

ВЛИЯНИЕ ДОБЫЧИ И РАЗРАБОТКИ НЕФТИ И ГАЗА НА ЭКОЛОГИЮ ВОДНО-БОЛОТНЫХ УГОДИЙ РАЙОНА «НИГЕР-ДЕЛЬТА» НИГЕРИИ

INFLUENCE OF PRODUCTION AND DEVELOPMENT OF OIL AND GAS ON ECOLOGY WETLANDS OF THE AREA NIGER-DELTA OF NIGERIA

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Аннотация. Деградация окружающей среды из-за загрязнения углеводородами на протяжении многих лет является неотъемлемой частью деятельности по добыче нефти и газа в Нигерии. Наиболее значительный и крупномасштабный выброс нефтепродуктов и связанных с ними загрязняющих веществ в экосистему происходит через случайные разливы (в виде аварий) и сжигание газа. Было проведено исследование на экологические последствия добычи нефти и газа в нигерийском регионе Нигер-Дельта. Нигер-Дельта представляет собой участок земли, через который река Нигер течет, разделяется и впадает в Атлантический океан. Это географический объект, расположенный на юге Нигерии, где находятся нефтедобывающие штаты Нигерии. Были обсуждены нефтяные деятельности и их экологические последствия, а также меры восстановления экологически пострадавших участков. Устойчивое развитие было рекомендовано в нефтедобывающей сфере страны, чтобы стимулировать экономику и удовлетворять желания жителей общин в сфере защиты окружающей среды.

Ключевые слова: загрязнение нефтью, разлив нефти, деградация земель, экологическая катастрофа, экосистема водно-болотных угодий, нигерийская дельта.

Annotation. Environmental degradation due to hydrocarbon contamination has for many years been an integral part of oil and gas production in Nigeria. The most significant and large-scale removal of oil products and associated pollutants into the ecosystem occurs through accidental spills (in the form of accidents) and gas combustion. A review was carried out on the ecological consequences of oil and gas production in Nigeria's Niger Delta region. Niger Delta is a piece of land through which the River "Niger" flows, bifurcates and delivers into the Atlantic Ocean. It is a prominent wetland region in the south of Nigeria where the oil-producing states of Nigeria are located. Oil activities and their environmental consequences, as well as measures to restore environmentally-affected areas were discussed. Sustainable development was recommended in the country's oil-producing sector to stimulate the economy and meet the wishes of host communities / residents and their environmental quality aspirations.

Keywords: oil pollution, oil spill, land degradation, ecological disaster, wetland ecosystem, Niger-Delta.

Introduction

Over the past four decades, as oil industries spread their operations in the Niger Delta, the physical environment has come increasingly under threat. Ashton-James et al. [1] argued that there is no doubt that the oil industry has a significant adverse environmental impact upon the Niger Delta. This not only damages human ecosystems, leading to deprivation and environmental health problems, but it also distorts social conditions.

According to the World Banks Report of 1995 titled: «National Environmental Action Plan: Towards the Development of an Environmental Action Plan for Nigeria about the oil Industry», oil wells are located throughout the delta areas. Chronic leaks result in widespread destruction of fishing and agriculture resources. Oil exploration has contributed significantly to the deforestation of the state. Between 1979 and 1989 there were 784 reported significant incidents of oil pollution and in some cases, marine life was completely destroyed in the affected areas of Delta, Edo, Akwa Ibom, Cross River, Rivers and Ondo states. Pollution also is attributed to spillage, washing of tankers, dredging, moving of heavy equipment and DE-ballasting [2]. Since Nigeria has a long coastline of oil producing states, this paper evaluates the environmental implications of the exploration and exploitation activities in the coastal region of the country, which are predominantly wetlands, with a view to promoting sustainable development in the region.

The study area

The Niger Delta Area is located in the South-South region of Nigeria, with a total area of 7,722.04 square miles, and located between 4°15'N and 4°50'N and 5°25'E and 7°37'E. The population of the area is about 31 million [3]. The accumulation of marine sediment buildup and fluvial activities during the upper Cretaceous, led to the formation of the Niger Delta, which is typified by widespread interconnectivity of deltaic tributaries, mangrove swamps, flood plains, creeks, and coastal barrier islands. The soils are of fluvial origin, characteristic of the back-swamps soils include peat covered water-logged weighty clay whereas clay and silty-loamy soils found in elevated areas [4]. The region is home to the oil-producing states of Nigeria namely Abia, Akwa Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers. The oil-rich area is home to Nigeria's vast crude oil reserves, which stands at nearly 40 billion barrels excluding its enormous natural gas reserves, which is estimated at approximately 100 trillion cubic feet[5]. The Niger Delta is the world's largest mangrove forest, West Africa's most extensive freshwater swamp forest, Nigeria's last remaining rainforests and one of the continent's remaining sanctuaries of unique wildlife [6]. It is indeed a region of vast human and natural resources.

Environmental degradation resulting from oil production

According to Auko [7], various materials released into the environment in the course of oil production operations include Drill cuttings, drilling mud, and fluids used for stimulating production; Produced fluids, oil and water, and chemicals injected into them to control corrosion or assist the separation of oil from water; and general industrial waste.

Despite careful precautions, accidents do occur periodically in the drilling and exploitation of crude oil. These accidental discharges result from equipment failure and human error. It is known that the majority of oil spills during 1976–1980 occurred through accidental discharges attributed to equipment failure due to malfunctioning, age, overloading, and corrosion or abrasion of machine parts. Nigeria recorded 1,360 oil-spill incidents during 1976–1983 and the total quantity of oil released into the environment was 1,426 million barrels [8]. The occurrence of oil spill incidents and the corresponding volume within the period 1976–1983 are shown in Table 1.

Table 1 – Yearly distribution of oil spills in Nigeria (1976–1983)

S/No.	Year	Number of oil spills	Net volume spills (Barrels)
1	1976	128	20,023
2	1977	104	31,144
3	1978	154	97,250
4	1979	157	630,405
5	1980	241	558,053
6	1981	233	22,840
7	1982	213	33,612
8	1983	130	32,467
Total		1,360	1,425,794

Source: World Bank (1995) [8].

Significant pollutants or pollution indicators for selected sources in the oil industry include drilling mud and cuttings, oil and grease, chlorine, sulphides, turbidity, suspended solids, heat, pH (acidity/alkalinity PH), heavy metals, Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD).

Hydrocarbon Pollution of Soils and Air

Some parts of the Niger-Delta such as Ifie, Warri and Iboko were studied by Ukpong [9] on pollution of soils. These areas were chosen due to the continuous activities of major oil companies in the region. Expectedly, crop-yields were low in affected areas. During exploration for crude oil, dynamites shot into the ground cause uncontrollable gushing to the surface. The flow usually occurs along gradients into creeks or basin wetlands where vegetation is starved of air as anaerobic conditions are created. Where soils are polluted by hydrocarbons, soil organisms are destroyed, decomposition is slowed down, anaerobic conditions are created due to blocking of soil pores and nutrients are depleted. As a result of these, there tends to be a decrease in soil nutrient values as pollution becomes more severe. Increase in pollution leads to decrease in production output of food and cash crops and an overall reduction in financial earnings. Atmospheric pollution arising from gas flaring also affects the soil as rain passes through the atmosphere to soil surfaces. Considerable volumes of petroleum associated acids also find their way into the soil and water channels and affect viable plant growth.

Ecological Effects of Oil Exploration on Man and other Organisms

One of the routine soil and water quality parameters in the Niger-Delta is hydrocarbon. Ukpong [9] investigated the Total Hydrocarbon (THC) levels in some water bodies in the Niger-Delta and came up with the following results.

Table 2 – Total Hydrocarbon (THC) values in Water Samples from Selected Areas in the Niger-Delta

Location		THC (ppm)
Warri River		150,000
Ugbodede Creek		18,000
Ogune Creek		20,000
Edjeba River		60

The results show that hydrocarbon pollution is high and spreads faster in tidal areas. This spread can be phenomenal particularly if the source is offshore and the current is onshore in the direction as is usually the case along the Niger-Delta shoreline. In these polluted waters, sediment and mangrove mud becomes impregnated with hydrocarbons far from the pollution source and the effects include destruction of fish spawning grounds, decline in plankton that fish feed on and destruction of fishing as a profession. Human health in these areas deteriorates proportionately to the level of water pollution. Gas flaring has also been shown to cause infertility problems due to the heat emitted and respiratory problems due to the toxic substances that they breathe in. Other health effects of oil pollution on the community and workers include excessive heat and colds, falls from tall heights, disability from fire and explosion, dermatitis from improper handling of spillage materials, respiratory disorders and carcinogenesis.

Environmental impact of oil spills

Several «blow-outs» at prospecting sites coupled with spillage as a result of damage to pipelines have been reported from time to time in different sites in the oil producing areas of Nigeria [10]. Depending on the level of contamination, natural rehabilitation may take 1 to 25 years. A great percentage of those spills indicated in Table 1 occurred in sensitive environment in onshore and offshore areas of Nigeria. The effects of these spills have been catastrophic in many respects depending on the oil dosage, the type of oil, metrological conditions, physical geography of the area and the biota [7]. Statistics have shown that during 1976–1980, the majority of oil spill incidents occurred in the purely mangrove swamp zones and the offshore areas of the Niger-Delta, which constitute the most productive biological areas. Within six (6) months, mangrove vegetation started dying in the contaminated waters. Crabs, molluscs and periwinkles died while associated fire hazard spreading to about 25 ha of land occurred. Worse still, re-pollution of the top soil from below was noted about two years after the incident while water table was affected across 15.1 ha. From the above analysis, oil pollution whether it is due to a spillage or discharge of crude oil or refined petroleum products may damage the environment in various ways. In water, oil film on the water surface could prevent natural aeration and lead to the death of trapped marine organism. In some cases, fish may ingest the spilled oil or other food materials impregnated with oil and as such become inedible and unpalatable. Oil spill on the land could lead to retardation of vegetation growth for a period of time and in extreme cases, to destruction of vegetation. It could also create potential fire hazard, as in the Oyakamo oil pipeline spillage which rendered the soil unfit for cultivation and polluted about 360 km of salt marshes as reported by Royal Society of London in 1982. It was said that some shell-fish population may require 5 to 10 years to recover from the impact of the spill due to a decrease in the number of reproductive-age shell-fish stocks and an increase in the mortality of larvae setting on the oiled sediments. There were worries on the handling of drilling mud and cuttings, with respect to prohibited points of discharge, handling and disposal of oil-based mud at onshore and offshore locations, handling and disposal of cuttings and methods of sampling and analysis. These environmental problems seem to be well articulated by people in the oil-producing Niger-Delta; for instance Ikporukpo (1988) [12] in the study of two (2) small communities around the Forcados Oil Terminal, 86 % of the respondents in one (Odumodi) identified problems consequent on oil exploration, report oil pollution, among four broad groups of problems as the most important while the corresponding percentage for the other 6 community (Ogulagha) is 45 %.

Again, what we see are poorly designed causeways and canals, constructed to bring in heavy drilling equipment, which had affected the hydrology of the seasonally flooded fresh water swamps and the brackish water of the mangrove forest. Canals disrupt the delicate hydrological system, especially when they are constructed on the border zone between freshwater and brackish water in the riverine areas; as such, they can disrupt the viability of long-established fishing grounds. In the study area, a canal dug by Chevron near one of the oil-bearing communities in Polobubou/Tsekelewu, Warri North local government, Egbema, has reportedly caused accelerated erosion near the sea and has destroyed the local hydrological system by allowing saltwater into previous freshwater areas, thereby creating a saltwater marsh in place of much higher biodiversity freshwater swamp. Since the canalization of the area, salt water from the ocean has completely altered their ecosystem and endangered the communities means of survival; specifically, the traditional fishing ground and source of drinking water have been wiped out.

However, these artificial canals not only allow saline waters of the Atlantic into freshwater sources, they also lead to the scarcity of drinking water and kill many species of plants, animals and fishes. Their construction has precipitously altered the entire ecosystem, as freshwater is destroyed

Recommendations and conclusion

The Oil Spill Management Plan which involves investment in projects for the monitoring, control and clearance of spilled oil is very vital. 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. 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 organized by Directorate of Petroleum Resources (DPR). This will reinforce their commitment as stakeholders as well as act as a palliative measure towards achieving peace in the region. Proposed remediation of affected sites includes clean-up programs and remediation. In the context of the environment, remediation implies attempts to restore by deliberate action, the natural equilibrium condition that has been destroyed [9]; [10]; [12].

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