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Environmental Pollution in Relation to Oil Industry: A Case Study of Warri South Local Government Area of Delta State

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Abstract

The study examines some of the operation of the oil industries and their effects on soils of surrounding farm land of Ubeji and Ekpan both in Warri South Local Government Area of Delta State of Nigeria. Soil samples were collected at four different points in the study area; two from soil which have had spillage and two from soil without spillage. The soil samples were tested for the presence and concentration of selected heavy metals. Relevant information for the study was also sought through questionnaires from workers of the oil industry in relation to the polluting potentials of the industrial activities. The results obtained for soils with oil spillage were compared with those without any such occurrence. It was revealed that

variations exist in the concentration level of the heavy metals considered (lead, chromium, cadmium and nickel). Their concentration levels were observed to be relatively higher in soils which have had spillage. Thus, it is evident that the activities of oil industry constitute a threat and if the pollution extent of the area is not checked, the environment, the environment will be highly degraded to the point that human existence will be threatened.

Keywords: Environment, Pollution, Warri South, Oil Industry.

Introduction

The environment is defined as "the condition under which any person or thing lives and is developed, it is also the sum total of influence which modify and determine the development of life and character (Okpor, 2008). The environment of man is all-encompassing; it includes both the physical and human components. The physical components constitute soil, climate, vegetation, minerals and water resources and the physical configuration of the landscape; whereas human environment constitutes mankind and his ability to manipulate and transform the physical environment for comfort (Okpor, 2008).

The environment in recent times has been known to be modified through the activities of man and his technology. As population increases, so does his need for food, shelter, clothing and mineral resources. As world population continues to increase, people have been obliged to live in more marginal areas, so pressure on the environment has intensified thereby creating diverse and related environmental problems particularly via pollution.

Pollution is defined by Robert (1971) "as the contamination of the environment with any material or state of condition that create a stress on or unfavourable situation of an individual or organism, population, community or ecosystem beyond what is found in natural environment condition". Nest (1982) defined environmental pollution as "an undesirable change in the physical and biological characteristics of our air, land, water that may adversely affect human living conditions. Any situation which therefore disturbs in anyway the condition under which any person or thing lives or develop and hamper the development of life and character is environmental pollution.

Oil industries constitute a major source of pollutants to the environment. In most cases, these pollutants are discharged into drains or gutters which finally empty into water bodies or penetrate into adjacent farmlands. These

pollutants constitute a serious threat to the preservation of the quality of the environment and invariably the life of the surrounding populace. FEPA report on the effect of oil pollution in 1999, estimated that about two million tons of oil finds its way into the sea every year. The effect of this will be seen in the quality of safe water that will be available for human and animal consumption. Although, environmental pollution is undesirable and expensive, it is an inevitable consequence of most industrial nations. Oil in Nigeria being the main pivot of economic development and growth, has been accorded a great priority in various national development progrmmes. Since the discovery of oil in the year 1908, the emphasis on oil can never be underestimated as a means of achieving rapid growth in the nation's productive potentials and a way of improving the standard of living of people (Okeke, 1980). In any refinery and production plants, lots of pollutants are produced as a by-products or chemicals and ranges from gaseous, liquid and solid wastes at different stages. These pollutants constitute a threat to the environment and so the oil industry in Warri area is not an exception. It was observed that the activities of the oil industries make a great demand on the environment especially in terms of resource extraction and waste generation. The effect of oil pollution on the environment has given concern in the area following the incidence of oil spillage as a result of tank buckling, leakages due to corrosion, mal operation of line pegging unit and illegal bunkering. The question that agitates their mind is that which is the best solution that can be adopted to check pollution in the area, thus the study is aimed at identifying some of the modes of waste disposal of the oil industry in Warri South Local Government Area in order to assess the effects on the environment in the area.

Study area

The study area is located in the northwestern fringes of the Niger Delta, about a hundred kilometer, south of Benin City. It lies between latitude $5^0$30'N and $5^0$34'N and longitude $5^0$43'N and $5^0$48'E. It is bounded by Ughelli North Local Government area in the East, Ughelli Ughelli North and Burutu Local Government areas in the south, Warri North Local Government Area to the North. Warri is a low lying region, altitude not exceeding 6.10m (12ft) above sea level on the average. The seasonal flooding conditions of swamps and creeks are as a result of the low lying position of the town and its position on the bank of the river. Due to the location of the town, it possesses a vital asset of accessibility to sea, thus making it one of the most important and busy port west of the Niger Delta. The development of the

town can be traced to the activities of the port, which are linked to the activities of the oil industries.

The study area possesses a unique sedimentary basin of the West African continental margin. The Niger Delta is an active sedimentary basin at present and has since Paleocene times pro-graded a distance of more than 200km from the Benin and Calabar flanks to the present Delta (Reyment, 1964). The Delta sediments show an overall upward transition from marine prodelta shale through a sand/shale interval to continental sand.

Depending on sea level changes, local subsidence and sediments are supplied and the delta experiences increase of regression and transgression. The Benin formation is the topmost unit in the Niger Delta. It covers an area extending from west to east across the whole- Niger Delta and southward beyond the present coastline. The old sedimentary rocks of southern region consists of non-fossil ferrous, arkosic gravel poorly sorted, commonly cross-bedded sand stones of probable albian age, derived from the basement complex are found here. The soil that exists here is that of loamy sedimentary, which is prevalent over much of the Niger/Delta. The soil according to genetic classification scheme is the hydromorphic soils; clayed in nature with low organic matter concentration. Surface soils have a grayish colour, although the sub-soil is lateritic with red and yellow fringe. While sand are found when the surface soil is exposed to rain; because they are easily bleached and washed off.

The vegetation of Warri shows patches of the original vegetation cover. The mangrove swamp predominates and clusters everywhere and still exists along water course in some areas. The vegetation zone is mainly mangrove forest lying at an average height of 15-20 meters above sea level, the town is therefore situated in a swampy area surrounded by numerous creeks. The vegetation also boast a wide variety of aquatic plants. The spatial distribution of the natural vegetation in the area like other places can be therefore explained on the basis of the climate of the area. Warri is hot and humid most of the year. This is owing to the fact that it lies within the tropics. The average temperature is 25^0C in the wet months to 32^0C in the short unnoticed dry season. The area possesses a tropical continental climate.

Warri is an area encompasses every aspect of human endeavour. Hence land-use types ranges from industrial, administrative to agriculture etc. the industrial activities include the Warri Refinery and Petrochemical industry (WRPC), Nigeria Gas Company (NGC) and Shell Petroleum Development

Company (SPDC) and a host of other industries whose activities leads to the pollution of the area.

Materials and methods

Soil samples were collected from two locations that has close proximity to the oil companies. The two locations in the study area were each divided into two divisions for the purpose of sample selections. In each of the divisions, samples were selected randomly in a quadrant of 20cm x 20cm at an equidistance point of 10 meters within a predetermined depth of 0-15cm layer from the top soil, being the plough and the average root zone (Omoruyi et al, 2003). The mean of these soil samples were determined and used for the study. The study is based on results of one year investigation of two locations in Warri South Local Government Area of Delta State. The samples collected were placed in a polythene bag and labeled before taken to the laboratory for further processing and analysis. In addition, 50 questionnaires were administered to the workers of the oil companies. The staff were randomly selected based on willingness to respond or accept a set of questionnaires. Soil samples were analysed for the presence of heavy metals (lead, nickel, cadmium and chromium). 3 grams of each soil samples were first digested by subjecting to heat. Thereafter digested samples were passed through a UNICAM 969 Atomic Absorption Spectrophotometer (AAS) using various standard lamps for each element and the absorbance is read off from the (AAS) to give the mean and the concentration of each element in Mg/1. The percentage statistical analysis was adopted to ascertain the various methods of waste disposal employed by the oil companies.

This was done with the view of suggesting possible ways of effective control measures to ensure a sustainable environment.

Results and discussion

Data collected are presented in table 1-5 and discussed below. Table 1 showed the response of the staff of the Warri South oil industry, the major modes of disposal identified include; waste water plant, burying, gas flaring and open-sewer system. Gas flaring is seen to constitute the major form of waste disposal from the industrial activities as 40% of the respondents agreed to this fact. When gas flaring occurs, toxic gases are emitted into the atmosphere, which is subsequently washed down into the landscape in form of acid rain. This goes a long way to contaminate both the soil and water bodies alike. This finding corroborates the view of Awobajo (1981) that toxic

gases emitted into the atmosphere pollute the environment. 28% of the industrial workers admitted that waste is disposed through the waste water plants, while 16% were of the opinion that wastes are disposed by burying. This method have the potential of contaminating the soil of the area, this is made possible following the seepage of the buried waste deeper into the profile, as asserted by Abibueze (1992). Again, 16%, through open sewer system; when this happens the toxins from the waste tend to seep into the soil profile and the water bodies are contaminated (Anibueze, 1992).

Table 2-4 reveals that differences exist in the concentration of heavy metals: Lead, Cadmium, Nickel and Chromium in the soil of the area. The concentration of chromium in location A (Ubeji) where oil spills have occurred was estimated to be 1.768mg/1 while the sample from the control site, chromium was below detection. Lead concentration was 0.921mg/1, and the value from control site was 0.411mg/1, that is, a difference of 0.51mg/1. Lead is contained in crude oil, thus when crude oil spills on the soil, lead is also deposited on the soil, the difference in the concentration can be attributed to the amount of spillage or quantity of crude oil spilled on the soil, the concentration can also be attributed to other sources such as batteries deposition etc,. Cadmium concentration was 0.295mg/1and that of control site was 0.016mg/1. The concentration of nickel was 2.281mg/1 and that of control site was 1.410mg/1. The relatively high concentration of these metals in the soil of sample site can be attributed to the activities of oil companies which involve oil spillage, emission of chemicals and gas flaring. The result from the control site rather shows a relatively low concentration of these metals. Thus, there is an indication that the soils are gradually being polluted in areas where oil spills occur and this constitutes a potential hazard. The concentration of cadmium and chromium in location B (Ekpan) where oil spills have occurred was estimated to be 1.450mg/1 and 0.371mg/1 respectively while both elements were below detection level in control site. The reason for the inability of chromium to be detected in control site can be attributed to the fact that oil spillage have not occurred on the soil from which sample was collected. The concentration level of the lead was observed to be 0.987mg/1 and 0.50mg/1 for control site. The presence of lead in location B (Ekpan) though in low concentration may be as a result of other human activities other than oil spillage. Lead may occur in effluence from lead and battery manufacturers or even result from domestic waste containing lead material (Odeyemi and Oguseitan, 1985). The concentration of nickel

was seen to be 2.605mg/1 and 1.50mg/1 for control site. From the result it is also evident that oil pollution is gradually taking its roots in the area.

Locations A and B from Ubeji and Ekpan areas respectively represent areas that have experienced one form of oil spillage or the other. From the results obtained, it can be seen that the level of chromium is higher in Ubeji than Ekpan area with a concentration of (1.768 and 1.450mg/1 respectively). The level of lead, cadmium and nickel however, appears to be relatively higher in Ekpan than Ubeji. This variation in concentration could be attributed to the fact that more spills, leakages or illegal bunkering must have occurred in Ekpan area than in Ubeji area. Moreso, Ekpan is closer to the industrial layout than Ubeji.

The activities of the oil industries have varied impact on the state of the environment by way of posing potential hazard to the air, water or soil. Ugboma (2007) noted that the presence of heavy metal in the soil in relatively high concentration is known to have adverse effects on the growth of plants by causing stunted growth of crops and brings about poor harvest and often changes the taste of many food crops.

Conclusion

This study has examined environmental pollution in relation to oil industries in Warri South Local Government Area. The study revealed that oil industry within the study area constitutes a potential hazard to the surrounding farm lands of Ubeji and Ekpan area of Warri South by way of contributing to the presence and increase concentration of heavy metals in the soil areas sampled. This has affected agricultural activities which is the mainstay of rural economy. The accumulation of these heavy metals if unchecked, may reach a concentration that is dangerous to human health. Therefore, there is the need for both federal and state agencies charged with the study of protecting our environment to come up with enabling environmental legislations that will address the issue of industrial waste.

References

Anibueze, E.P.C. (1992). Promotion of Safety Awareness in the Nigerian Petroleum Industry. *Industrial Engineering Digest* 2:2

Awobajo, A.O. (1981). An Analysis of Oil Spill Incidents in Nigeria 1976-1980. Proceedings of *An International Seminar Warri* 57- 63.

Odeyemi, O and Ogunseitan, O.A. (1985). *Petroleum Industry and its pollution potentials in Nigeria***.** Elsevier Applied Science publishers, England . 223-229.

Okeke, E.I. (1980). Oil in the Nigerian Economy *NAPECTOR* 4th quarter NNPC, Lagos .

Okpor, O.M. (2008). *Tropical Forests Resources;* Idodo Ume Publishers Ltd., 32-46.

Omoruyi , S.A. , Orhue, U.X., Akerobo, A.A. and Aghumien C.I. (2003). *Introduction to Agricultural science* Idodo Umeh Publishers Ltd., 11: 4-7

Reyment, R.A. (1964). *Geological Formations in Nigeria Coasts.* In Rayre, D. (ed) Sedimentary Basin of African coasts

Robert, K. (1971). *Environmental Resource Pollution and Society***.** Murdoch , New York , 236-239.

NEST (1991). Nigerian's Threatened Environment: *A National Profile* Intec Printers Ltd., Ibadan .

Ugboma, P.P. (2007). *Effects of Rice Cultivation on Ndokwa Grassland soils of South Western, Nigeria.* M.Sc Thesis submitted to Department of Geography & Regional Planning, Delta State University, Abraka.

FEPA (1999). *Nigeria's National Agenda 21* FEPA Abuja

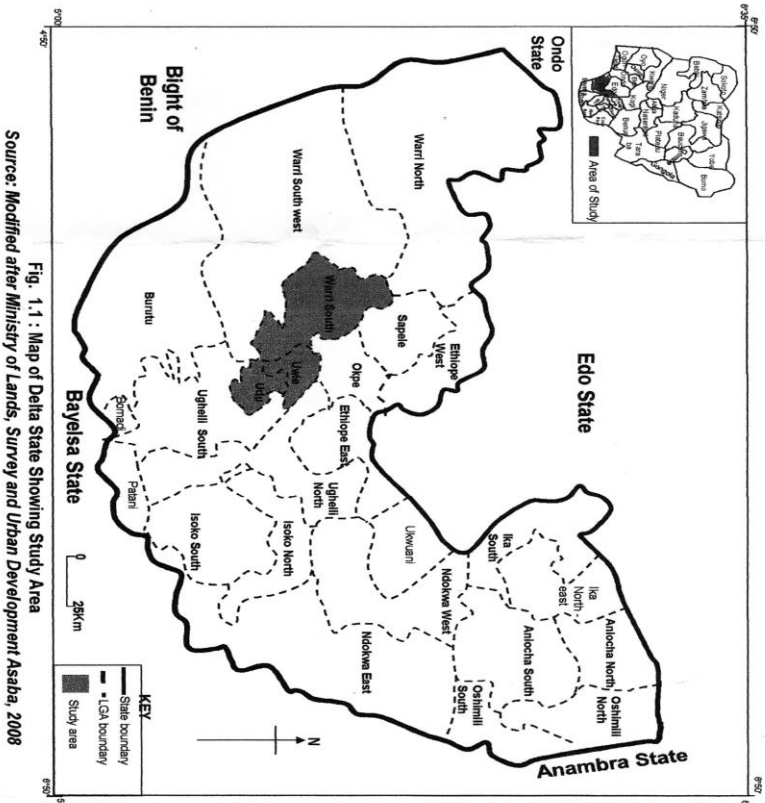

Fig. 1.1 : Map of Delta State Showing Study Area
Source: Modified after Ministry of Lands, Survey and Urban Development Asaba, 2008

Table 1 Methods of Waste Disposal

No.	Methods	Percentage
1	Gas flaring	40%
2	Waste water Plant	28%
3	Burying	16%
4	Open Sewer System	16%

Table 2: Soil Sample Analysis from location A

Location A Ubeji	Element	First signal Abs	Second signal Abs	Mean	Conc. Mg/1
	Chromium	0.035	0.035	0.035	1.768
	Lead	0.009	0.010	0.010	0.921
	Cadmium	0.007	0.007	0.007	0.295
	Nickel	0.040	0.040	0.040	2.281

Source: Field survey 2011

Table 3: Soil Sample Analysis from location B

Location B Ekpan	Element	First signal Abs	Second signal Abs	Mean	Conc. Mg/1
	Chromium	0.029	0.029	0.029	1.450
	Lead	0.007	0.013	0.010	0.987
	Cadmium	0.008	0.009	0.008	0.371
	Nickel	0.046	0.047	0.046	2.605

Source: Field survey 2011

Table 4: Soil Sample Analysis from location A

Location A Ubeji (Control site)	Element	First signal Abs	Second signal Abs	Mean	Conc. Mg/1
	Chromium	--------	--------	--------	Not dictated
	Lead	0.006	0.005	0.006	0.411
	Cadmium	0.004	0.004	0.004	0.016
	Nickel	0.025	0.025	0.025	1.410

Source: Field survey 2011

Table 5: Soil Sample Analysis from location B

Location B Ekpan (Control site)	Element	First signal Abs	Second signal Abs	Mean	Conc. Mg/1
	Chromium	--------	--------	--------	below detection
	Lead	0.003	0.003	0.003	0.501
	Cadmium	--------	---------	--------	below detection
	Nickel	0.014	0.012	0.026	1.500

Source: Field survey 2011

