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Articles

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ENVIRONMENTAL DAMAGE ARISING FROM OIL OPERATIONS IN THE NIGER DELTA REGION OF NIGERIA

Nyekwere Empire Hechime* & Stephen I. Ilesanmi*

ABSTRACT

The oil industry located within the NigerDelta region of Nigeria has contributed immensely to the growth and development of the nation's economy over the past five decades but unsustainable oil prospecting, exploration, development and production activities have rendered this unique part of the country one of the five most severely petroleum damaged ecosystems in the world. The Niger Delta consists of diverse ecosystems of mangrove swamps, fresh water swamps and rain forest. It is the largest wetland in Africa and among the ten most important wetland and marine ecosystems in the world. However, due to oil pollution arising from oil spillage and gas flaring the area is now characterized by contaminated streams and rivers, forest destruction and biodiversity loss. In general, the area is an ecological wasteland. This affects the livelihood of the host communities who depend on the ecosystem services for survival leading to increased poverty, adverse human health effects and socio-economic problems. The government has formulated legislations for protection of the environment from detrimental impacts of oil operations, but these must be made effective in terms of implementation, enforcement and monitoring by responsible agencies. This paper discusses the several impacts that oil exploration and production have had on the environment of the Niger Delta Region of Nigeria, and examines the efforts made by the government and multinational oil companies to remedy the situation.

Key words: Environmental damage; Oil operations, Niger Delta Region, Environmental laws.

1. INTRODUCTION.

Oil is the basis of economic life of Nigeria. Oil exports provide not only a large share of national income, but are also the main foreign exchange earner. Oil, thus, represents a great asset, which could potentially provide all the capital necessary for Nigeria's economic development.[1] On the international level,

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Nigeria is among the world's top 10 oil exporters, and Niger Delta generates a substantial amount of the Nation's production capacity, and houses a significant proportion of the country's oil infrastructure.[2]The Niger Delta region consists of 9 oil–producing states (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Ondo, Imo and Rivers) and 185 local government areas. This region cuts across over 800 oil–producing communities with an extensive network of over 900 producing oil wells and several petroleum production–related facilities.[3]

The ecological zones in the Niger Delta region can be broadly grouped into tropical rainforest in the northern part of the Delta and mangrove forest in the warm coastlines of Nigeria. Mangrove forests and swamps, which are characterized by regular salt–water inundation, lie at the centre of a complex and sensitive ecosystem which is vital to the local economy and accommodates important flora and fauna.[4] The Niger Delta, which is the largest mangrove forest in Africa and the third largest in the world, is the richest part of Nigeria in terms of petroleum resources and diverse natural ecosystems supportive of numerous species of terrestrial and aquatic fauna.[5]

Before the advent of commercial oil production in the Niger-Delta about sixty years ago (in1958), the region was essentially a pristine environment which supported substantial subsistence resources for the mostly sedentary populations. These included among other things, medicinal herbs and barks, fish and shrimp, crabs and clams, wood for energy and shelter, as well as a stable soil for farming and habitat for exotic wildlife. There was the Delta elephant,

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[2]Nelson Takon,'Environmental Damage arising from Oil Operations in Niger Delta of Nigeria: How not to continually live with their Specific Impact on Population and Ecology' (2014)3(9) *International Journal of Development and Sustainability* 1878, 1879.

[3]Aniefiok E. Ite et al., 'Petroleum Exploration and Production: Past and Present Environmental Issues in the Nigeria's Niger Delta' (2013)1(4) *American Journal of Environmental Protection* 78, 80.; Osuji L. C., and C. M. Onojake, 'Trace Heavy Metals Associated with Crude Oil: A Case Study of Ebocha-8 Oil-Spill-Polluted Site in Niger Delta, Nigeria'(2014) 1(11) *Chemistry & Biodiversity*1708.

[4]Aniefiok E. Ite,Ugochukwu C. N. C., and Ertel J, 'Negative Impacts of Oil Exploration on Biodiversity Management in the Niger Delta area of Nigeria'(2008) 26(2) *Impact Assessment and Project Appraisal* 139.

[5]*Ibid*

the white crested monkey, the river hippopotamus, as well as a colorful array of exotic birds, crocodiles, turtles and alligators. The region also accounted for a large percentage of Nigeria's commercial fisheries industry.[6]

Oil as a natural endowment in a particular community, area or region, with its exploration and exploitation is expected to be an abundant blessing to such community, area or region. Unfortunately and regrettably too, oil has turned out to be a curse to the Niger-Delta Region of Nigeria since 1956 when it was first discovered in the region. The inhabitants of the region have been subjected to untold hardship through oil pollution, environmental degradation, destruction of aquatic lives, and other negative activities that are inimical to the existence and survival of the people of the region as a result of oil exploration and exploitation.[7]

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. The Niger Delta consist of diverse ecosystems of mangrove swamps, fresh water swamps, rain forest and is the largest wetland in Africa but due to oil pollution the area is now characterized by contaminated streams and rivers, forest destruction and biodiversity loss,[8] gas flaring that has led to serious atmospheric pollution, ground water and soil contamination, constant heat around the flare pits, which has resulted in the loss of aquatic lives.[9] The exploitative tendencies of the oil firms in plundering for fossil fuel had truncated the sustainability of the Niger-Delta environment.[10]

[6]L. A.Afinotan and V.Ojakorotu,'The Niger Delta crisis: Issues, challenges and prospects' (2009) 3(5)*African Journal of Political Science and International Relations* 191, 194.

[7]Oviasuji P. O. and Uwadiae, J., 'The Dilemma of Niger-Delta Region as Oil Producing States of Nigeria'(2010) 16 *Journal of Peace, Conflict and Development* 110, 110-111.

[8]Adati A. Kadafa,'Environmental Impacts of Oil Exploration and Exploitation in the Niger Delta of Nigeria' (2012) 12(3)*Global Journal of Science Frontier Research Environment & Earth Sciences* 18, 19.

[9]Oviasuji and Uwadiae (n 7) 116.

[10]Odisu T. Andrews, 'The Nigerian State, Oil Multinationals and the Environment: A Case Study of Shell Petroleum Company (SPDC)' (2015) 7(2) *Journal of Public Administration and Policy Research* 24, 25.

2. ENVIRONMENTAL IMPACT AND OIL INDUSTRY ACTIVITIES IN THE NIGER DELTA REGION OF NIGERIA

2.1 Oil Spillage.

An estimated 9 million-13 million (1.5 million tons) of oil has been spilled into the Niger Delta ecosystem over the past 50 years[11] from over 7000 oil spill incidents; a yearly average of about 240,000 barrels.[12]

Thousands of barrels of oil have been spilled into the environment as a result of corroded and ill-maintained oil pipelines and oil tanks in the Delta. Some of these facilities have been in use for decades without replacement or adequate maintenance. Sabotage is another major cause of oil spillage. Organized "oil pirate" groups engage in oil bunkering, stealing Nigeria's crude oil at the phenomenal rate of nearly 300,000 bpd. They damage and destroy oil pipelines in their effort to steal oil from them. Nigeria lost about N7.7 billion in 2002 as a result of oil theft and related pipeline damage.[13]

In Nigeria, 50% of oil spills are due to corrosion, 28% to sabotage and 21% to oil production operations due to engineering drills, inability to effectively control oil wells, failure of machines, and inadequate care in loading and unloading oil vessels.[14] The various causes of oil spills include:

a. **Blow Outs:** Oil well blow out occurs when the well is not kept under control that is to behave in such a way that the hydrostatic mud head counter balances the formation pressure and prevents the formation fluid from entering the well formation during drilling operations.

b. **Sabotage:** When the cause of spill is mischievously deliberate and not accidental.

c. **Corrosion:** When the cause of leakage is rusty equipment.

d. **Equipment Malfunction:** Breakdown and failure of equipment are often the most frequent causes of separator and tank over-flow.

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[11] Kadafa (n 8) 21.

[12] Ordinioha B. and Brisibe S., 'The human health implications of crude oil spills in the Niger delta, Nigeria: An interpretations of published studies' (2013) 54(1) Nigerian Medical Journal 10-11, 10-16 http//:www.nigeriamedj.com/test.asp?2013/54/1/10/108887 accessed 8 March 2017.

[13] Niger Delta Biodiversity Project. UNDP Project Document www.undp.org>undp>projects>NGA accessed 17 October 2016.

[14] *Ibid.*

e. **Operations / Maintenance Error:** Bad oil operation practices like untrained personnel and lack of maintenance of the equipment.

f. Natural causes (rain, flood, etc.)

g. Accident from third party

h. Unknown Causes.[15]

The first oil spill in Nigeria was at Araromi in the present Ondo state in 1908. 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. The Funiwa No.5 Well in Funiwa Field blew out an estimated 421,000 barrels of oil into the ocean. From January 17th to January 30th 1980 when the oil flow ceased, 836 acres of mangrove forest within six miles off the shore was destroyed. The Oyakama oil spillage of 10th May, 1980 spilled approximately 30,000barrels of oil.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 Ogada-Brass pipeline oil spillage near EtiamaNembe in February 1995 spilled approximately 24,000 barrels of oil which spread over freshwater swamp forest and into the brackish water mangrove swamp.[16]

In 1997 and 1998, Shell Petroleum Development Company (SPDC) spilled 106,000 from its installations at Jones creek alone.[17]Shell Petroleum Development Corporation (SPDC) reported that 50,200 and 123,777 barrels of oil were spilled in 1998 and 1999 respectively.[18]In January 1998, Mobil recorded its worst spillage at the Idoho off-shore site which spread within 30 days from Akwa-Ibom to Lagos. Within the first months of 2008 alone, Nigeria recorded 418 cases of oil spills.[19]Records reveal that in 2010 a total of 3,203 cases of oil spills were recorded. These spills have destroyed farmlands, polluted surface and ground waters while fishing, hunting and forest products

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[15]Tosan S. N. Eyitsede, 'Oil Pollution Management and Environmental Assessment in the Niger Delta: A Case Study of Operations of Chevron Nigeria Ltd in Ugborodo Community in Delta State of Nigeria' (2010) 1, 25-26 uir.unisa.ac.za>handle>thesis_eyitsede.s accessed 18 October 2016.;Ordinioha and Brisibe (n 12) 10.

[16]Kadafa (n 11) 21-23.

[17]Afinotan and Ojakorotu (n 6) 194-195.

[18]CelestinaIhayere, Doris F. Ogeleka and Theresa I.Ataine, 'The Effects of the Niger Delta Oil Crisis on Women Folks' (2014) 6(1)*Journal of African Studies and Development* 14, 17.

[19]Afinotan and Ojakorotu (n 17) 194-195.

gathering – the traditional occupations of the Niger Delta peoples – have witnessed drawbacks.[20]The soil, rivers and creeks of Niger Delta, which used to be alkaline in nature 17-40 years ago, have now, become dangerously acidic.[21]

The people in that area run the risk of not having potable drinking water, no good land to farm, no good air to breath, no good sea to fish, no forests to gather firewood because in search for straight lines for easy exploration, trees are cut down and forests destroyed. Majority of the people also have no good house to live in because of flooding and stagnation. The rate of cases of cancer, infertility, leukemia, bronchitis, asthma, still-births, deformed babies and other pollution-related ailments are unusually high in this region.[22]The spills also have negative effects on the marine habitat which has become contaminated. This poses great human health risk from the consumption of contaminated seafood.[23]

2.2 Gas Flaring.

Gas flaring is the burning off of unwanted and unutilized associated gases that are extracted from the innards of the earth along with crude oil. Gas flaring dates back to the inception of oil exploration and production in Nigeria because the Nigerian gas is found in association with crude oil.[24]Natural gas is produced as a by-product of the oil extraction process. Although gas can be captured and used to meet local energy needs or re-injected into the ground, it requires less infrastructural investment for a company to simply ignite it. Nigeria originally fixed 1985 as the deadline forthe end of gas flaring, but the

[20]AkachiOdoemene,'Social Consequences of Environmental Change in the Niger Delta of Nigeria' (2011) 4(2)*Journal of Sustainable Development*123, 125.

[21]Afinotan and Ojakorotu (n 19) 194-195.

[22]Ihayere, Ogeleka and Ataine (n 18) 17.

[23]Twumasi Y and Merem E.,'GIS and Remote Sensing Applications in the Assessment of Change within a Coastal Environment in the Niger Delta Region of Nigeria' (2006) 3(1)*International Journal of Environmental Research & Public Health* 98.

[24]Nwaji, U.E., 2009. 'Gas Flaring: Legal and Environmental Perspective' (2009) 1(1)*Nigerian Journal of Petroleum, Natural Recourses and Environmental Law* 26.

process continues to this day.[25]In many places, gas flaring has occurred '24 hours a day for over 35 years.'[26]

The Energetic Solution Conference (2004) estimates that the Niger Delta region has about 123 gas flaring sites. About 45.8 billion kilo watts of heat are discharged into the atmosphere from 1.8 billion cubic feet of gas daily in the Niger Delta region, leading to temperatures that render large areas inhabitable. UNDP, 2006 estimates that Nigeria flares 75%of the gas it produces which is more than any other country in the world.[27]A report by the Central Intelligence Agency (CIA) indicated that 'everyday, eight million cubic feet of natural gas are burned off in flares that light the skies across the Delta…,[28]

Gas flaring is a serious problem within the Niger Delta region and has led to loss in biodiversity, with forest and economic crops being destroyed. 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.[29]

One study explored the spatial variability effects of gas flaring on the growth and development of common crops in the Delta, including cassava and pepper. The results suggest that a spatial gradient exists in the effects of gas flares on crop development. Retardation in crop development manifests in decreased dimensions of leaf lengths and widths of cassava and pepper crops closer to the gas flare point. Statistical analysis also confirms that cassava yields are higher at locations further away from the flare point. In addition, the amount of starch and ascorbic acid in cassava decreased when the plant is grown closer to the gas flare. High temperatures around the gas flare appear to be the most likely cause of this retardation.[30]

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[25]Lisa Stephens, 'The Illusion of Sustainable Development: How Nigeria's Environmental Laws are failing the Niger Delta' (2011) 3(6)*Vermont Law Review* 387, 393.; D.S.P. Alamieyeseigha, 'The Environmental Challenge of Developing the Niger Delta', in Augustine A. Ikein et al. (eds), 'Oil, Democracy, and True Federalism'(2008) 248, 254.

[26]Lisa Stephens andKaniye S. A. Ebeku, 'Oil and the Niger Delta People in International Law: Resource Rights, Environmental and Equity Issues' (2006) 150 (Quoting D. Robinson, Ogoni: The Struggle Continues (1996) 28.

[27]Kadafa (n 16) 23.

[28]Odoemene(n 20) 125.

[29]Kadafa (n 27) 23.

[30]UNDP Project Document (n 13) 35; Dung, E. J. et. al., 'The Effects of Gas Flaring on Crops in the Niger Delta, Nigeria' (2008) *GeoJournal* 73(4)297.

Much of the vented gas is released as methane, a gas with particularly adverse consequences for global warming[31] and ozone depletion[32] and is a major source of Carbon and other gaseous substances that contaminate the air, land and shallow groundwater resources. Gas flaring also causes acid rain which has rotted corrugated roofs and generated sulphur emissions.[33] Natural gas flares release greenhouse gases into the atmosphere and cause acid rain. Gas flaring has been linked to reduced crop yields, disruption of nocturnal animals, contamination of rain water, and corrosion of tin roofs.[34]

Communities have reported a range of illnesses associated with the pollution caused by gas flaring, including gastrointestinal problems, skin diseases, cancers and respiratory ailments. It is difficult to ascertain how many are specifically caused by the oil and gas industry as these are generally long-term illnesses. A 2001 scientific study of the adverse health effects of gas flaring in Canada lists various cancers, respiratory disease, heart disease, rheumatic disorders and eye problems.[35] In 2005, the Climate Justice Programme and Environmental Rights Action(EJP/ERA) warned that gas flaring in Nigeria can cause leukaemia among populations living close to the flares, citing supporting evidence from the US Environmental Protection Agency. They estimate that around 35,000 people live within a 1.3 km radius and 330,000 people within a 5 km radius of a flow station.[36] Another study carried out in southeastern Nigeria showed evidence of acid rain due to gas flaring, which can contaminate water bodies and soils.[37] In addition to direct health impacts on adjacent communities, gas flaring in Nigeria has also contributed to global greenhouse gas emissions.

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[31] Stephens (n 25).

[32] Yinka, Omorogbe,'Law and Investor Protection in the Nigerian Natural Gas Industry' 14(2)*Journal of Energy and Natural Resources Law*179, 181.; Okorodudu-Fubara, M.T.,'Energy, Oil and Gas and the Environmental' (2006) National Sensitization and Strategy Development forum organized by the National Institute for Policy and Strategic StudiesKuru – Nigeria, 29 – 31, March 2006.

[33] Takon (n 2)

[34] Stephens (n 31)

[35] Baumüller, Heike et al.,'TheEffects of Oil Companies' Activities on the Environment, Health and Development in Sub-Saharan Africa (Chatham House, United Kingdom 2011)23.

[36] *Ibid*, 23; The Climate Justice Programme and Environmental Rights Action, Gas Flaring in Nigeria: Á Human Rights, Environmental and Economic Monstrosity (CJP/ERA /Friends of the Earth Nigeria 2005)

[37] *Ibid*, 23; Akpan, E.R.,'Acidic Precipitation and Infrastructural Deterioration in Oil-Producing Communities of AkwaIbom State: A Case Study of Eket, South Eastern Nigeria' (2003) 2(1)*Global Journal of Environmental Science* 47.

According to OPEC, Nigeria produced a total of 22.8 billion barrels of oil from 1958 to 2003 and from Shell's record, an average of a thousand cubic feet of gas is flared per barrel and when computed, it implies that 22.8 trillion was flared during this period. Anyway, in the mid-nineties 87% of associated natural gas produced in Nigeria was flared before the Nigerian Liquefied Natural Gas Plant commenced production in 1999 as against, 21% rate for Libya, 0.6% for the United States and 4% in the rest of world. Indeed, the gas flared in the country is documented as one of Africa's greatest man-made environmental disasters.[38]

2.3. THE MANGROVE SWAMP: a case for environmental damage from oil activities

Ecologically, mangroves are defined as an assemblage of tropical and semi-tropical trees and shrubs that inhabit the coastal intertidal zone. A mangrove community is composed of plant species whose special adaptations allow them to survive the variable flooding and salinity stress conditions imposed by the coastal environment. Mangroves worldwide cover an approximate area of 150,000 square kilometers (km2) of sheltered coastlines, which is about 50% of their historic range.[39]

Niger Delta's mangrove swamp is known to be part of the world's third largest, after those in South Asia and South America, respectively, and one of the world's listed heritage sites. The forest is 'rich in biodiversity, largely of such low trees as rhizophora and racemosa with their breathing roots standing above the oxygen-deficient mud to absorb air'. Like other forests, the mangrove terrain remains a traditional haven for the production of food and home for fish, shellfish, marine mammals and rapidly expanding shrimp aquaculture in Niger Delta.[40]

The mangrove not only provides shelter, nutrients and nursery for some species of aquatic animals but, also acts as a filter for major towns in Niger Delta, by not only making use of the nutrients but absorbing toxics from moderate but polluted runoff. The forest is also a repository of medicines (principally unorthodox), source of fuel wood and charcoal, timber for industry, and construction materials, such as foundation piling and poles for

[38]Takon (n 33) 1881.

[39]Rebecca Hoff and Jacqueline Michel eds., 'Oil Spills in Mangroves -Planning & Response Considerations' (U.S. Department Of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service 2014) 1.

[40]Takon (n 38) 1885.

riverrinecommunities in the state. Thus the mangrove forest is of huge benefit and economic advantage in the Niger Delta region.[41]

In spite of the forest's inherent resilience arguably, it is one of the most threatened ecosystems in Niger Delta as a result of oil operations. The negative impacts of oil industry activities endangers the mangrove forest via the effects of oil spills, fragmentation by oil pipelines and other petroleum exploration and production activities. The impact of an oil spill on the Delta mangrove swamp depends among other factors, on;

1. The type of oil
2. The volume spilled
3. The nature of the spillage (e.g. continuous or intermittent)
4. The nature and ecological sensitivity of the impacted environment
5. The prevailing meteorological and or oceanographic conditions etc.[42]

Known and potential impacts of oil spill on the Niger Delta mangrove swamp include;

1. Mass mortality and or tainting of fish and other aquatic resources
2. Ground water contamination
3. Abandonment of fishing grounds and associated livelihood pursuits
4. De-vegetation and related ecological damage
5. Loss of biodiversity in breeding grounds
6. Loss of drinking and industrial water source
7. Reduction of land area available for agriculture
8. Increased economic burdens of pollution clean-up, population rehabilitation etc
9. Loss of recreational facilities and aesthetic values of the environment
10. Impairment of human health
11. Worsened rural under-development, poverty and heightened community embitterment.[43]

In environments that are completely aquatic, oil sometimes floats on water surfaces, where it is dispersed to shorelines by wind and wave actions, invariably affecting the mangrove floor. The mangrove ecosystem of the Niger

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[41] *Ibid.*

[42] Prevention of Pollution from Shipping Activities and Strengthening of National and Regional Oil Spill Management Systems in sub – Saharan Africa www.ais.unwater.org>ais>getprojectdoc accessed 15 October 2016.

[43] *Ibid.*

Delta occupies intertidal land in a broad zone of tidal creek behind the barrier islands. This is different from what obtains in some other regions, where mangrove forests occur only as a thin band along the coast and are exposed directly to seawater.[44]Oil pollution in many intertidal creeks has left mangroves denuded of leaves and stems, leaving roots coated in a bitumen-like substance sometimes 1 cm or more thick.

The Delta's aquatic and marine environments have been affected the most by these spills: 25% of the oil spill events have occurred in the Delta's freshwater wetlands, 69% in the offshore environment and only 6% on land. The Delta's critical mangrove belt is literally "caught in the middle:" oil spilled up stream in the freshwater wetland areas is ultimately flows downstream to the mangroves, while wave and tidal action brings oil spilled offshore into the near-shore mangrove estuarine ecosystem. The actual extent of the ecological disaster in the Delta is uncertain. An estimated 10% of Nigerian mangrove ecosystems have been degraded or destroyed by oil pollution. Mangroves are highly susceptible to oil exposure, which can kill mangroves within a few weeks to several months.[45]

Oil spillages remain the major cause of depletion of vegetative cover and the mangrove ecosystem in the Niger Delta of Nigeria. Crude oil contamination of land affects soil mineral and organic matter content, cation exchange capacity, redox properties and PH values. It creates anaerobic conditions in the soil, which – coupled with water logging – may result in accumulation of toxic aluminium and manganese ions. Large areas of the mangrove ecosystem have apparently been destroyed in the Nigerian coastal environment. The mangroves, once a source of both fuel wood for the indigenous people and a habitat for the area's biodiversity is now unable to survive the oil toxicity of its habitat.[46]

Oil-impacted mangroves may suffer yellowed leaves, defoliation, and tree death. More subtle responses include branching of pneumatophores (vertical root structures), germination failure, decreased canopy cover, increased rate of mutation, and increased sensitivity to other stresses. Although oil spills are time-limited events, the effects are aggravated because the oil pollution

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[44]**Osuji L. C.** and **Ezebuiro P. E.**, 'Hydrocarbon Contamination of a Tropical Mangrove Floor in Niger Delta, Nigeria' (2006) 3(3) *Int. J. Environ. Sci. Tech.* 313, 313.

[45]UNDP Project Document (n 30) 33.

[46]Oil Spill Damage on Mangroves in the Niger Delta (Biomass Research Report 1302) in The Impact of Oil Exploration, Extraction and Transport on Mangrove Vegetation and Carbon Stocks in Nigeria (Biomass Research Report 1401 2014) 19-20https://milieudefensie.nl>rapporten>oil... accessed 15 October 2016.

becomes a chronic, annually reappearing threat. In many parts of the Delta, the oily substance is stored in the soil and re-released with each annual flooding event. Reliable, Delta-wide figures on the extent and conditions of mangrove forests are not available.[47]

Mangroves can be killed by heavy or viscous oil that covers the trees' breathing pores thereby asphyxiating the subsurface roots which depend on the pores for oxygen. Mangroves can also be killed through the toxicity of substances in the oil, especially lower molecular weight aromatic compounds, which damage cell membranes in the subsurface roots. This in turn impairs the normal salt exclusion process, and the resulting influx of salt is a source of stress to the plants. The organisms among and on the mangrove trees are affected in two ways. First, there may be heavy mortalities as a direct result of the oil. For example, oil may penetrate burrows in the sediments, killing crabs and worms, or coat molluscs on the sediment surface and aerial roots. Second, dead trees rot quickly, leading to loss of habitat for organisms living in the branches and canopy of the trees, and in the aerial root systems.[48]

A satellite-based study of the Niger Delta revealed that between 1986 and 2003, more than 50,000 acres of mangroves disappeared from the coast, largely because of oil and gas exploration as well as coastal erosions. All these are not only eliminating sustenance means but as a 2006 UN report warns: "pushing the delta towards ecological disaster"[49]

In the scoping report for the Niger Delta Natural Resource Damage Assessment and Restoration Project (the 'Niger Delta scoping report'), a team of experts from Nigeria, the UK and the US convened by the Nigerian Conservation Foundation concluded that: - The damage from oil and gas operations is chronic and cumulative, and has acted synergistically with other sources of environmental stress to result in a severely impaired coastal ecosystem and compromised livelihoods and health of the region's impoverished residents.[50]

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[47] *Ibid*, 34.

[48] Biological Impacts of Oil Pollution: Mangroves. International Petroleum Industry Environmental Conservation Association (IPIECA) Report Series. Volume Four www.ipieca.org> Library 14 October 2016.

[49] Odoemene (n 28)

[50] Heike et al(n 35)17;FMoE et al, Niger Delta Natural Resource Damage Assessment and Restoration Project Phase 1(Scoping Report 2006).

3. Efforts made by the Federal Government of Nigeria in Protecting the Environment

From the commencement of the search for oil in Nigeria, legislations were passed by the Federal Governmentto regulate various petroleum operations in order to safeguard and improveenvironmental quality. These legislations include:

1. Oil Pipelines Act 1956 (amended in 1965);
2. Mineral Oils(Safety) Regulations (1963);
3. Petroleum Production Act (1967);
4. Oil in Navigable Waters Act(1968);
5. Petroleum Acts (1969);
6. Petroleum (Drilling and Production) Regulations (1969);
7. Associated Gas Re-injection Act(1979);
8. Federal Environmental Protection Agency (FEPA) Act of (1988);
9. Harmful Waste (Special Criminal Provisions etc) Decree No. 42 (1988);
10. National Policy on the Environment, 1989 (revised in 1999);
11. Oil Pollution Act (1990);
12. National Environmental Protection (Effluent Limitations) Regulations (1991);
13. Environmental Protection (Pollution Abatement in Industries Generating Wastes) Regulations (1991);
14. Environmental Impact Assessment (EIA) Act(1992);
15. Oil in Navigable Waters Act(1968);
16. Department of Petroleum Resources (DPR) Environmental Guidelines and Standard for the Petroleum Industry in Nigeria (EGASPIN) (2002);
17. National Oil Spill Detection and Response Agency (NOSDRA) Act 2006
18. National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007.

Nigeria has also adopted either by ratification, acceptance, and approval or accessions various international treaties on environmental protection. These international treaties include:

1. African Convention on the Conservation of Nature and Natural Resources 1968
2. International Convention on Oil Pollution Preparedness, Response and Co-operation 1990
3. International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971

4. International Convention on the Prevention of Marine Pollution by the Dumping of Waste and Other Matters 1972
5. Convention on Co-operation in the Protection and Development of Marine and Coastal Environment of West and Central Africa Region 1981
6. Basal Convention on the Control of Trans Boundary Movements of Hazardous Waste and their Disposal 1989
7. The African Charter on Human and Peoples (Ratification and Enforcement) Act 2004
8. International Convention on Civil Liability for Oil Pollution Damage (Ratification and Enforcement) Act 2006

Despite all these laws, the environment has and continues to be degraded by Petroleum exploration activities. On the legal side, a weak legislative framework limits the possibility of meaningful accountability for oil-related environmental degradation.[51]The State has failed to enforce these regulations. Some of these laws do not make sense; for instance the Gas Re-injection Act1979 stipulates a fine of 10 US Cents per 1,000 standard cubic fit of gas flared. This is against the 10 US dollars fine paid in Western world.[52]NOSDRA Act only contemplates two fines: (1) operator failure to report oil spill >> N500, 000 ($3, 125) per day; and (2) failure to clean up oil spill >> N1m ($6, 300) (one-time). The Oil and gas sector are exempted from oversight by National Environmental Standards and Regulations Enforcement Agency (NESREA). Criteria for revocation of oil exploration or production licenses by Ministry of Petroleum do not contemplate environmental harm.[53]

On the practical side looms the issue of regulatory capture – regulatory agencies generally lack structural or actual independence from the regulated sector.[54]The State's regulating agencies in the oil industry-Department of Petroleum Resources (DPR), NOSDRA etc are underfunded to meet the challenges of the industry. They lack the necessary logistics for their operations. They rely on the oil firms for logistics such as aircraft, boat and well equipped laboratories. The interventionist agency of the State such as NDDC has not

[51]Megan S. Chapman and Lawrence B. B. Dube, 'After Bodo: Effective Remedy & Recourse Options for Victims of Environmental Degradation Related to Oil Extraction in Nigeria' (Centre for Environment, Human Rights, and Development (CEHRD) 2015) 16.
[52]Kadafa(n 27) 27.
[53]Chapman and Dube (n 51) 16.
[54]*Ibid*

improved the condition of life in the Niger Delta region because of widespread corruption in the polity.[55]

4. Recommendation and Conclusion.

Petroleum contamination and environmental degradation associated with exploitation and production of petroleum resources has clearly impacted the natural environment, human health and safety, physical and socio–economic environments in the Niger Delta. In addition, unsustainable operational practices by the multinational oil companies and the ineffective government's petroleum development policies has led to more socio–economic problems and complex environmental degradation in the Niger Delta.[56]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 affects the health of the people.[57]

Oil spills and gas flaring have contaminated, degraded and destroyed the mangrove forests and water bodies of the Niger Delta, thereby causing serious destruction of its biodiversity over the years. The Niger Delta mangrove forest is the third largest in the world, and the largest in Africa. The mangrove forests and water systems harbour a vast biodiversity; mangrove forest provides medicines, fisheries, wood for fuel and shelter for the local people. The survival of endangered species including the Delta elephant, the white-crested monkey, the river hippopotamus and crocodiles is increasingly being threatened by oil exploration and exploitation.[58]The harmful effects of oil exploration on the environment are many. Oil spill kills plants and animals in both the lowland forests and the estuarine zone. Oil settles on beaches, damaging organisms that live there; it also settles on the ocean floor and kills benthic organisms such as crabs. Oil poisons algae, disrupts major food chains and decreases the yield of edible crustaceans. It also coats birds, impairing their flight or reducing the insulative property of their feathers and thus making the birds more vulnerable

[55]Kadafa (n 52) 27.

[56]Aniefiok,Ugochukwu and Ertel (n 4) 87.

[57]Adati A.Kadafa,'Oil Exploration and Spillage in the Niger Delta of Nigeria' (2012) 2(3)*Civil and Environmental Research* 38, 49.

[58]Collins N. C. Ugochukwu and Jürgen Ertel, 'Negative Impacts of Oil Exploration on Biodiversity Management in the Niger Delta Area of Nigeria' (2008)26(2) *Impact Assessment and Project Appraisal* 139.

to cold. Oil endangers fish hatcheries in coastal waters and also contaminates the flesh of commercially valuable fish.[59]

There is nowhere in the world where the environmental atrocities and human rights violations associated with the activities of the oil industry can be tolerated; yet they are routinely ignored in the Niger Delta region of Nigeria. The legacy of irresponsible corporate practices and bad government policy on extractive activities has impacted on the people and communities that inhabit the region for decades. Despite the injustice that the people of the Niger Delta have suffered from the extractive industry, neither the government nor the oil companies has paid adequate attention to the environmental impacts of their operations and the human rights abuses done to the people of the region. Even where they claim to have made efforts, it is not sufficient to remedy the adverse impacts of their operations.[60]

RECOMMENDATION

- Revising and updating environmental legislations, reviewing the license of the oil companies and stringent penalties for violations of environmental laws will go a long way in ensuring compliance with environmental laws.
- Proactive and effective enforcement of environmental laws by environmental institutions.
- Adoption of environmentally friendly technology that will minimize impacts of petroleum development on the environment; gas flaring, the gas can be converted to alcohol for diverse uses or used as an alternative energy source.
- Environmental restoration by government and oil companies
- Development of environmental management and research institutions
- Periodic Environmental Impact Statement (EIS) and Environmental Impact Assessment (EIA)

[59] *Ibid.*
[60] Chapman and Dube (n 54) 16.