria's exports and about 80% of the government's revenue, from as far back as December 1981. In these present times the overall contribution of the oil sector to the national economy grew from 84% in 2000 and 95% in 2002 to about 96.7% in 2003 (Twumasi and Merem, 2009). The Niger Delta region has emerged as one of the most ecologically sensitive regions in Nigeria. Oil and gas from the region are the main source of revenue for the Nigerian state, accounting for about 97% of the country's total export. Since the discovery of oil in the region, oil has dominated the country's economy. The Niger Delta is highly susceptible to adverse environmental changes, occasioned by climate changes because it is located in the coastal region. Conclusive reports have stated that due to oil exploration and exploitation activities, the area has become an ecological wasteland.

3.0 OIL SPILLAGES IN NIGER DELTA

An estimated 9 million- 13 million (1.5 million tons) of oil has been spilled in to the Niger Delta ecosystem over the past 50 years; 50 times the estimated volume spilled in Exxon Valdez oil spill in Alaska 1989 (FME, NCF, WWF UK, CEEESP-IUCN 2006). The first oil spill in Nigeria was at Araromi in the

present Ondo state in 1908 (Tolulope, 2004). In July 1979 the Forcados tank 6 Terminal in Delta state incidence spilled 570,000 barrels of oil into the Forcados estuary polluting the aquatic environment and surrounding swamp forest (Ukoli, 2005; Tolulope, 2004). The Funiwa No.5 Well in Funiwa Field blew out an estimate 421,000 barrels of oil into the ocean from January 17th to January 30th 1980 when the oil flow ceased (Ukoli, 2005; Gabriel, 2004; Tolulope, 2004), 836 acres of mangrove forest within six miles off the shore was destroyed. The Oyakama oil spillage of 10th may 1980 with a spill of approximately 30,000bbl (Ukoli, 2005). In August 1983 Oshika village in River state witnessed a spill of 5,000 barrels of oil from Ebocha-Brass (Ogada-Brass 24) pipeline which flooded the lake and swamp forest, the area had previously experienced an oil spill of smaller quantity; 500 barrels in September 1979 with mortality in crabs, fish and shrimp. Eight months after the occurrence of the spill there was high mortality in embryonic shrimp and reduced reproduction due to oil in the lake sediments (Gabriel, 2004). The Ogada-Brass pipeline oil spillage near Etiana Nembe in February 1995 spilled approximately 24,000 barrels of oil which spread over freshwater swamp forest and into the brackish water mangrove swamp.

The Shell Petroleum Development Company (SPDC) since 1989 recorded an average of 221 spills per year in its operational area involving 7,350 barrels annually (SPDC Nigeria Brief, May 1995:3). From 1976-1996 a total of

4647 oil spill incidences spilling approximately 2,369,470 barrels of oil into the environment of which 1,820,410.5 (77%) were not recovered. Most of these oil spill incidences in the Niger Delta occur on land, swamp and the offshore environment (Nwilo and Badejo 2005a, 2005b, 2004; Twumasi and Merem, 2006; Uyigue and Agho 2007). NNPC estimates 2,300 cubic meters of oil

has spilled in 300 separate incidences annually between 1976-1996 (Twumasi and Merem, 2006).

4.0 CAUSES OF OIL SPILLAGES IN NIGER DELTA

Oil spills are a common event in Nigeria. Half of all spills occur due to pipeline and tanker accidents (50%), other causes include sabotage (28%) and oil production operations (21%), with 1% of the spills being accounted for by inadequate or non-functional production equipment. Corrosion of pipelines and tankers is the rupturing or leaking of old production infrastructures that often do not receive inspection and maintenance (Baird, 2010).

A reason that corrosion accounts for such a high percentage of all spills is that as a result of the small size of the oilfields in the Niger Delta, there is an extensive network of pipelines between the fields, as well as numerous small networks of flowlines—the narrow diameter pipes that carry oil from wellheads to flowstations—allowing many opportunities for leaks. In onshore areas most pipelines and flowlines are laid above ground. Pipelines, which have an estimate life span of about fifteen years, are old and susceptible to corrosion. Many of the pipelines are as old as twenty to twenty-five years (Perception and Reality, 2010).

Shell admits that "most of the facilities were constructed between the 1960s and early 1980s to the then prevailing standards. SPDC [Shell Petroleum and Development Company] would not build them that way today." (Anderson, 2005). Sabotage is performed primarily through what is known as "bunkering", whereby the saboteur attempts to tap the pipeline. In the process of extraction

sometimes the pipeline is damaged or destroyed. Oil extracted in this manner can often be sold.

Sabotage and theft through oil siphoning has become a major issue in the Niger River Delta states as well, contributing to further environmental degradation (Bogumil, 2017). Damaged lines may go unnoticed for days, and repair of the damaged pipes takes even longer. Oil siphoning has become a big business, with the stolen oil quickly making its way onto the black market (Perception and Reality, 2010).

While the popularity of selling stolen oil increases, the number of deaths are increasing. In late December 2006 more than 200 people were killed in the Lagos region of Nigeria in an oil line explosion (CNN, 2006; "Standing Up To Big Oil, 2010).

Nigerian regulations of the oil industry are weak and rarely enforced allowing, in essence, the industry to self-regulate (Shell International Petroleum Company, 1995).

5.0 EFFECTS OF OIL SPILLAGE

Oil spillage has a major impact on the ecosystem into which it is released and may constitute ecocide (Shell International Petroleum Company, 1995). Immense tracts of the mangrove forests, which are especially susceptible to oil (mainly because it is stored in the soil and re-released annually during inundations), have been destroyed. An estimated 5 to 10% of Nigerian mangrove ecosystems have been wiped out either by settlement or oil. The rainforest which previously occupied some 7,400 km² of land has disappeared as well (Shell International Petroleum Company, 1995).

Spills in populated areas often spread out over a wide area, destroying crops and aquacultures through contamination of the groundwater and soils. The consumption of dissolved oxygen by bacteria feeding on the spilled hydrocarbons also contributes to the death of fish. In agricultural communities, often a year's supply of food can be destroyed instantaneously. Because of the careless nature of oil operations in the Delta, the environment is growing increasingly uninhabitable (CNN, 2006; "Standing Up To Big Oil, 2010).

People in the affected areas complain about health issues including breathing problems and skin lesions; many have lost basic human rights such as health, access to food, clean water, and an ability to work (Raymond, 2013).

On January 30, 2013, a Dutch court ruled that Shell is liable for the pollution in the Niger Delta (Nwilo *et al.*, 2007).

5.1 Loss of mangrove forests (Deforestation)

Vegetation in the Niger River Delta consists of extensive mangrove forests, brackish swamp forests, and rainforests. The large expanses of mangrove forests are estimated to cover approximately 5,000 to 8,580 km² of land (Janice, 2007). Mangroves remain very important to the indigenous people of Nigeria as well as to the various organisms that inhabit these ecosystems.

Human impact from poor land management upstream coupled with the constant pollution of petroleum has caused five to ten percent of these mangrove forests to disappear. The volatile, quickly penetrating, and viscous properties of petroleum have wiped out large areas of vegetation. When spills occur close to and within the drainage basin, the hydrologic force of both the river and tides force spilled petroleum to move up into areas of vegetation (Janice, 2007).

Mangrove forests are included in a highly complex trophic system. If oil directly affects any organism within an ecosystem, it can indirectly affect a host of other organisms. These floral communities rely on nutrient cycling, clean water, sunlight, and proper substrates. With ideal conditions they offer habitat structure, and input of energy via photosynthesis to the organisms they interact with. The effects of petroleum spills on mangroves are known to acidify the soils, halt cellular respiration, and starve roots of vital oxygen (Conservation Foundation, 1996).

5.2 Depletion of fish populations

The fishing industry is an essential part of Nigeria's sustainability because it provides much needed protein and nutrients for people, but with the higher demand on fishing, fish populations are declining as they are being depleted faster than they are able to restore their number. Fishing needs to be limited along the Niger River and aquacultures should be created to provide for the growing demand on the fishing industry. Aquaculture allows for fish to be farmed for production and provide more jobs for the local people of Nigeria (Janice, 2002).

Overfishing is not the only impact on marine communities. Climate change, habitat loss, and pollution are all added pressures to these important ecosystems. The banks of the Niger River are desirable and ideal locations for people to settle. The river provides water for drinking, bathing, cleaning, and fishing for both the dinner table and trading to make a profit. As the people have settled along the shores of the rivers and coasts, marine and terrestrial habitats are being lost and ecosystems are being drastically changed. The shoreline along the Niger River is important in maintaining the temperature of the water because the

slightest change in water temperature can be fatal to certain marine species. Trees and shrubs provide shade and habitat for marine species, while reducing fluctuation in water temperature (World Wildlife Fund, 2006).



Figure 8: Ogoniland showing gas flaring at one of the oil facilities.

Source: www.unep.org October 2009

5.3 Water hyacinth invasion

Water hyacinth is an invasive species that was introduced into Africa as an ornamental plant, and which thrives in polluted environments. Water hyacinth

has the capability to completely clog the waterways in which it grows, making it nearly impossible to navigate fishing boats (Friends of the Earth, 2004). In recent years it has found its way into the Niger River, choking out both sunlight and oxygen to the marine organisms that live there.

When a species such as water hyacinth makes its way into the ecosystem, it competes with native plants for sunlight, diminishing energy resources within the marine environment. With the loss of energy some populations will not be able to survive, or their numbers may drop beyond a point of no return, creating a threatened environment. Added to the loss of energy, water hyacinth also takes up and depletes the water of oxygen which is essential to the livelihood of all marine organisms (Friends of the Earth, 2004)..

5.4 Natural gas flaring

Nigeria flares more natural gas associated with oil extraction than any other country, with estimates suggesting that of the 3.5 billion cubic feet (100,000,000 m³) of associated gas (AG) produced annually, 2.5 billion cubic feet (70,000,000 m³), or about 70%, is wasted by flaring (World Bank, 2008). This equals about 25% of the UK's total natural gas consumption and is the equivalent to 40% of Africa's gas consumption in 2001. Statistical data associated with gas flaring are notoriously unreliable, but Nigeria may waste US\$2 billion per year by flaring associated gas (Friends of the Earth Nigeria, 2008).

Flaring is done as it is costly to separate commercially viable associated gas from the oil. Companies operating in Nigeria also harvest natural gas for commercial purposes but prefer to extract it from deposits where it is found in isolation as

non-associated gas. Thus associated gas is burned off to decrease costs.

Gas flaring is generally discouraged as it releases toxic components into the atmosphere and contributes to climate change. In western Europe 99% of associated gas is used or re-injected into the ground. Gas flaring in Nigeria began simultaneously with oil extraction in the 1960s by Shell-BP. Alternatives to flaring are gas re-injection or to store it for use as an energy source. If properly stored, the gas could be used for community projects (Friends of the Earth Nigeria, 2008).

Gas flaring releases of large amounts of methane, which has a high global warming potential. The methane is accompanied by the other major greenhouse gas, carbon dioxide, of which Nigeria was estimated to have emitted more than 34.38 million metric tons of in 2002, accounting for about 50% of all industrial emissions in the country and 30% of the total CO₂ emissions. While flaring in the west has been minimized, in Nigeria it has grown proportionally with oil production (Agency for Toxic Substances and Disease Registry, 2007).

5.5 Acid rain

Acid rain is another problem within the Niger Delta region caused by gas flaring which has led to loss in biodiversity, with forest and economic crops being destroyed. The dominance of grasses and shrubs in some parts of the region is indication of loss of natural forest, this may be due to acid rain but other factors maybe the cause such as agricultural activities and the exploration and exploitation of oil companies (Uyigue and Agho, 2007; Opukria and Ibaba, 2008). The concentration of acid in rain water appears to be higher in the Niger Delta region and decreases further away from the region (Uyigue and Agho, 2007).

The heat generated from gas flaring kills vegetation around flaring area, destroys mangrove swamps and salt marshes, suppresses the growth and flowering of some plants, induces soil degradation and diminishes agricultural productivity (UNDP, 2006; Mba, 2000:223). A study by Salau (1993) and Adeyemo (2002) about the impact of gas flaring on agriculture showed a direct relationship between gas flaring. Gas flaring is related oil spillage and UNDP, 2006 estimates that Nigeria flares 75% of the gas it produces which is more than any other country in the world.

5.6 Toxicity to humans

Apart from the above issues the toxicity to humans causing respiratory illness, leading to kidney disease, neurological disease and potential death (Ndubisi and Asia 2007). Oil exploration and exploitation activities such as this have significantly contributed to the environmental degradation of the Niger Delta region in spite of government measures to stop gas flaring by 2008 and the existence of monitoring agencies, regulations and standards, the flaring activities in the area is still a problem. Gas flaring in the area is a major source of CO_x, NO_x, SO_x and particulate matter and the cumulative environmental impact of these flaring activities result in contaminant build up on land, shallow ground water, greenhouse effect and general global warming and have also caused high concentration of acid rain within the region.

6.0 REMEDIES OF OIL SPILLAGE

The use of biological remediation has also been implemented in areas of the delta to detoxify and restore ecosystems damaged by oil spills. Bioremediation involves biological components in the remediation or cleanup of a specific site. A study conducted in Ogbogu located in one of the largest oil producing regions of

Nigeria has utilized two plant species to clean up spills. The first stage of cleanup involves *Hibiscus cannabinus*, a plant species indigenous to West Africa. *H. cannabinus* is an annual herbaceous plant originally used for pulp production. This species has high rates of absorbency and can be laid down on top of the water to absorb oil. The oil saturated plant material is then removed and sent to a safe location where the hydrocarbons can be broken down and detoxified by microorganisms. The second stage of bioremediation involves a plant known as *Vetiveria zizanioides*, a perennial grass species. *V. zizanioides* has a deep fibrous root network that can both tolerate chemicals in the soil and can also detoxify soils through time requiring little maintenance. The people of Ogbogu hope to use these methods of bioremediation to improve the quality of drinking water, soil conditions, and the health of their surrounding environment.

7.0 CONTROL OF OIL SPILLAGES

Oil spillage can be controlled through the following ways:

1. Illegal bunkering activities should be checked
2. Pipeline vandalism should be avoided
3. Government should establish security outfit that will check the activities of hoodlums on oil wells and pipelines
4. Pipeline installation companies should also use quality materials that can resist rusting during installing
5. Movement should also be restricted around pipelines

8.0 CONCLUSION

Oil exploration in Nigeria has had severe environmental and human consequences for the indigenous people who inhabit the area surrounding oil extractions. The social and environmental cost of oil production has been

extensive. They include destruction of wildlife and biodiversity, loss of fertile soil. Pollution of air and drinking water, degradation of farmland and damage to aquatic ecosystem, all of which have caused serious health problems for the inhabitants of the area surrounding oil production.

Environmentalists and people generally give blame to the oil companies but the Federal Government provides the laws, legislations and license, which the oil companies must adhere to. The Federal Government has to take steps, which they have started with NOSDRA, NDDC, UNEP, UN SPDC and NGOs. Improvement has begun in terms of achieving sustainable development in the Niger Delta, the government should continue to allocate more revenue into the Niger Delta for steps toward finding a permanent and lasting solution.

9.0 RECOMMENDATIONS

1. The roles and responsibilities of all the stakeholders in the monitoring and control of oil exploration and exploitation activities in the region must be clearly defined.
2. In addition, the communities through 'Oil Spill Monitoring and Control Committees' should educate their people on the need to stop 'sabotage induced spills' by making them realise that any damage to the environment is a damage to oneself; which can never be fully repaired.
3. However, any offender caught should be prosecuted according to the provisions of the law of the land.
4. Another approach is to ensure that indigenous oil companies should be given priority in securing licenses to operate in the Niger-Delta region during a bidding process organised by Directorate of Petroleum Resources (DPR).
5. This will reinforce their commitment as stakeholders as well as act as a palliative measure towards achieving peace in the region.

6. The government should mandate all the oil companies operating in the region to embark on the continuous provision of infrastructure (such as water, good roads, electricity, health facilities, schools, markets, etc) for the host communities. Compulsory life insurance schemes must be put in place for the inhabitants of the oil producing areas in addition to the provision of adequate and immediate compensation and clean-up of spills.
7. There is the need for the government to also develop a National Oil Spill Contingency Plan to complete the formation of the "Clean Nigeria" Association by the Oil companies.

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