

CAPTURE FISHERIES/FISH PROCESSING TECHNOLOGY

REVIEW OF CRUDE OIL POLLUTION EFFECTS ON FISH AND FISHERIES OF NIGERIAN WATERS.

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ABSTRACT

This paper reviews some adverse effects of crude oil pollution on fish and fisheries in Nigerian waters. The main causes of spillage include blowout, sabotage, corrosion of pipeline, equipment malfunction, operations/maintenance error etc. There are spillage records from 1976 to 1997 with respect to the yearly oil spill incidents, the sizes of spill in relation to the ecological operational areas and the causes of oil spills in relation to sources of oil spill within oil operation. Based on the observation from the analyses of the spillage reports, several steps were recommended in order to reduce the incident of crude oil spillage in Nigeria petroleum industry for the safety of our fragile water bodies and the fisheries resources stock in them.

INTRODUCTION

Pollution is a process of contaminating a medium (air, water or soil) with impurities to a level of quality that is less desirable. Pollution occurs as a result of anthropogenic activities which concentrate the emission and discharges in areas where people live and work (Odiete, 1999). Anthropogenic emissions and discharge (waste) increases as population increase and industries expands as people become more affluent and lifestyle and wastes increases (Odiete, 1999). When pollutants are introduced into the aquatic environment, the substances may cause hindrance to fishing, impair the quality or use of water, reduction of resources or amenities derived from water (fresh, brackish and salt water) and cause harm, damage or injury to living organisms (Odiete, 1999). Crude oil is one of the most complex mixtures of natural product, extending over a very wide range of molecular weights or structures. It contains hundreds of different hydrocarbons, some sulphur and nitrogen compounds, and metals such as vanadium and chromium (Odiete, 1999). Much of the sulphur in crude petroleum stays with the heavier fractions such as fuel and automotive oil, and less in the volatile fractions such as petrol or gasoline (motor spirit) (Odiete, 1999). Nigeria has a coastal line of about 850 kilometers and continental shelf area of about 41,000sq.km (Powell *et al*, 1985). States that constitute the coastal lines are: Cross Rivers, Akwa-Ibom, Rivers, Bayelsa, Delta, Ondo and Lagos state. Although its exploitation has created some of the largest fortunes and has helped to achieve impressive economic growth and development, it has also generated problems in our environment. In as much as Nigeria continues to rely on crude oil sales as the major means of our national income, the implications are obvious that more oil prospecting activities will continue in our coastal areas and thus more spills will result, since it is impossible to take a drop of crude oil without shedding a bit into our ecological fragile waters. The first crude oil spill in the aquatic ecosystem was noticed in 1895 in London, since then it has become a continuous phenomenon around the world (Vandermeulen, 1987). Spills have been attributed to occur as a result of damaged pipelines, accidents involving barges, roads and rail tankers. After when oil was discovered at Oloibiri in Bayelsa State, it was not until in 1970 when outrageous spills in Nigeria occurred (Ifeadi and Nwankwo, 1987). In 1970, (Shell B.P.Bomu 11 blowout) and 1972 (Safraap, FIF Obogi blowout) occurred which resulted in a mass reduction and decline in the number and type of fish being caught by fishers in the coastal waters of Nigeria.

CLASSIFICATION OF NIGERIAN COASTAL WATERS

The Nigerian shoreline is dominated by extensive stretches of beach areas, barriers ridges, tidal flats and mangrove swamps. Powell *et al* (1985) distinguished three major ecological provinces within the Nigerian coast line, all of which are well developed in Niger Delta. These fresh water flood plains, the brackish water and mangrove swamps, and the marine backed beach-ridge barrier Islands. The author observed like Baker (1981), that the coastal line is highly indented by tidal inlets and estuaries especially along the Niger Delta region. These indentations, due to the in-land waters and for the tributaries of the Niger Delta provide complex pathways for the tidal action of sea water to transport pollutants from off-shore into the brackish and freshwater ecosystem.

FACTORS/CAUSES OF CRUDE OIL SPILLAGES

Crude oil spillages in our environment are caused by so many factors, they include: equipment failure, human errors, transportation operations, collisions and natural disasters (Abowei and Sikoki, 2005). Whatever must have caused the spill, it can be prevented by proper engineering practices, equipment and procedures. The main cause of spill in the Nigerian petroleum industries are not entirely different from what exists in other parts of the world. However, Ifeadi and Nwankwo (1987) observed that there are a few peculiar characteristics of the Nigerian situation.

According to the author, spill in Nigeria are mainly caused by the following: burst/Rupture/ corrosion of flow lines/pipelines, over pressure failures/ over flow of process equipment components, sabotage of well heads and flow lines, hose failures on the SBM/SPM tankers loading system, failure along pump discharge manifolds (vibration effects) and oil well blowouts. Flow line /pipeline leaks have accounted for more than 30% of the total occurrence of oil spill (Powell et al., 1985). Pollution arising from sabotage appears to be peculiar to Nigeria. The motivation for these sabotage can be attributed to three major reasons namely: a wrong sense of revenge, theft and manoeuvres to claim compensation probably because of apparent lack of sensitivities, for the welfare of the people in the polluted area on the part of the operating companies.

EFFECTS ON FISH AND FISHERIES

Crude oil pollution affects fish and fisheries either directly and indirectly. Thus, fishes may respond directly to pollution or pollutants or they may react indirectly to the pollution or pollutants through the changes or alteration in the physical, chemical and biological conditions of water body. The following are some of the effects of crude oil pollution on fish and fisheries:

Settled coating on the bottom sediment may distort fish spawning sites (spawning grounds) which may result in the fish spawning in an unusual area and this may affect the survival of the young for that year (Cheremisinoff and Young, 1975; Abowei and Sikoki, 2005).

Eggs that are already laid may be killed or destroyed completely by the smothering power of the crude oil and this may affect the given year class of fish (Cheremisinoff and Young, 1975).

Local fishing industries are affected as a result of the disappearance of some commercially important fish species (Adeniyi *et al.*, 1983; Ademoroti, 1996).

Extinction of endangered species. The endangered species may outrightly go into extinct, due to the oil pollution (Ezenwa and Ayinla, 1993).

Planktonic organisms are killed and this may affect the fish species because it is their primary source of natural food. As a result hindering their growth and developmental processes (Powell, 1988).

It causes environmental hypoxia. Hypoxia means any condition in which the amount of oxygen is below normal (Odiete, 1999; Edema, 2008).

It causes changes in some physiological parameters in the fish such as swimming stamina, increase or decreases in the metabolic rate, reduce blood oxygen saturation etc. That is to say any level of oxygen below that threshold, the organisms will be expending excess energy to maintain homeostasis and thus, some degree of physiological stress is occurring. This may result to the death of organisms e.g. fish etc.

Gill coating and malfunction. Floating oil on surface waters may coat the gills of fishes and prevent respiration (Odiete, 1999).

Reduction of the number of catch expected by the fishers.

Oxygen Diffusion Prevention: They prevent oxygen from diffusing into the water (Ademoroti, 1996; Abowei and Sikoki, 2005; Edema, 2008).

Fin Erosion and Fin Rot: They may deform fins and inhibit swimming of fishes (Powell, 1987).

Crude oil pollution will impair the quality of the fish products, making it unfit for human consumption.

CONCLUSION

Adequate studies of the impact of crude oil pollution in Nigeria coastal waters have not yet been conducted in most cases of reported oil pollution incidents. One major reason for this is that, they lack basic knowledge on the biology of the ecosystem. This re-emphasizes the need for scientific baseline survey in all operational areas or oil-based industries, as oil spill impact assessment in previous unserved areas presents considerable problems in the selection of reference or control site. Therefore, properly documented baseline data will contribute to an understanding of the ecology of the areas, and would form a temporary control in the event of pollution. One of the common problems in the evaluation in the acute short term impact of oil pollution, especially in mangrove experiment, it shows that trained staff are rarely present when pollution occurs. As observer arriving within a month or even a week after an oil spill cannot make or give an accurate assessment as most molluscs and polychaetes affected would have died within the 1st 72-hour (i.e. 3days) of the spill. Evaluation becomes more difficult in the absence of pre-spill data, although some evaluation is possible by using unpolluted areas with the same hydrographic features as spatial control. The position is, however, improving as some oil companies operating in Nigeria have either completed the baseline surveys for their operational areas or are in the process of doing so, such studies will ensure that with time, proper impact assessments could be carried out.

RECOMMENDATIONS

We, therefore; recommend the following as measures to remedy the problems: oil pipelines under water should be checked on regular basis to avoid oil spillage, the loading and off-loading of crude oil in rivers, oceans or seas should be done carefully to avoid spill, it is also vital to establish procedures for monitoring environmental

consequences of major sites of crude oil exploitation operations with a view to planning appropriate measures to reduce the adverse effects on the environment and aquatic resources or stocks, to safe guide our fisheries resources or stocks in Nigeria coastal waters, will require strict compliance to all environmental laws and regulations by the producers, and product transport merchants, storage depots of the products (crude oil) must be well secured, fishes that are caught from crude oil polluted water bodies should not been eaten because prolonged consumption of infested fish may cause cancer, bronchitis and even heart failure in man, site that is affected by crude oil should be properly treated so that it will not be a continuous source of pollution in that area, the government should enforce the existing laws to its fullness in order to stop or reduce the rate of vandalisation of oil pipelines and the Government and Non-governmental Organisations (NGOs) should educate the public on the danger of oil spillages on the environment.

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Table 1: Some of the sources of oil pollution in the Nigeria National petroleum corporation (NNPC) operational areas.

Activities / Operation	Source of pollution
Exploration	Noise from detonation processes, movement of heavy and light vehicles, rattling of drilling rigs 24 hours daily, problems of disposal of spent lubrications, diesel and domestic wastes, spent drilling mud's and chemicals and well blowouts.
Refining and petro-chemical processes	Effluent discharges, gas-flaring and emissions, tank leakages, -valve malfunctioning and human errors, explosions and fire outbreaks.
Pipeline and product marketing operations (PPMO)	Pipeline leakages and ruptures, tank leakages and overflows, road tanker and sea tanker collision, malfunctioning of valves and pumps at jetties or depots and house ruptures.

Sources :Ifeadi and Nwankwo, 1987.

Table 2: Categorization of oil spills in terms of quantity and type of environment in Nigeria.

Category	Quantity	Type of Environment
Minor	Less than 25 barrels	Inland water
	Less than 250 barrels	On land, off shore or Coastal water
Medium	Between 25-250 barrels	Inland waters
	Between 250-2,500 barrels	On land, off shore or Coastal waters
Major	Over 250 barrels	Inland water
	Over 2,500 barrels	On land, off shore or Coastal waters

Source: Ifeadi and Nwankwo, 1987.

Table 3: Oil spill incidents in Nigeria from 1976 – 1997*.

Year	No. of spills	Volume of spill (bbls)
1976	128	26157
1977	104	32879
1978	152	489294
1979	157	694117
1980	241	600511
1981	238	42722
1982	257	42840
1983	173	48351.3
1984	151	40209
1985	187	11876.6
1986	155	12905
1987	129	31866
1988	208	9172
1989	195	7628.161
1990	160	14940.816
1991	201	106827.98
1992	367	51141.91
1993	428	9752.22