

## **Evaluation of the Impact of Oil Tanker Accidents on Niger Delta Areas in Nigeria.**

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**Abstract::** *This study was carried out to critically evaluate the impact of maritime tanker accidents in the Nigerian coastal Environment with its objective to determining the causes of the maritime tanker accidents and the effects on the coastal environment. Data was collected by both primary and secondary sources with a personal interview of ninety respondents out of a target population of 200 officially recognized maritime tanker operators in Nigeria. Secondary data was also generated by the consultation of periodicals, journals and magazine. Demographic characteristics of the respondents was analyzed using both descriptive statistical tools like the percentage, tables while the hypothesis was tested utilizing a chi square statistical tool in order to determine the acceptance or the rejection of the stated hypothesis. The study revealed that marine tanker oil accidents were caused mainly by human errors also that marine tanker accidents actually do have a negative effect on the Nigerian coastal Environment and that these tanker accidents in the Nigerian coastal environment affects the nation's economy by the detrimental effects it places on aquatic habitat, farmland and the climate as a whole. Consequently, it was recommended amongst others that the need for and enforced coast guard agency should be on ground to check mate operations along the Nigeria coastal environment and penalties be placed on defaulters of coastal environmental regulations.*

**Keywords:** *coastal, accidents, tanker, marine, environment, economy, regulations.*

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### **I. Introduction**

Oil Spill Incidents in Nigeria have occurred in various parts and at different times along our coast. Some major spills in the coastal zone are the GOCON's Escravos spill in 1978 of about 300,000 barrels, SPDC's Forcados Terminal tank failure in 1978 of about 580,000 barrels and Texaco Funiwa-5 blowout in 1980 of about 400,000 barrels. Other oil spill incidents are those of the Abudu pipe line in 1982 of about 18,818 barrels, The Jesse Fire Incident which claimed about a thousand lives and the Idoho Oil Spill of January 1998, of about 40,000 barrels. The most publicised of all oil spills in Nigeria occurred on January 17 1980 when a total of 37.0 million litres of crude oil got spilled into the environment. This spill occurred as a result of a blow out at Funiwa 5 offshore station. Nigeria's largest spill was an offshore well-blow out in January 1980 when an estimated 200,000 barrels of oil (8.4million US gallons) spilled into the Atlantic Ocean from an oil industry facility and that damaged 340 hectares of mangrove (Nwilo and Badejo, 2005). According to the Department of Petroleum Resources (DPR), between 1976 and 1996 a total of 4647 incidents resulted in the spill of approximately 2,369,470 barrels of oil into the environment. Of this quantity, an estimated 1,820,410.5 barrels (77%) were lost to the

Environment. A total of 549,060 barrels of oil representing 23.17% of the total oil spilt into the environment was recovered. The heaviest recorded spill so far occurred in 1979 and 1980 with a net volume of 694,117.13 barrels and 600,511.02 barrels respectively.

Available records for the period of 1976 to 1996 indicate that approximately 6%, 25%, and 69% respectively, of total oil spilled in the Niger Delta area, were in land, swamp and offshore environments. Also, between 1997 and 2001, Nigeria recorded a total number of 2,097 oil spill incidents. Thousands of barrels of oil have been spilt into the environment through our oil pipelines and tanks in the country. This spillage is as a result of our lack of regular maintenance of the pipelines and storage tanks. Some of these facilities have been in use for decades without replacement. About 40,000 barrels of oil spilled into the environment through the offshore pipeline in Idoho. Sabotage is another major cause of oil spillage in the country. Some of the citizens of this country in collaboration with people from other countries engage in oil bunkering. They damage and destroy oil pipelines in their effort to steal oil from them. SPDC claimed in 1996 that sabotage accounted for more than 60 percent of all oil spilled at its facilities in Nigeria, stating that the percentage has increased over the years both because the number of sabotage incidents has increased and because spills due to corrosion have decreased with programs to replace oil pipelines (SPDC, 1996).

Pirates are stealing Nigeria's crude oil at a phenomenal rate, funneling nearly 300,000 barrels per day from our oil and selling it illegally on the international trade market. Nigeria lost about N7.7 billion in 2002 as a result of vandalisation of pipelines carrying petroleum products. The amount, according to the PPMC, a subsidiary of NNPC, represents the estimated value of the products lost in the process.

## **1.2 Statement Of Research Problem**

The impact of oil tanker accidents on the Nigerian coastal environment cannot be examined without investigating the source of the problems, which are the causes of these tanker accidents in the first place. Therefore, it is of utmost necessity in this study to look into the various factors contributing to the laxity in the standard of safe practices as well as the preparedness for emergencies involved in the marine tanker industry. In precise term, this research work will concentrate on marine oil tanker accidents and the environmental pollution occurring during the course of oil carriage by sea with particular references to the standard of safe practices by the operators involved and the preparedness for emergencies of both the operators and the managers together with the government agency as a central co-coordinating body. The focus of the study however, are, what exactly are the causes of these perils in the marine oil tanker industry, what are their impact and implications on the environment and how can they be minimized or completely stopped from re-occurring again in the Nigerian oil tanker Industry.

It is as a result of this impending problem that this study has set out carry out detailed research to achieve the following objectives:

- To find out the causes of oil tanker accidents in the Nigerian waters.
- To investigate and examine the impact and implications of such tanker accidents on the environment.

In the bid to achieve the above stated objectives, research questions such as, “what are the causes of the oil Tanker accidents in the Coastal areas” and what is/are the impacts of these tanker accidents on the environment. Furthermore, hypothesis was formulated and stated thus

- Oil tanker accident does not have adverse effect on the Nigerian Niger Delta coastal environment

## **II. Review Of Related Literature**

### **2.1 REVIEW OF MARINE OIL TANKER ACCIDENTS ON THE NIGERIAN COASTAL ENVIRONMENT**

The Nigerian coastal environment has suffered untold degradation from the activities of tanker men and tanker operations in Nigeria; worst among these activities is the issue of tanker accidents. The rate of tanker accidents is highly determined by the level of safety practices in the carriage of oil by sea, as it is widely believed in the maritime industry that eighty percent of the accidents occurring in the shipping industry are caused by human error while the remaining twenty percent is attributed to technical or equipment failure (Freudentahl 1992).

The recent increase in oil tanker accidents in Nigeria together with their associated environmental implications has called for a course for concern. Even though the most worrisome of them all as of now are the global environmental ones. Each particular problem has a linkage effect with another, which tends to exacerbate the effects of others thus creating waves of anxiety, worry and concern for all lovers of the environment. The problems created by oil tanker accidents are threats to both aquatic and terrestrial life and can lead to their extinction. The major environmental problems caused by oil tanker accidents range from pollution of air, water and land to biological losses and atmospheric contamination, these are as a result of accidents such as fire outbreak, collision, explosion, grounding, flooding, sinkage and so on. Oil tanker accidents such as fire outbreak and exposure lead to the release of gases such as SO<sub>2</sub>, NO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub> and CO which produce organic acids resulting in acid rain. Other accidents such as explosion, grounding, flooding, sinkage, oil spillage and so on lead to pollution of various degrees both of the sea and the air (due to the volatile nature of the cargo carried) and also the coastline and its environs. However, while some blame these tanker accidents on the operational system occurring through the low level of safety practices in the carriage of oil by sea in Nigeria; others blame it on the shore-based management system in Nigeria, which is attributed to the decline in the national economy. In furtherance to this, below is the table showing the list of some oil tanker accidents in Nigeria together with the section of the environment being affected, this table also reveals the causes of these tanker accidents in the Nigerian territorial waters. For the purpose of this study, the list of tanker accidents to be given will be from 1997, the advent of hike in tanker accidents in Nigeria till date.

### **2.2 Cause of Accidents**

#### **2.2.1 Human Error**

Accidents do not just happen; they are usually the results of often many contributing elements of which each one certainly is manageable, in other words, they are caused. Table 1 shows the list of oil tanker accidents that, had occurred in Nigeria, it is obvious that all the stated accidents are caused by human error one way or the other. The tanker accidents caused by human error range from poor maintenance and carelessness, to negligence and sometimes lack of experience in one way or the other both on the part of the operators/seafarers on one side and also on the part of the shore-based management team on the other side. Others include lack of effective safety management system between the ship and the shore and lack of adequate motivation for the seafarers. Looking at the nature of accidents in table 1, it could be clearly pointed out that no tanker accident listed was

caused by an Act of God. However, within the scope of human error, the causes of accidents in the carriage of oil in Nigeria could basically be said to be operational error or management/managerial negligence.

### 2.2.2. EQUIPMENT/TECHNICAL MALFUNCTIONS

Although these equipment are usually operated by human beings, yet, their sudden or unexpected failure/malfunction and their consequential effects in the tanker industry cannot be underestimated. Sometimes, some of the accidents in the tanker industry are caused by technical problems which in some cases do occur without any prior warnings, such equipment failure or technical problem include; the failure of navigational equipment, loss of steering system, loss of propeller, pipe burst, hose burst, loss of propulsion power, blackout and so on. Technical problems such as loss of steering system or propeller, pipe burst, hose burst, loss of propulsion power, blackout and so on. Technical problems such as loss of steering system or propeller may lead to the grounding or foundering of the tanker, which may eventually lead to oil spill. Other failures such as pipe burst or host burst can lead to explosion, fire out break and oil spill which eventually degrades the environment. However, some school of thought believes that the issue of equipment failure or technical malfunctions should still be grouped with human error because equipment failed either due to their manufacturers' factory faults or wrong installation which is still indirectly a human fault even though it may not directly be the fault of the tankermen /seafarers.

The various accidents that occurred in the oil tanker industry constituted various forms of hazard to the Nigerian coastal environment, fire accidents pollutes both the air and the sea, the oil fire smoke being released into the atmosphere eventually combined with rain which fall as acid rain into both the sea and the shore. Oil Spills constituted a visual nuisance to the sea and also destroys the beauty of the beaches and the coast in general. Sunken and foundered tankers constitute obstructions to dimersal fishing in various fishing grounds and sometimes eventually constitute derelicts both in our oceans and along the Nigerian coast. This is just to mention a few; the impact of tanker accidents on the Nigerian coastal environment has ever been underestimated. These various tanker accidents together with the various forms of pollution and degradation they contribute to the environment constitute negative socio-economic impact on the maritime industry, the environment and the national economy at large. However, we cannot lay emphasis on the activities of the tanker industry without relating it to the general activities of the oil companies in Nigeria some of which are owners or contracted the services of these oil tankers one way or the other, and also with their involvement in oil exploitation and production in Nigeria.

Table 1:

| No | Names of Tankers                                 | Time of Occurrence | Nature of Accident  | Environment Section Affected        |
|----|--|--------------------|---|-------------------------------------|
| 1. | M.T.Al-Zainah<br>Location: Lagos                 | June, 1997         | Explosion: The last cargo of the ship was PMS (Premium Motor Spirit), later, hot work was carried out in one of the cargo tanks not properly washed and gas freed and then, an explosion occurred.  | Air                                 |
| 2. | M.T. Aribi<br>Location:- Bonny<br>Town anchorage | March, 1999        | Flooding and Sinkage: The tanker was fully loaded with about 2000 tons of AGO (Automotive Gas Oil) and so she had a small free board, she took in water into the engine room though the propeller shaft and later sank due to uncontrollable flooding. The entire cargo (AGO) was lost with the ship.   | Air, Sea and Coastline in the area. |
| 3. | M.T. Walvi-14<br>Location:- Eket<br>Offshore     | October, 1999      | Explosion: - The small fresh water tanker was loading fresh water from an offshore production platform when some dangerous gases entered the cargo tank through the water hose, one of the crewmembers lit a cigarette on the maindeck and there was an explosion.  | Air                                 |
| 4. | M.T. Real Progress<br>Location: - Lagos          | Jan, 2000          | Explosion: - The ship was loaded with 7000 tons of PMS (Premium Motor Spirit), the PMS leaked from the pump room to the pump-motor room and the Bosun's store through the pump/pump-motor shaft hole due to malfunctioning packing. There were some chemical reactions in the pump-motor room and the Bosun's store, which generated static electricity, and then there was an explosion in the pump-motor room and the | Air                                 |

|    |                                   |           |   |     |
|----|-----------------------------------|-----------|---|-----|
|    |                                   |           | Bosun's store.  |     |
| 5. | M.T. Crown O<br>Location: - Warri | Jan, 2000 | Explosion: - The ships compressor was bad, the chief engineer attempted to start the main engine with compressed oxygen bottle, there was an explosion and then fire. | air |

Source: Environmental safety magazine(2005)

### 2.3 ENVIRONMENTAL DEGRADATION IN NIGERIA

Pollution has been defined under S.38 of the Federal Environmental Protection Agency Decree (No. 58 of 1988) as man-made or man-aided alteration of the chemical, physical or biological quality of the environment to the extent that is detrimental to that environment or beyond acceptable limits and pollutant shall be constructed accordingly.

Environment is also defined under the same section as including water, air, land and all plants, animals or human beings living therein and the interrelationships, which exist among these or any of them. From the above, it is obvious that pollution involves the introduction by man activities into the air, land or water, substances that are harmful to any form of life. Examples of such substances are oil, industrial waste, sewage, discharge into atmosphere of vehicle exhausts, noise and so on. However, oil is not the most noxious environmental pollutant but it is the most visible pollutant.

Environmental degradation is a by-product of human activities. It results when natural environment has been indiscriminately interfered with the grossly exploited that the pristine composition of the components of the environment is modified and critically threatened. Many factors encourage environmental degradation, but in any case, the impact of some factors may be more pronounced. In the early part of the last century, the significance of environmental degradation was relatively low because the human population especially in Nigeria was quite low. The pressure on the natural environment was not remarkable and the effects of human activities on the environment were still within the range nature could accommodate. The significance of environmental degradation in the Nigerian coastal environment and observed at the inception of oil related operations. The increasing pressure on the natural environment caused by oil exploitation and transportation, exploited population growth, increasing human needs and demand for survival, poverty, unemployment are the chief causes of environmental degradation in the Nigerian coastal environment. However, this paper will not deal with all the causes of environmental degradation but will focus on environmental degradation resulting from accidents/incidents occurring onboard coastal oil tankers.

### III. Methodology

A sample is selected from every accessible sub group called a strata of population. A sample size of 90 respondents was utilized and this includes various people from severally engaged in the tanker and environmental sector of the economy. Both primary and secondary data were collected for the study through the use of personal interviews and the review of several literatures, journal articles and books on oil environmental pollution and accident s. during the course of the interview particular emphasis was laid around the cause of maritime tanker accidents in Nigeria. Also examined where the review of the impact of Nigerian coastal environment of these oil tanker accidents and the economics implications on an individual, the community and the nation at large. For the purpose of comprehension and the analysis of the data collected descriptive statistical tool like the simple percentage, pie charts, was used in the analysis of the data. Each question and area of concentration was fully analyzed using the aforementioned descriptive tools on the number based on number of responses received from the available respondents in the field of study. And the hypothesis was finally tested using **Achi-squared test**, which is also referred to as **chi-square test** or  $\chi^2$  test.

### IV. Data Analysis

#### 4.1 DEMOGRAPHIC DATA OF THE RESPONDENTS

Below , a carefull presentation of the demographic information of the respondents will be presented to depict their age, sex.

TABLE 2.0 RESPONSE RATE OF PERSONEL

| VARIABLES         | SAMPLE SIZE | ACTUAL RESPONSE | %   |
|-------------------|-------------|-----------------|-----|
| Top Management    | 90          | 6               | 7   |
| Middle Management |             | 12              | 13  |
| Senior Staff      |             | 30              | 33  |
| Junior Staff      |             | 42              | 47  |
| Total             | 90          | 90              | 100 |

Source: field study, (2013)

From the table 2.0 above it can be clearly seen that the top Management, Middle Mgt., Senior staff and Junior staff was 7%, 13%, 33% and 47% respectively.

Table 3.0 Gender response

| VARIABLES | SAMPLE SIZE | ACTUAL RESPONSE | %   |
|-----------|-------------|-----------------|-----|
|           | 90          |                 |     |
| Male      |             | 62              | 69  |
| Female    |             | 28              | 31  |
| Total     | 90          | 90              | 100 |

Source: field study (2013).

From the table 3.0 above it can be seen that from the total response rate of ninety respondents ,69% of them were male and 31% were female.

Table 4.0 Age of Respondents

| VARIABLES     | SAMPLE SIZE | ACTUAL RESPONSE | PERCENTAGE |
|---------------|-------------|-----------------|------------|
| 16 – 25 years |             | 6               | 7          |
| 26 – 35 years | 90          | 40              | 44         |
| 36 – 45 years |             | 38              | 42         |
| 46 – 55 years |             | 4               | 5          |
| 56 and above  |             | 2               | 2          |
| Total         | 90          | 90              | 100        |

Source: field study( 2013).

Respondents age level was 44% which accounted for the highest respondents also meaning that most of the respondents were youths within the age bracket of 26-35years. The next was 36-45years which was about 42%, others were 7%,5% and 2%.

#### 4.2 Analysis of interview Questions

From the series of questions posed to the respondents, responses were analysed descriptively using the percentage. Below is a table of the result of the questions.

Table 5.0

| VARIABLES   | SAMPLE SIZE | ACTUAL RESPONSE | PERCENTAGE |
|---|-------------|-----------------|------------|
| <b>Does oil tanker accidents do have an adverse effect on the Nigerian coastal environment.</b> | 90          |                 |            |
| Yes   |             |                 |            |
| No  |             | 71              | 79%        |
|   |             | 19              | 21%        |
| <b>That oil tanker accident has adverse effect on other sectors of the national economy</b>     | 90          |                 |            |
| Yes   |             |                 |            |
| No  |             | 82              | 91%        |
|   |             | 8               | 9%         |
| <b>What is the major cause of tanker accidents</b>  | 90          |                 |            |
| Human error   |             | 88              | 91         |
| Mechanical error  |             | 2               | 9          |

Source: field study, (2013)

#### 4.3 TEST OF HYPOTHESIS USING THE CHI SQUARE STATISTICS.

##### 4.3.1 HYPOTHESIS 1

| NULL HYPOTHESIS (H <sub>0</sub> )  | ALTERNATIVE HYPOTHESIS (H <sub>i</sub> )   |
|--|--|
| That oil tanker accidents do have adverse effect on the Nigerian coastal environment | That oil tanker accident does not have adverse effect on the Nigerian coastal environment. |

Using Chi-Square,  $(X^2) = \left\{ \frac{(F_o - F_e)}{F_e} \right\}^2$

Where: F<sub>o</sub> = observed frequency

Fe = expected frequency  
 { = Summary

**OBSERVED FREQUENCY (Fo)**

| CATEGORIES OF WORKERS | YES       | NO        | TOTAL     |
|-----------------------|-----------|-----------|-----------|
| Top Management        | 4         | 2         | 6         |
| Middle Management     | 9         | 3         | 12        |
| Senior Staff          | 25        | 5         | 30        |
| Junior Staff          | 33        | 9         | 42        |
| <b>TOTAL</b>          | <b>71</b> | <b>19</b> | <b>90</b> |

Formula for expected frequency

$$Fe = \frac{RT \times CT}{GT}$$

Where:

RT = Total of Row  
 CT = Total of Column  
 GT = Grand Total

**EXPECTED FREQUENCY (Fe)**

| CATEGORIES OF WORKERS | YES       | NO        | TOTAL     |
|-----------------------|-----------|-----------|-----------|
| Top Management        | 4.733     | 1.267     | 6         |
| Middle Management     | 9.467     | 2.533     | 12        |
| Senior Staff          | 23.667    | 6.333     | 30        |
| Junior Staff          | 33.133    | 8.867     | 42        |
| <b>TOTAL</b>          | <b>71</b> | <b>19</b> | <b>90</b> |

Source: chi square table

| Fo | Fe     | Fo-Fe  | (Fo-Fe) <sup>2</sup> | $\frac{(Fo-Fe)^2}{Fe}$ |
|----|--------|--------|----------------------|------------------------|
| 4  | 4.733  | -0.733 | 0.537                | 0.113                  |
| 2  | 1.267  | 0.733  | 0.537                | 0.424                  |
| 9  | 9.467  | -0.467 | 0.218                | 0.023                  |
| 3  | 2.533  | 0.467  | 0.218                | 0.086                  |
| 25 | 23.667 | -1.333 | 1.777                | 0.075                  |
| 5  | 6.333  | -1.333 | 1.777                | 0.281                  |
| 33 | 33.133 | 1.333  | 0.018                | 0.001                  |
| 9  | 8.867  | 0.133  | 0.018                | 0.002                  |
|    |        |        |                      | <b>1.005</b>           |

Source; chi square table

Computed value of X<sup>2</sup>

$$\begin{aligned} \text{Degree of freedom} &= (R-1) (c - 1) \\ &= (4-1) (2-1) \\ &= (3) \quad (1) \quad = \quad 3 \end{aligned}$$

**DEGREE OF FREEDOM = 3**

The table of value X<sup>2</sup> at 0.05 with 3 degree of freedom is 7.815

**INTERPRETATION:** Since the computed value of X<sup>2</sup> which is 1.005 is less than the table value of X<sup>2</sup> at 0.05 which is 7.815, the hypothesis is within the acceptance region. Therefore, the hypothesis is accepted by the respondents.

**V. Discussion Of Findings**

Below are the findings from the study carried out during the course of the study.

It was discovered that the major cause of marine tankers accidents in Nigeria is as a result of human factor errors and this human error has greatly led to the negative effects the tanker accidents have posed in the coastal environment in Nigeria. Water bodies have suffered a great deal of infection that has triggered the death of aquatic organism, widespread of diseases and reduced food cultivation.

**VI. Conclusion**

With all data collected and utilized for this study, it is believed that adequate justice has been done to this study. Most of the reason that is responsible for the current rise in oil Tanker accidents in Nigeria has been revealed. The impacts of these accidents on the Nigerian coastal environment, National economy, National



image and lives and property were also highlighted. The various findings also revealed that majority of the Marine oil tanker accidents in Nigeria are widely caused due to human error even though the current level of emergency response in Nigeria is relatively low.

## 5.2 RECOMMENDATIONS.

Problems often suggest their own solutions. Sometime the solution can be initiated with little trouble because of lack of restrictions. Other times a great deal of ingenuity is required to effect solution and sometime no solution seems to appear at all. In view of the many problems, findings and conclusion drawn in this research work, the following recommendation are made towards the elimination of tanker accidents and the enhancement of the protection of the Nigerian coastal environment.

- The Federal Government should fully establish a body such as the coastal guard changed with the responsibility of enforcing already existing laws and regulations that has to do with the protection of the Nigeria coastal environment. Such laws include the petroleum regulation of 1969, oil in Nigeria waters act of 1968, criminal code of Nigeria, Federal environment protection decree no 58.
- There is also for the government to formulate and promulgate laws which have more stringent penalties for violators of the pollution act. If the tanker operator and managers become aware of stringent consequences, it will make them to be more safety conscious during the normal course of their operation which will in turn enhance the protection of the environment.
- Knowing that it takes time, money and energy to combat the menace of pollution the federal government and the local authorities need to put all resources together to ensure adequacy in the protection of our environment.
- The Nigeria government should also establish a central coordinating unit saddled with the responsibility of pollution and environmental protection in a unified manner so no one aspect of the environment will be left without control or protection.
- The National Authorities through the local authorities should create awareness by enlightening and sensitizing the public about their responsibility to the environment. Knowing that the greatest service any individual can do to humanity is to protect his environment.

## Bibliography .

- [1]. Akpofure, E.A., Eferi, M.L. and Ayawei, P., (2000). The Adverse Effects of Crude Oil Spills in the Niger Delta. *Urhobo Historical Society*.
- [2]. Allen, J.R., 1965. Late Quaternary of the Niger Delta, and Adjacent Areas. *Sedimentary Environments and Lithofacies AAPG V.49*. p547-600.
- [3]. Nwillo, A. and Badejo, O. (2005), Oil tanker accidents and Solutions. *Environmental watch, Portharcourt*. Sound publishers Portharcourt. Vol 4, pp16-19
- [4]. Burn K.A., S.D. Garrity & S.C. Levings, 1993. How many years until Mangrove Ecosystems Recover from Catastrophic Oil Spills? *Mar. Pollut. Bull.* 26, 239-248.
- [5]. Dublin-Green C.O., A. Awobamise and E.A. Ajao, 1997. Large Marine Ecosystem Project For the Gulf Of Guinea (Coastal Profile Of Nigeria), Nigeria Institute of Oceanography Encyclopedia Americana, 1994. International Edition, Grolier Incorporated.
- [6]. Energy Information Administration, 2003. Nigeria Country Analysis Brief. Energy Information Administration.
- [7]. Environmental Watch, Volume 2, No.13, October 16th- October 31st 2001. ISSN: 1119-2739, by Augustine Timbiri of our Environmental Desk.
- [8]. Freduhaul, J., Garrity S.D. & S.C. Levin's, 1990. Effects of an Oil Spill on the Gastropodsofa Tropical Intertidal Reef Flat. *Mar. Environ. Res.* 30, 119-153.
- [9]. GESAMP (IMO/FAO/UNESCO/WMO/IAEA/UN/UNEP, 1993. Joint Group of Experts on the Scientific Aspects of Marine Pollution. Impact of Oil and Related Chemicals and Wastes on the Marine Environment. GESAMP Reports and Studies No 50. International Maritime Organization, London, U.K.
- [10]. Hoff, R., 1993. Bioremediation: An Overview of its Development and use for Oil Spill Cleanup. *Mar. Pollut. Bull.* 26, 476-481.
- [11]. IMO (1996) Guidelines on The Application of the IMO International Safety Management (ISM) Code, International Chamber of Shipping (ICS) and International Shipping Federation (ISF), London, U.K.
- [12]. IMO (1997), International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), International Maritime Organization (IMO), London, U.K.
- [13]. IMO (1997), International Convention for the Safety of life at Sea, 1974 and its protocol of 1978 (SOLAS 74/78). International Maritime Organization (IMO), London, U.K.
- [14]. IMO (1978) International Safety Guide for Oil Tankers and Terminals, International Chamber of Shipping (ICS), and Oil Companies International Marine forum (OCIMF), London, U.K.
- [15]. LONGMAN (1987) Dictionary of Contemporary English. Longman Singapore Publishers p.t.e Ltd, Singapore.
- [16]. Ibe, A.C., 1988. Coastline Erosion in Nigeria. University of Ibadan Press
- [17]. Gabriel D. (1995) A 10 minute guide on the IMO'S ISM Code. CYMEPA, Puzzle Designs Ltd, Limasol, Cyprus.
- [18]. House D.J (1987): Seamanship Techniques, William Heinemann Ltd, London, U.K.
- [19]. McGuiness, K.A., 1990. Effects of Oil Spills on Macro- invertebrates of Salt marshes and
- [20]. Mangrove Forests in Botany. Bay, New South Wales, Australia. *Exp. Mar Biol. Ecol.* 14 2121-135.
- [21]. Mikala K., 1995. Use of GIS as a Tool for Operational Decision Making. Implementation of National Marine Oil Spill Contingency Plan for Estonia. Carl Bro International a/s, Glostrup, Denmark
- [22]. MARTON G.S. (1978): Tanker operations, second Edition, Cornell Maritime Press. Maryland, USA.
- [23]. NWORUH G.E. (2001) Basic Research Methodology for Researchers, Trainees and Trainers in Management Science, Ambix Publishers, Owerri Nigeria

- [24]. Ntukeko D.S., 1996. Spillage: Bane of Petroleum, Ultimate Water Technology & Environment. Olagoke W., 1996. Niger Delta Environmental Survey: Which Way Forward?, Ultimate Water Technology & Environment.
- [25]. Oshineye, A., 2000. The Petroleum Industry in Nigeria: An Overview. Modern Practice Journal of Finance & Investment Law. Learned Publications Limited. Vol. 4. No. 4
- [26]. Oyem, A., 2001. Christian call for Action on Nigerian Oil Spill. Sage-Oxford's Christian Environmental Group.
- [27]. Ozekhome, M., 2001. Legislation for Growth in the Niger Delta, Midweek Pioneer
- [28]. Parthiphon, K., 1994. Oil Spill Sensitivity Mapping Using a Geographical Information System. Department of Geography, University of Aberdeen. EGIS Foundation.
- [29]. Prince R., 1993. Petroleum Spill Remediation in Marine Environments. Critical Rev. Microbiol. 19(4), 217-242.
- [30]. Reddy, G.S. and Brunet M., 1997. Numerical Prediction of Oil Slick Movement in Gables Estuary. Trans of International, Epinay/Seine, Cedex, France
- [31]. Salu, A.O., 1999. Securing Environmental Protection in the Nigerian Oil Industry. Modern Practice Journal of Finance & Investment Law. Learned Publications Limited. Vol. 3. No. 2.
- [32]. Sandberg, E.C., 1996. Development of Remote Sensing for Coast Guard Applications. Remote Sensing. No. 28, pp 12.