International Policy Brief Series - Education & Science Journal
Vol. 4 No 1, October 2014
www.internationalpolicybrief.org

EFFECTS OF NNPC PIPELINE OIL SPILLAGE ON THE SURFACE WATER OF MASSIVE COMMUNITY, BENUE STATE-NIGERIA

[1]Yunana Mba Abui, [2]Galadimawa N. H. [3]Markus Bulus & [4]Siaka Stephen
[1&2]Department of Environmental Management, Kaduna State Universit
[3]Department of Architecture, Kaduna State University
[4]Department of Basic and Remedial Studies, Nuhu Bamalli Polytechnic, Zaria

Abstract
The study examined the water quality of River Uji (affected) and Gwer (unaffected) with the view to determine the quality of the water, investigate the causes of oil spillage and the implications on the host communities of Massive. Water samples were collected at four sampling points along each river. The parameters determined were Turbidity, Electrical Conductivity, Nitrate, Sulphate, Bicarbonate and Alkalinity, Total hardness, Total Dissolved Solids, Ammonia, Silica, Cupper, Iron, Lead, Nickel, Manganese, Biological Oxygen Demand, Chemical Oxygen Demand and Oil + Grease. A structured questionnaire was used to collect data on the effects of the oil spillage from five villages within the same geographical region. The results show that most of the parameters observed were highly concentrated above the recommended permissible limit set by WHO. This revealed that the river Uji had become contaminated by the NNPC pipeline oil spillage into it, rendering it unsuitable for human use. The oil spillage has also affected communities' farmlands, crop output and their vegetation adversely. For sustainable management of the water resource, it is recommended that there is the need for the Federal Government and the NNPC to give attention to the oil Pipeline along the host communities. There should be a concerted effort for a periodic data collection from affected areas to assess the damage done to the environment of the people by oil pipeline related disasters. The NNPC should hold regular public enlightenment meetings with the host communities of the oil pipelines to create awareness on the danger of oil pipeline vandalism and how to manage spills caused by eruption of the pipeline. The NNPC should give assistance or pay compensation to victims of oil pollution from pipeline spills. Geographic Information Systems (GIS) could be used to identify oil spill responders and provide information about the closest resources of oil spill response equipment. The use of hyper-spectral imagery to detect oil spills in water and soil is required so that it can be used to monitor oil facilities and thereby prevent worst scenarios when a leak in the facility is found.

ISSN Print: 2315-8425, Online 2354-1660

ESJPRCD: 014:2:4

Keywords: Environment, Degradation, Pollution, Oil Spillage and Surface Water.

Background to the Study

Many developing countries have experienced untold environmental degradation and ecological deterioration in the past century, with little or no real solution to alleviate many of these concerns. Poorly planned human interference has been the major cause. Nigeria has extensive human and natural resources. The exploitation of these resources over the past few decades has left a waste land of environmental problems (Bhatt, 2009).Crude oil has had profound impact on the world civilization than any single natural resource in recorded history (Pyagbara, 2007). Oil keeps the factors of the industrialized countries working and provides the revenues, which enable oil exploiters to execute ambitions, national and economic development plans. Yet behind this deification of oil, nothing is said about its impact on the environment. Oil and gas pipeline projects are known to be possible sources of environmental degradation due to rising rates of vandalism and other causes. It is also known that oil and gas pipeline interdiction is a big social problem in Nigeria (Akpan, 2005).In Nigeria; communities regard their farmlands, forests, and other aspects of their environment as the source of living for their present and future generations. There is therefore, the need for adequate provision to be made to mitigate adverse effects of oil pipelines on the communities they pass through for their present and future generations.

There were many incidences of oil spill in the NNPC oil pipeline within Benue State, having devastating consequences on some host communities of the pipeline (Church, Maria, Scarpered and Middleton, 2004).Information on environmental effects of oil and gas pipeline projects in Nigeria is more important now than ever before. The environment has become an important agenda for every one including the government, oil and gas industry executives, the host communities of oil fields and pipelines and the general public. With all the oil discharge into the river, it is expected that the water would be seriously polluted and would have detrimental effects on the vegetation, fish, crabs and snail.The oil in the river may also prevent the use of it for drinking, irrigation and other domestic purposes as it can negatively affect human health.

Literature Review

Pipeline Projects and Oil Spillage

A pipeline may be defined as a series of pipes that are usually underground used for carrying fluid such as water, oil and gas, among others, over long distances. Pipelines are by far the most economical, practical and safe means of oil and gas transportation. Dubey, (2007), considered pipeline transportation has been save due to their tenfold efficiency over rail/trucking operations and accrue important environmental and safety benefits by reducing the highway congestion, pollution and spill. Pipeline

transportation is most prevalent in USA where nearly two thirds of the tons-mile of oil gets transported annually through a network of more than two million kilometres of pipelines, in some of the toughest terrains, pipelines are used for transmission, distribution and gathering (Dubey, 2007).Pipeline routes passing through usually sensitive areas like water supply reservoirs, populated areas and ecologically sensitive areas need extra precaution against accident and spillage (Church et al, 2004).

Pipeline Oil Spillage and their Effects on the Environment

Non – maintenance and intentional attacks on an existing supply service system, whether considered as sabotage, vandalism or interdiction (Church et al, 2004), pollutes the environment, people living near oil pipeline projects suffer a lot of adverse effects as a result of pipeline oil spillage including their heavy dependence on an ecosystem that could be imbalanced by intrusion of the pipelines and deprivation of their means of livelihood (Anifowoshe, 2008).

In the event of massive oil spill, thousands of people in the area would lose their livelihood and hundreds of plants and animals would be destroyed (Hough, 2001). Oil spills involve the release of dangerous hydrocarbons such as benzene and poly nuclear aromatic hydrocarbons into the soil and water sources. These spillages affect vast stretches of land and waterways thus polluting not only crops but also aquatic life and sources of water for domestic uses. As the spills occur, it spreads onto farmlands and water bodies. The toxic crude seeps into the ground and is taken up by the roots of plants. Recent studies have shown that oil spills lower soil fertility and cause poor growth of plants (Pyagbara, 2007). Contaminated sites by hazardous substance are a major environmental contaminants which can persist for many years in soil and sediments, where they affect health and the environment (Hough, 2001).Oil spills are common events in Nigeria (especially in Niger Delta Region) and occur due to a number of reasons. These include: corrosion of pipelines and Tankers, sabotage, oil producing operations and inadequate or non-functional production equipment (Pyagbara, 2007).

The Study Problem

Nigeria's economy is highly dependent on crude oil. This product has to be transported from the refineries to the major towns and cities in the country. Long distances are involved in most cases and there have been incessant cases of accidents involving petrol piping of such products from one place to another (Anifowoshe, 2008). Non-maintenance and international attacks on an existing supply service system, whether considered as a sabotage, vandalism or intentional, leads not only to loss of critical infrastructure but also pollutes the environment (Anifowoshe, 2008).The Enugu-Makurdi stretch of the NNPC oil pipeline entered Benue State at Utonkon in Ado Local Government Area and passes through Otukpo in Otukpo

Local Government Area, Taraku and many rural communities in Gwer east Local Government Area (Massive Area) and terminates at the April Depot near Makurdi. There have been cases of serious spillages as a result of vadalization and non-maintenance along the Benue pipeline, leading to devastation of farmland, soil, ground and surface water and loss of aquatic life as a result of NNPC oil pipeline spillage.

Due to the oil spillage, the surface waters (rivers) have become seriously dangerous, leading to the accumulation of toxic products in the receiving water bodies with potentially serious consequences on the host communities .Several investigations have shown positive correlation between the pollution and the quantity of the crops as well as the health of the inhabitants, but no in-depth study has been conducted on the water quality of the river in relation to the effects in general .It is important to analyse the water and determine its suitability for domestic, industrial, and agricultural uses. It is also important in water quality studies to know the amount of organic matter present in the system and the quantity of oxygen required for the stabilization of the water. Though some works have been done on the pipeline oil spillage in Massive area, most of the works however, appear rather not comprehensive. These works dealt with the impact of oil spillage on the welfare of the inhabitants. There is therefore, the need to undertake an in-depth study of the Effects of the NNPC Pipeline Oil Spillage on the Surface Water of Massive Area of Benue State

Aim and Objectives

The study is aimed at assessing the effects of the NNPC oil pipeline project on the surface water of Massive communities in Benue State.
This will be achieved through the following objectives:

1 To determine the surface water quality of some selected rivers in the Massive communities.
2 Examine the implications of the oil spillage on the rivers in the Massive communities.
3 Examine the causes of the oil pipeline spillage in Massive area.
4 To assess the effects of the oil spillage on the Massive communities

The Study Area

The study area is located within latitude 70 15'N and 70 39'N and longitude 80 13'E and 80 37'E. The major settlements within the area are Taraku, Shawa, Tse Ugeas, Anzuku, Zuwua, Tse Alem, Abi, Magondo and Mtsuwenem. The area had a population of 38,655 people in 2006 census (National Population Commission, 2006), The area is located in the southern Guinea Savannah region of Nigeria which is characterized by the distinct wet and dry seasons. The mean annual rainfall is 1137mm annually ((Adoga et al, 2005)). The rainy season spans from April to October

and the dry season spans from October to April with the temperature of between 200c - 400c during the dry season. The vegetation of the area is that of the southern guinea savannah vegetation zone, characterized by the secondary forest re-growth interspersed with extensive savannah tall grasses. The prominent among the tree species are Doniclla Oliver, Prosodies Africa and Patricia biglohosa, Androgen gayrus, Andropogon schriensis, Hyperthermia involucrate (Idogh at al, 2005)The relief of the area is a gentle slope to toward the west and spotted isolated highlands of 152m above the sea level (Federal Survey, Nigeria, 1971). The area is underlain by the Awgwu shales. The soil of the area consists of sandy to loamy soils which are moderately acidic in nature (Idoga et al, 2005).The area is drained by river Gwer, Bar, Miche, Akor, Agor, Ansa, Gbaye and Uja. The Enugu-Makurdi NNPC oil pipeline section crosses river Uja, Bundu, Ulabo, Ukor, Okpeli, Gber and Fete. The study area major activities are farming where Yams, Maize, Millet, Soya Beans, Cassava, Groundnuts, Tomatoes and other cereal crops are grown.

Methodology

The study employed two methods in the collection of data. These include the use of surface water samples collection of one oil affected (life) and one unaffected (control) selected rivers to establish the water quality. A structured questionnaire was also used to collect data from five villages located within the affected and five unaffected villages within the same geographical region to establish the effects of the oil spillage on them. The questionnaire sourced information on the respondent's socio-economic characteristics, cases of pipeline vandalization and the effects of the oil spillage on the crops and the lives of the inhabitants of the area. For the surface water sampling, four samples were collected from each river using Grab method. In the affected river (Uja), one sample was collected close to the oil spill sites and labelled 'A1' and three samples downstream at 2km interval each and labelled A2, A3 and A4. The same sampling method was carried in the second unaffected river (Gwer) and labelled B1, B2, B3 and B4.The water samples were stored under cold conditions of lower temperature of 40c and were taken to the National Water Resources Institute Kaduna for analysis.

The water samples were analysed for Turbidity using a HACH 2100 P Turbid meter. Electrical Conductivity was determined with Cybersan 510 conductivity meter. Nitrate was determined using Dionex-80 ion analyser, Sulphate, Bicarbonate and Alkalinity was determined with strong acid titration method. Total hardness, Total Dissolved Solids and Ammonia were determined using Standard method. Silica, Cupper, Iron, Lead, Nickel and Manganese were determined using Atomic Absorption Spectrophotometer. Biological Oxygen Demand, Chemical Oxygen Demand and Oil + Grease were determined using Azide modification of Winkler's method.A total of 100 questionnaires were administered to the oil spillage affected (life) areas and 60 to the unaffected (control) areas using random sampling techniques. The data obtained was analysed using frequencies, tables and percentages.

Results

Surface water Sample Results

The analysis of water samples of Uja (oil affected river) reveals that the value of the temperature at the four sampling point (A1, A2, A3 and A4) was within the acceptable limit of WHO of 300c. It was observed that the values were 29.50c at A1 and A2 while at A3 and A4 was 300c. The results of the water samples of river Gwer (unaffected oil spillage area) have the values of the temperatures within the permissible limit of WHO. All the sampling points recorded the values of 29.50c.The pH of the water samples was found to be 6.80 at A1, A2 sampling point and 5.90 at A3 below the acceptable limit of WHO standard of 6.5 – 8.5. This indicates that the river Uja is acidic in nature except at point A4 downstream where the amount of the oil spills reduces. In comparism with the Gwer (table 2), the values of the pH at the sampling points are within the acceptable limit of WHO. This indicates that the river Gwer is alkaline in nature. This is because less or no acidic substance is discharged into the river from the oil spillage.

The values of turbidity of the water samples of river Uja was observed, at A1, A2 A3 have 21.1UNT and 11.5 at point A4, indicating increase in the pollutants. The result indicates that turbidity of the river Uja is above the accepted limit of WHO standard of 0 -5NTU. River Gwer where oil spillage is affected obtained the same results like that of river Uja (table 2). This is an indication that the source of turbidity of the river is more from other sources than the oil spillage.The results of the Dissolved Oxygen of river Uja at the sampling points was observed to have the values of 0.5mg / l at A1 and A4 and A2 and A3 have the values of 0.2mg / l and 0.3mg / l respectively. The values are within the acceptable limit of WHO standard. In contrast, river Gwer sampling points have the values of 0.2mg / l, 2mg / l, and 2.5mg / l respectively even higher than that of river Uja, though the values are within the permissible limit of WHO standard of 4.0mg / l. The Total Suspended Solid of the water samples of river Uji was found to have values of 825.0mg / l at A1, A2; 600.0mg / l at A3 and 814.0mg / l at point A4. These results rise above the permissible limit standard of WHO of 30mg / l. On the other hand, river Gwer (unaffected river), has the values of 38.0mg / l at B1, 21.0mg / l at B2 and B3 while B4 had 30.0mg / l, where the results fall within the permissible limit of WHO standard of 30mg / l.

The concentration of sulphate in the water samples of the river Uji at sampling point were observed to have the values of 30.0mg / l, 24.6mg / l, 22.8mg / l and 23.6mg / l at A1, A2, A3 and A4 respectively. The values of sulphate parameter are above the permissible limit of WHO standard of 0.2mg / l. Compared with to the values of the water samples obtained at river Gwer. At B1 and B4, the values were 18.4mg / l and B2 and B3, the values were 17.8mg / l and 16.0mg / l respectively. This shows that both at river Uji and Gwer, sulphate substances of pollution had increased tremendously. The results of nitrate in the water samples of river Uji at all the sampling points shows

a high concentration values of 0.9mg/l, 0.4mg/l, 0.32mg/l and 0.28mg/l above the permissible limit standard of WHO of 0.2mg/l. The river Gwer has the same results at all its sampling points. This indicates that there are other sources of nitrate other than the oil spillage into the river.As evident in the levels of metal parameters, the water samples of river Uji have the values within the acceptable limits of WHO standard with the exception of Zinc and Copper which have values of 2.20mg/l 2.10mg/l, 1.86mg/l and 2.0mgl and 1.44mg/l, 1.36mg/l, 1.20mg/l and 1.16mg/l respectively are above the permissible limit of WHO standard of 0.2mg/l. The results obtained in river Gwer show the same pattern with that of Uji where the values of Zinc and Copper exceeded the permissible standard of WHO.

The results of the Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values were above the permissible limit of WHO standard of 4omg/l and 10mg/l respectively both at river Uji and Gwer. The BOD values at river Uji at the sampling points was 222mg/l, 216mg/l, 230mg/l, 196mg/l and COD values was 444mg/l, 432mg/l, 460mg/l and 392mg/l respectively. While the values of river Gwer at the sampling points was 74mg/l, 71mg/l, 68mg/l 72mg/l for BOD and 148mg/l, 142mg/l 136mg/l 144mg/l for COD. The results show that the concentrations of these parameters are found more in river Uji than in river Gwer because of the oil spillage into river Uji. The results of Oil obtained from the water samples of river Uji indicated that the values of oil parameters were higher above the WHO acceptable limit of 10mg/l. The values at the sampling points were 64mg/l, 42mg/l, 16mg/l and 10mg/l. this shows a gradual reduction downstream to 10mg/l at a distance of 6km. At the river Gwer, the values of oil fall within the permissible limit of WHO standard of 10mg/l. It is an indication that river Gwer was not polluted by the oil spillage from the pipeline.

Table 1: Results o f (life) Surface Water Samples of the oil Spillage affected river Uja

PARAMETERS	A1	A2	A3	A4	WHO STANDARD
Temperature 0^0c	29.5	29.5	30	30	30
pH	6.80	5.90	6.80	7.10	6.5 – 8.5
Colour	550	550	451	550	
Turbidity mg/l	21.1	12.1	12.1	11.5	0 – 5
Dissolved Oxygen	0.5	0.2	0.3	0.5	4.0
Total Suspended Solid mg/l	825.0	825.0	600.0	814.0	30
Sulphate mg/l	30.0	24.6	22.8	23.6	0.2
Nitrate mg/l	0.0.9	0.4	0.32	0.28	0.2
Iron mg/l	0.30	0.24	0.22	0.18	0.3
Lead mg/l	0.016	0.014	0.012	0.008	0.05
Mercury mg/l	0.003	0.001	0.001	0.001	0.2
Zinc mg/l	2.20	2.10	1.86	2.00	0.2
Nickel mg/l	0.080	0.050	0.040	0.030	0.2
Copper mg/l	1.44	1.36	1.20	1.16	0.2
BOD mg/l	222.0	216.0	230.0	196.0	10
COD mg/l	444.0	432.0	460.0	392.0	40
Oil mg/l	64.0	42.0	16.0	10.0	10

Table 2: Results of (control) Surface Water Samples of Unaffected River Gwer

PARAMETERS	C1	C2	C3	C4	WHO STANDARD
Temperature 0^0c	29.5	29.5	29.0	29.0	30
pH	7.10	6.60	7.30	7.00	6.5 – 8.5
Colour	246.0	142.0	206.0	243.0	
Turbidity mg/l	21.1	12.1	12.1	11.5	0 – 5
Dissolved Oxygen mg/l	02.3	2.4	2.5	2.5	4.0
Total Suspended Solid	38.0	21.0	21.0	30.0	30
Sulphate mg/l	18.4	17.8	16.0	18.0	0.2
Nitrate mg/l	0.0.9	0.4	0.32	0.28	0.2
Iron mg/l	0.14	0.16	0.12	0.16	0.3
Lead mg/l	0.002	0.000	0.04	0.001	0.05
Mercury mg/l	0.000	0.000	0.000	0.000	0.2
Zinc mg/l	1.64	1.16	1.70	1.42	0.2
Nickel mg/l	0.014	0.010	0.012	0.012	0.2
Copper mg/l	0.84	0.76	0.82	0.74	0.2
BOD mg/l	74.0	71.0	68.0	72.0	10
COD mg/l	148.0	142.0	136.0	1440.0	40
Oil mg/l	1.00	00.0	1.00	1.00	10

The Occurrence and Effects of Oil Spillage from 2005 – 2010 in Massive Communities

This Section explains the occurrence and the effects of the oil spillage from 2005 – 2010 in the communities. The analysis of the data collected from the questionnaire show a record of 34 oil spill cases within the study area from 2000 – 2010. The spills took place in 15 villages within the Massive communities. It was also observed that the causes of the oil spillage were mostly vandalization and physical actions and only one unkown case at Tse Kula Ayar Ubuku.

Table 3: Occurrences and the effects of Oil Spillage from 2005 – 2010 in Massive Communities

Villages	Year	Occurrence	Cause	Effects
Anchiha	2000	7 times	Vandalism	Crops Damage, Surface water, vegetation and reduction of fishes
Tse Uwua Shawa	2002	1 times	Vandalism / physical	Crops Damage, Surface Water, vegetation and reduction of fishes
Tse Ber Tura	2003	2 times	Physical	Crops Damage, Surface water, vegetation and reduction of fishes
Tse okabi / Agula	2004	3 times	Physical	Crops Damage, Surface water, vegetation and reduction of fishes
Tse Nyaku / Akuji	2005	3 times	Physical	Crops Damage, Surface water, vegetation and reduction of fishes
Orwuatsaga Mbasombo	2006	4 times	Vandalism	Crops Damage, Surface water vegetation and reduction of fishes
Tse Tsaikpa Mbaagba	2007	2 times	Vandalism / physical	Crops Damage, Surface water, vegetation and reduction of fishes
Tse Kula Ayar Ubuku	2008	3 times	Unknown	Crops Damage, Surface water, vegetation and reduction of fishes
An shua Mbatsada	2009	5 times	Vandalism	Crops Damage, Surface water, vegetation and reduction of fishes
Tse Ugesa Mbatanyan	2010	2 times	Vandalism / physical	Crops Damage, Surface water, vegetation and reduction of fishes

Discussion of Findings

The results of the water samples presented in table 1 show that river Uji had become contaminated by the oil spillage from pipeline vandalisation. Many parameters measured were high above the standard observed by WHO. The level of the contamination of the water is such that it is no more fit for drinking and to support

aquatic life. The river was observed to be acidic. This is due to the addition of the oil spills into the river. The acidic river is an indication that the river is not good for drinking and is dangerous to some aquatic life and crops.

The river shows a high value of Total Suspended Solid. The high content is believed to be originated from the organic matter from the surroundings. As observed by Dix (2001), that a small amount of suspended solid particles makes water turbid. It has been found to reduce the effects of solar energy absorption resulting in lowering the rate of photosynthesis, reduction in plant growth and slows down natural water purification processes .Sulphate and Nitrate was found to be highly concentrated. This is dangerous to soils, vegetation and human health. The pollutants are in particulate form and when rain falls and the farmlands get flooded and are subsequently irrigated, they sink into the soil to be taken up through the plant Xylem tissue. The plant may grow stunted with broad and green leaves, but eventually produce low yield. These have no much direct effects on the plants but on the consumer that feeds on the plants (Abui, 2013). Fish are known to harbour these toxic pollutants in their organs. Human consumption of these fish possesses some danger for human life (Schwaites, 2008).Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD) are one of the parameters in the pollutants that are highly concentrated in the river Uji. This is an evidence of high concentration of biologically resistant substances as well as organic impurities. It is an indication also that the river exhibits a relatively high proportion of biodegradable substances. This study agrees with that of the World Bank (1998) that these parameters result in Oxygen saturation in the water as a vital factor which affects its support for the aquatic ecosystem.

The high level of the oil creates a film on the water surface, thus preventing aeration and causing environmental destruction of the aquatic lives. The oil in the water prevents direct contact of the water body with the atmospheric oxygen for exchanges. Birds are particularly vulnerable to oil pollution, because they encounter the floating oil on the water surface. With these results obtained, some plants and animals species do not survive, others are reduced in number and some food chain nets are affected. It is obvious that the river cannot be relied upon as a good source for human activities (farming, swimming domestic and industrial uses). According to Pyagbara, (2007), the effects of oil on the aquatic life is determined by the quantity of oil and the duration experienced by the organisms, the state of the oil which might be fresh, weathered or refined products, the season, the habitat and the natural stresses to which the organism is subjected to. His study agrees with the findings of this work. Oil pollution may cause the occurrence of cancer and respiratory problems for man. Other diseases may include skin ailments such as rash and dermatitis, eye problems, gastro-intestinal disorders (Wikipedia, 2011).

The Effects of Oil Spillage in Massive Communities

The results obtained from the questionnaire administration on the effects of the pipeline oil spillage in Massive communities shows that the farmers have been experiencing declining crop outputs from their farmlands over the years. The deteriorating crop outputs according to farmers are attributed to the polluted nature of the water and the soil from the oil spillage. The deposits of oil particulates and other chemicals cause immediate destruction of crops. Farmers complain of the destruction of food crops such as rice, soya beans, guinea corn, maize, yams and cassava .During the interview, the farmers believed that the oil spillage was responsible for the reduction and disappearance and loss of the fish population. They complained that the fish had died, some had migrated and what they now have are small tinny fishes that cannot fetch them enough for their survival in the area. The inhabitants of the study area complained of pollution of the water which they depended on for drinking, cooking, washing and feeding their animals. The effects of the oil spillage is so severe that majority of the inhabitant are thinking of relocating to other communities to enable them earn their source of living. Others have to go to neighbouring communities to look for alternative source of water. This affects the economic life of the people.

Conclusion

The results of the water samples show that river Uji had become contaminated by the oil spillage from pipeline vandalisation. Many parameters measured were high above the standard observed by WHO. The level of contamination of the water is such that it is no longer fit for drinking and to support aquatic life. The deteriorating crop output in the area is due to the polluted nature of the water and the soil from the oil spillage. It was also noticed that the oil spillage has resulted in the reduction, disappearance and loss of fish population as well as the pollution of the water upon which the communities depend for drinking, cooking, washing and feeding their animals. The effects of the oil spillage is severe to the extent that majority of the inhabitant have opted to relocates to other communities to enable them earn their living. Others have to go to neighbouring communities to look for alternative source of water. This has affected the economic life of the people. It is therefore, necessary for the federal government and the refinery to take drastic steps to address this menace that leads to poverty in the study area.

Recommendation

There is the need for the Federal Government and the NNPC to pay attention to the oil Pipeline along the host communities in Benue State as it is done in the Niger Delta. There should be concerted efforts towards periodic data collection from affected areas to assess the damage done to the environment and the people by oil pipeline related disaster. The NNPC should hold regular public enlightenment meetings with the host communities of the oil pipelines to create awareness on the danger of oil

pipeline vandalism and how to manage spills caused by eruption of the pipeline. The NNPC needs to extend an arm of friendship with the pipeline host communities by employing their youths and rendering help to them. The NNPC should respect the laws of the land associated with protection of the environment against oil pollution including: Harmful waste Law cap 165,LFN 1990, The mineral oil (safety) Regulations 1963 and oil pipeline Act 1956, and give assistance or pay compensation to victims of oil pollution from pipeline spills instead of sending law enforcement agents to kill some of them, arrest and harass them or destroy their properties .Medium Scale Digital Maps made from satellite imageries and images from satellites in orbit could be used for managing oil spill incidences in the country. Geographic Information Systems (GIS) could be used to identify oil spill responders and provide information about the closest resources of oil spill response equipment. Establishment of regional spill response along the pipelines and the use of data collected through hyper-spectral imagery will help in managing oil spill problems in Nigeria. The use of hyper-spectral imagery to detect oil spills in water and soil has a lot of advantages in the field, it can be used to monitor oil facilities and therefore prevent worst scenarios when a leak in the facility is found. It can also be used in planning the clean-up of the area by quickly identifying the affected areas and possible path of the spill to be one step ahead. Advancement in information system, satellite imaging systems and improved software technologies has led to opportunities for a new level of information products from remotely sensed data. The integration of these new products from existing response systems can provide a wide range of analysis tools and information products that were not possible before. The petroleum industry should work closely with government agencies, universities and research centres to come up with management strategies for combating the menace of oil spill incidents.

References

Abui M. Y., (2013) “Environmental Effects of Kaduna Refinery & Petrochemical Company Effluents Discharge in Romi Area of Kaduna State” Ph.D Thesis Dept of Geography & Planning University of Jos.

Akpan, W., (2005) “Oil, people & the Environment: Understanding Land Related Controversies in Nigeria's Oil Region

Anifowose, B., (2008) “Assesing the Impacts of Oil & Gas Transport on Nigeria's Niger – Delta Environment” U 21 Postgratuate Research Conference 1 on water – how need drvers Research underpins Solution to World-wide problems, 20th - 25th July 2008, University of Birmingham, Bamingham, UK.

Bhatt, R. P., (2009) “The Need & Use of Geographic Information Systems for Environmental Impact Assessment in Nepal” Hydro NEPAL, issue No 4 January, 2009

Champman, L., (2007) “Transport & Climate Change” a review” Journal of Transport Geography. 15 (5), 354-367

Church, R. L., Maria, P., Scaparra & Middleton, R.R., (2004). "Identifying critical infrastructure" The Median & Covering Facility Interdiction Problems. Anals of the Association of American Geographers 94(3, 491-502)

Dix, H. M., (2001) "Environmental Pollution" J. Willey & Sons Limited pp 60-80

Dubey, R. P., (2007). Remote Sensing & Image Processing Area Space Application Centre Ameda bad 380015

Hough, S., (2001). "Chad Oil Pipeline to Cameroon & its Impacts" Ted Case Studies Number 650.http / / WWWl.american.edu / TED / chad-pipeline.htm National Population Commission, (2006). Annual Abstract of Statistics 2006. www.nigerianstat.gov.ng / "nigerianstat.gov.ng

Pyagbara, L. S., (2007). "The Adverse Impacts of Oil Pollution on the Environment & Well being of a Local Indigenous Community:

The Experience of the Ogoni People of Nigeria. U.N. Deparment of Economic & Social Affairs Divission for Social Policy & Development.

Schwaites, F. N., (2008) "Factors Controlling the major Chemistry & small Lakes example for the prairie parkland of Canada. Hydrologic volume 58. Pp81 – 94

Wikipedia, the free Encylopedia, (2009) "Environmental Impact Assessment D: / Environmental%20impact%20assessment%20wikipedia,%20the%free%2 -6 / 25 / 09.

World Bank, (1998) "Pollution Study a cleanup of river Kaduna part C report" KEPA / ABUCONS