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## **Oil Spills and Oil Pollution – Management and Contingency Planning for Oil Spill in the Niger Delta Region of Nigeria**

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### **Abstract**

While oil exploration is a necessary risk in a complex society, because of the enormous benefits to humanity, attention must be given to good industry practice and safety that will prevent or reduce the release of oil into the environment with attendant negative impacts. A better way of doing the business of oil exploration and production with minimal impact to the environment necessitated this work. Industry has invoked many operating and maintenance procedures to reduce accidents that lead to spills. The rate of spillage has decreased in the past 10 years, even with increased oil production, transportation, and consumption. Despite this, spill experts estimate that 30%-50% of oil spills are either directly or indirectly caused by human error, with 20%-40% of all spills caused by equipment failure or malfunction. Emerging spill risks include increased maritime activity in the waterways, deepwater exploration and development [1]. A careful study of the different causes of oil spills and the best methods to management the effects on the environment drove the objectives of this work. Oil spills have many adverse effects on the environment. Clear effort for effective and prompt management of the spill incidents is a key success factor in reducing escalation of the attendant negative impacts on the environment by deploying a workable contingency plan suitable to the specific ecozones of interest. This work affirms that, a workable pre tested emergency response plan is the key to a successful spill incident management where every gap existing would have been identified and closed out before deployment in a real time incident.

**Keywords:** Contingency Planning; Management; Niger Delta Region; Oil Spills; Oil Pollution.

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## **1. Introduction**

Oil spills and oil pollution are unwanted occurrences that are in most cases unavoidable. The concentrated focus and operation of oil exploration and production activities in the Niger Delta ecozones exposes these ecosystems to serious devastation with consequent negative impacts on the environment.

Crude oil exploration is one of such activity that can affect the environment negatively especially when accidents occur in operations resulting to spillage of oil. As a result of the impacts of crude oil operations to the environment, there have been actions in the activities of crude oil exploration across the globe to prevent the high risk of oil spillage and the accompanying environmental hazards [2].

However, the attendant risk has not been ameliorated by the players in the oil industry who jostle for the liquid gold" thereby putting pressure on the oil producing communities and the surrounding environment. According to [3], one of the factors that cause discharge of oil to the environmental is the unethical engineering operations practiced by the industries involved.

Several catastrophic impact of oil spill have occurred such as the Exxon Valdez oil spill which occurred in Prince William Sound, Alaska, on March 24, 1989 with an estimated crude oil spill of 260,000 to 750,000 barrels and more recently the BP deep-water horizon oil spill on 20 April 2010 in the Gulf of Mexico caused by the explosion and sinking of the Deep water Horizon oil rig. It caused an oil discharge for 87 days with an estimated the total discharge at 4.9 million barrels [3]. Prompt reactive response and management of spill incidents by deploying an effective contingency plan reduces escalation and impacts on the environment. This is corroborated in [4] that oil exploration and production facilities must have spill prevention and counter measures plan in place in case of emergency situations.

### ***Statement of Problem***

Spillage of oil from exploration activities in the many parts of the world has lead to massive environmental degradation in the past decades. Such problems include contamination of water bodies, danger to aquatic life, destruction of flora and farmlands which includes resort centers, destruction of properties, loss of lives and many more [5]. In addition, oil spillage impacts to the environment can lead to unwanted migration of people from the areas. According to [6], the consequences of oil spill is far-reaching as it impacts negatively on the economy of a region, pollutes water thereby health of the local community, contaminates soils rendering it useless for farming and the reputation of the oil companies involved.

### ***Objectives***

- Review of appropriate literatures pertaining to the study
- Investigation of the various causes and impacts of oil spills in the Niger delta region.
- Investigation of the management systems used in controlling oil spills in the Niger delta region.
- Identifying the main factors affecting the effectiveness of management systems to reduce oil spills in the region.

**Significance of the Study**

The study has a significant role to play in discovering approaches to prevent, respond, and manage issues of oil spillage in oil production activities in The Niger delta region of Nigeria. This study will critically investigate and analyse the causes and provide recommendations for the improvement of the oil spills management in the Niger delta region of Nigeria, in order to reduce and where possible prevent the occurrence of oil spillages in the region.

**Scope of Study**

This study is focused on oil spillage in the Niger delta region of Nigeria but particularly on the management systems practiced in controlling oil spills in the area. This study is necessary at the time considering the increasing environmental deterioration in the Niger delta region and presently the increase of movement of people from the rural areas to urban area.

The Niger delta region of Nigeria is the source of over 90 per cent of crude oil, which is the main stay of the Nigerian economy. Oil accounts for over 90 per cent of the country’s export earnings and some 80 percent of government revenue.

**1.1 Oil Spills**

An **oil spill** is the release of a liquid **petroleum** hydrocarbon into the environment, especially the marine ecosystem, due to human activity, accident, operational failure and or willful interference on oil facilities or natural disaster [7].

According to [8], Oil spillages are forms of industrial pollution caused by the unwanted release of crude oil associated with exploration and transportation of petroleum. The table below shows the different categories, quantities and environment of oil spills in the Niger Delta.

**Table 1:** Oil Spill Categories. Source: Ifeadi and Nwankwo (1987)

Category	Quantity	Environment
Minor	Less than 25bbls	Inland waters
	Less than 250bbls	Onshore, Offshore or coastal region
Medium	Between 25 – 250 bbls	Inland waters
	Between 250 – 2500 bbls	Onshore, Offshore or coastal region
Major	Over 250 bbls	Inland waters
	Over 2500 bbls	Onshore, Offshore or coastal region



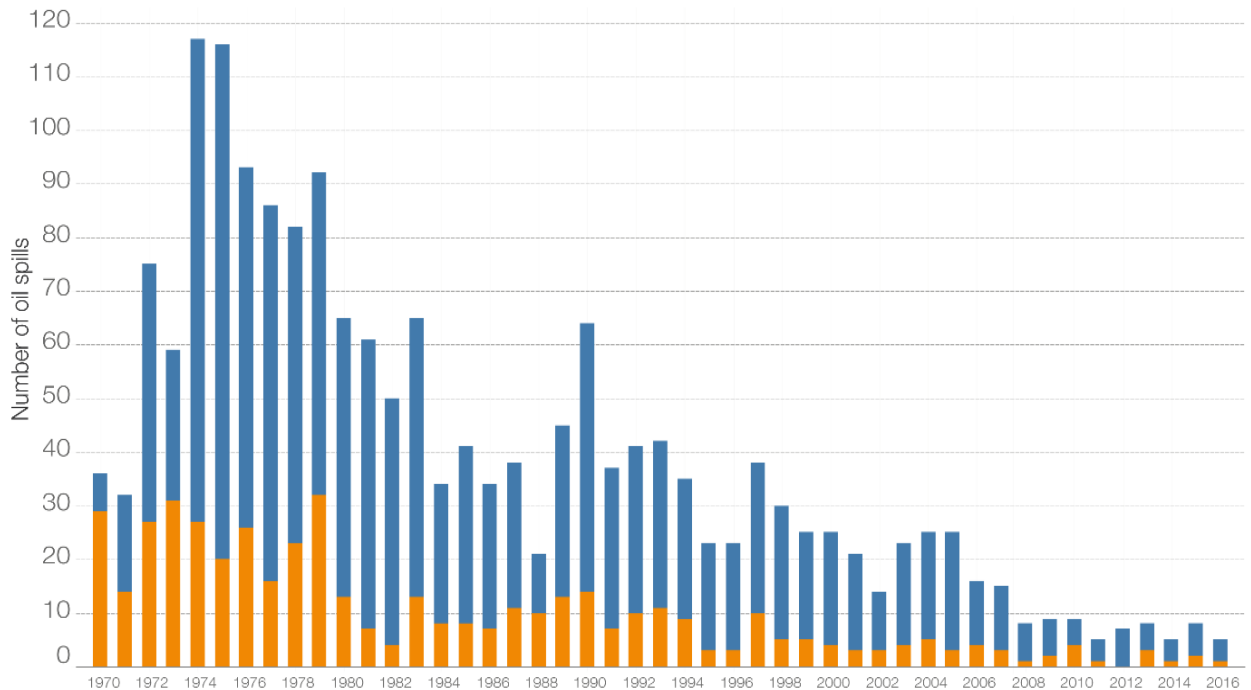
**Figure 1&2:** Oil Spill Release into the Environment.

Some major oil spill incidents in history includes:

- The *Amoco Cadiz* Oil Spill (1978)
- The *Castillo de Bellver* Oil Spill (1983)
- The Incidents at the Nowruz Oil Field (1983)
- The Kolva River Spill (1994)
- The Mingbulak (or Fergana Valley) Oil Spill (1992)
- The *Atlantic Empress* Oil Spill (1979)
- The *Ixtoc 1* Oil Spill (1979)
- BP's *Deepwater Horizon* Oil Spill (2010)
- The Persian Gulf War Oil Spill (1991)
- The *Exxon Valdez spill* into Prince William Sound, Alaska, in March 1989
- GOCON's Escravos spill (1978)
- SPDC's Forcados Terminal tank failure (1978)
- Texaco Funiwa-5 blowout (1980)
- Abudu pipe line (1982)
- Jesse Fire Incident
- Idaho Oil Spill (January 1998)

## Number of oil spills from tankers worldwide, 1970–2016

The bars show the number of oil spills per year. Smaller oil spills (7-700 Tonnes) in blue ■ and large oil spills (>700 Tonnes) in orange ■.



Data source: International Tanker Owners Pollution Federation (ITOPF) for the number of oil spills, United Nations Conference on Trade and Development (UNCTAD) for trade data. The interactive data visualization is available at [OurWorldinData.org](https://ourworldindata.org). There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.

**Figure 3:** Numbers of Marine Oil Spills from Tankers Worldwide from 1970- 2016. Source: <https://ourworldindata.org/oil-spills>

### 1.2 Oil Pollution

The release of the liquid **petroleum** hydrocarbon into the environment with negative consequences on the ecosystem, especially the marine ecosystem, due to human activity, accident, operational failure, and or willful interference on oil facilities or natural disaster constitute oil pollution [7].



**Figure 4&5:** Oil Spill Release into the Environment.

The table below shows oil spill incidents in the Niger Delta of Nigeria.



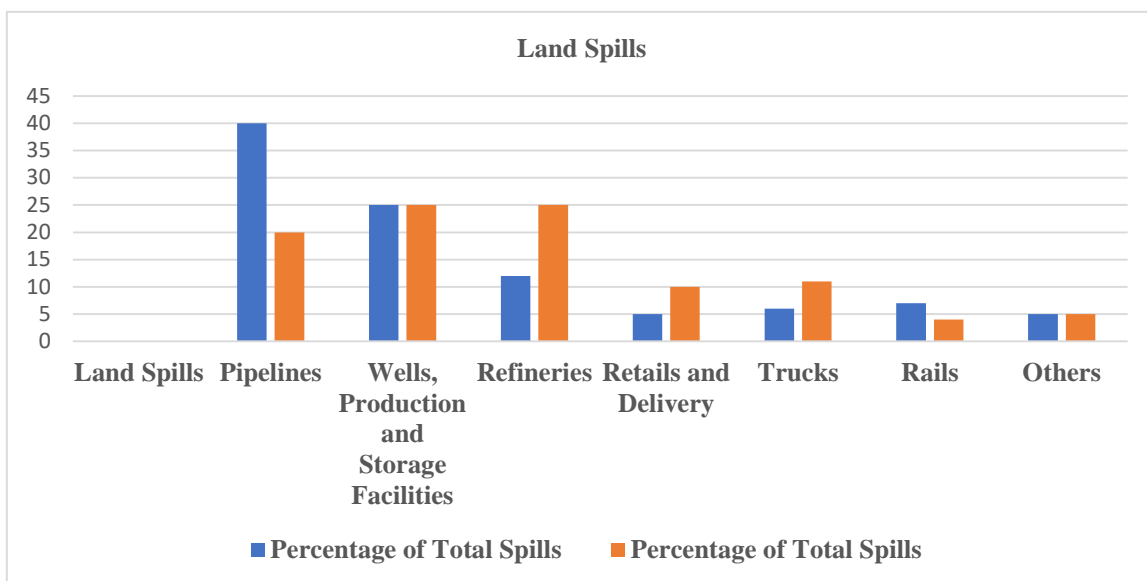
**Table 2:** Oil Spill Incidents in the Niger Delta. Source: Tim Cock, 2012, (The Guardian, 2012).

Date	Location	Gallons(Qty)	Company Vessel/Oil
01/05/2001	Ogoniland	Unknown (but significant)	Shell
20/08/2001	Ogbodo	2,926,000	Shell
11/2008	Ogoniland	1,640	Shell
02/2009	Ogoniland	311,000	Shell
01/05/2010	Niger Delta	29,414,000	Exxon Mobil
21/12/2010	Bonga field	1,694,000	Shell
21/06/2010	Bonga field	Unknwown (but significant)	Shell

A comparative analysis of spill incident from American spill statistics 2010 was also looked at as shown below:

**Table 3:** Percentage of Total Land Spills per Volumes and Numbers. Source: North American Spill Statistics 2010

Source	Percentage of Total Spills	
	Volume	Number
Land Spills		
Pipelines	40	20
Wells, Production and Storage Facilities	25	25
Refineries	12	25
Retails and Delivery	5	10
Trucks	6	11
Rails	7	4
Others	5	5

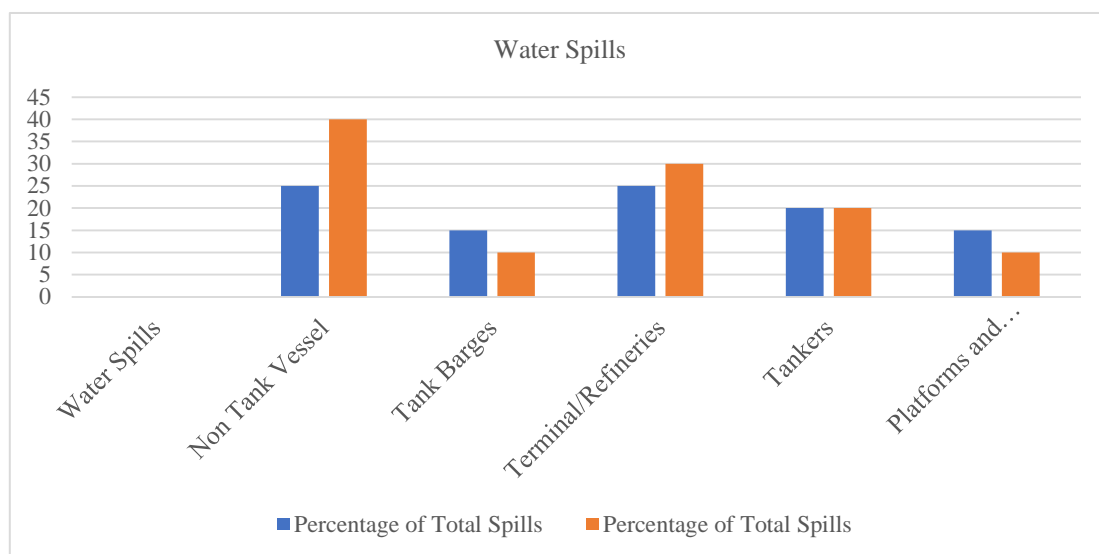


**Figure 6:** Percentage of Total Land Spills per Volumes and Numbers

**Table 4:** Percentage of Total Water Spills per Volumes and Numbers. Source: North American Spill Statistics

2010

Source	Percentage of Total Spills	
	Volume	Number
Water Spills		
Non Tank Vessel	25	40
Tank Barges	15	10
Terminal/Refineries	25	30
Tankers	20	20
Platforms and Pipelines	15	10



**Figure 7:** Percentage of Total Land Spills per Volumes and Numbers

### 1.3 Management of Oil Pollution

A number of management measures to prevent and respond to oil spill already exist in various countries including Nigeria. Different policies and mechanics are being put in place to avert or react to oil spill episodes with the policies usually aimed at giving structure to oil production and exploration activities of organisations laying ground rules with regards to oil spill incidents [9]. A few of the communal laws and universal understandings in place suggested by the Federal Environmental Protection Agency of Nigeria (FEPA) to help protect the environment particularly from activities resulting in pollution by oil companies include:

- a. Endangered Species Decree Cap 108 LFN 1990,
- b. Federal Environmental protection Agency Act Cap 131 LFN 1990,
- c. Harmful Waste Cap 165 LFN 1990,

- d. Petroleum(Drilling and Production) Regulations, 1969,
- e. Mineral Oil (Safety) Regulations, 1963,
- f. International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971,
- g. Convention on the Prevention of Marine pollution Damage,1972,
- h. African Convention on the Conservation of Nature and Natural Resources,1968,
- i. International Convention on the Establishment of an International Fund for the Compensation for Oil Pollution Damage, 1971.

Other acts and regulations in line with controlling oil spillage as suggested by (Oshineye,2000) include:

- i)The Mineral Oil (Safety) Regulations 1963, focuses on safety in the emission of inflammable gases and impose punishments for violation and defiance.
- ii) Petroleum Regulations 1967, that is against the emission of fossil oil into waters within port areas and makes available precautionary measures in the conveyance of petroleum and guidelines for safe operation of lines
- .iii) Petroleum Drilling and Production Regulation 1969, that requires holders of production licence to safety, including the provision of current approved equipment to prevent contamination of midland waters, river water courses, the territorial waters of the Federal Republic of Nigeria or the high seas by oil or other fluids
- .iv) Oil in Navigable Waters Act 1968, which prohibits the emission of petroleum or any mixture containing oil into the territorial reserve or navigable inland waters.
- v) Oil Terminal Dues Act 1969, that precludes the emission of oil to regions in the main land where oil terminals are located.vi) Petroleum Refining Regulations 1974, which besides other activities deals with necessary development requirements for stockpiling oil tanks to reduce harm from spillage.
- vii) Associated Gas Re-Injection Act 1979 that enforces the re-infusion of such cohorted gas or oil not used in a streamlined venture. This is to eliminate gas flaring.
- viii) Oil Pipeline Act 1956 (as amended by Oil pipelines Act 1965) which kicks against the contamination of all areas including waters bodies

The key measuring parameter and success factor of any spill incident is managing the oil pollution once it occurred from start to finish in an efficient and coherent system.



Managing the oil pollution involves the deployment of series of reactive strategies in reducing the impacts on human community, environment as well the social economic resources of the people by attempting to restore back the status of the environment.

In managing the pollution, attention must be paid to:

- Logistics needs
- Administrative aspects such as the legal implications, claim and compensations
- Press - depending on the size of the incident, the ecological and social effects, media is a serious attraction and distraction which must be managed with care.

## 2. The Strategies

### 2.1 Risk assessment of the spill situation

### 2.2 Contain the spilled oil with appropriate containment



Figure 8&9: Managing Spilled Oil by Boom Corraling.

### 2.3 Recovery of spilled oil



Figure 10&11: Recovery of Spilled Oil.



## 2.4 Storage and Evacuation of recovered oil



Figure 12&13: Storage and Evacuation of recovered Spilled.

## 2.5 Clean up and site restoration



Figure 14 &15: Clean Up and Site Restoration.



**Figure 16:** Restored Site.



**Figure 17:** Restored Clean Water Body After Spilled Oil Recovery.

### **3. Contingency Planning**

An Oil Spill Contingency Plan is an organized and predetermined course of

actions to be pursued in the event of an oil spill emergency. This orderly arrangement of events to contain and control oil spill incidents shall be compiled in a document by all operators in the petroleum industry for approval by the Director of Petroleum Resources, and subsequent implementation by the operators.

Oil Spill Contingency Plan has basically three functions:



- (i) To ensure that the environment is protected,
- (ii) To ensure that manpower, equipment and funds are available to effectively contain and clean up oil spills when they occur and,
- (iii) To ensure that good record-keeping is maintained and accurate information concerning the spill incident management.

Effective and adequate contingency planning for oil spills is very necessary if prompt and effective response must be achieved in the face of an emergency. One of the primary objectives of oil spill planning and response during emergencies, is that after protecting human life, next is to reduce the environmental consequences of the spill and the cleanup efforts. This objective is best achieved if the locations of sensitive resources are identified in advance, so that protection priorities can be established, and cleanup strategies selected. With only a few hours to respond, there is no time for responders to contact all the different resource managers for information on what areas are the most important to protect hence the need for Environmental Sensitivity Index [ESI] Mapping.

Environmental sensitivity index (ESI) maps are a compilation of information about coastal shoreline sensitivity, biological resources, and human resources. This information is used in planning to create response and cleanup strategies *before* an accident occurs so that authorities are prepared to take action in the event of such a spill incident. Advance planning reduces the harmful consequences of oil spills and cleanup.

ESI maps have many features that make them great tools for spill response teams. The maps are created using geographic information system (GIS) techniques in order to present regional maps with data on biological and human resources in an area, as well as information on sensitive shorelines.

Environmental Sensitivity Index [ESI] mapping is one of the tools used in curbing these challenges. The Environmental Sensitivity Index [ESI] is developed to reduce the environmental consequences of a spill and help prioritize the placement and allocation of resources during cleanup efforts.

The successful use of geographic information system versions of the ESI concept during the past ten years has led to improvements and refinements, including:

- the development of tidal inlet protection strategy maps produced before a spill that specify the type of response (e.g., boom, skimmer) and where and how to place it,
- seasonal summary maps,
- classify the sensitivity of rivers using a river Reach Sensitivity Index (RSI),
- regional watershed analysis to identify hazards and potential spill consequences,
- the identification of protection priorities and protection methods for unusually sensitive areas to environmental damage if there is a hazardous liquid pipeline accident.

There are levels of contingency plans:

- Facility Plans
- Local or Area Committees Plans
- Regional Plans
- National Plans

For sensitive area mapping to be effective, it must be an integral component of an overall planning activity which is a key requirement of the Oil Pollution Act of 1990 that advocated the establishment of Area Committees for contingency planning.

To mitigate the impacts of oil spill incidents when they occur and improve on the response strategies and timely response in the Niger Delta Region of Nigeria, the following improvement plans are recommended:

#### **4. Improvement Plan**

- Development of partnership among industries and the government in country.
- Ensure that training and exercises are carried out frequently.
- Develop an effective Tier 1 and Tier 2 capability within oil industries in the region with mutual agreements with international assistance for Tiered 3 spill incidents.
- Maintain a central spill response data base accessible to member companies under mutual aids agreements.
- Ensure that response equipment stockpiles are not duplicated among member companies, but strengthen each member with unique required equipment that are accessible to other members in - country.
- Utilise oil spill modeling capability to simulate oil fate and behaviour as well as using GIS to assess the adequacy of any given oil spill contingency plan [10].

#### **5. Conclusion**

Oil spills and oil pollution are integral parts of the oil exploration and production activities. In most cases, spills are not under the direct controls of the producing companies especially in cases of wilful interventions, such as sabotage, bunkering, oil theft and vandalism of production facilities.

Other sources like natural disaster and accidents in the waterways contribute to oil spills and pollution.

Effective management of the oil spills and pollution requires proactive planning ahead of the incident and subsequent deployment of tested contingency plans to manage the emergency.

The deployment of effective contingency plan and the accentuated efforts of all parties involved with other strategic and operational response plans will reduce escalation and impact of pollution on the environment.

Oil spillage has had a major negative impact on the citizens of Nigeria, and the economy as a whole. An illustration of this can be seen in the friction caused between the

oil producing/servicing companies and resident communities resulting in frustrations, finger pointing, clashes, general resentment and mistrust. Management and control of spills have been handled poorly and this has directly contributed to an escalation of the negative impacts on all involved. Central to the poor state of affairs are the largely obsolete laws and regulations in the Nigerian oil industry which have been outpaced by the prevailing technology for crude oil development and use. There is therefore an urgent need to review the existing oil industry laws and create new ones. The new laws to be promulgated must be relevant to the current state of affairs and strictly enforced to deal with every aspect of the industry, and very importantly, oil spillage.

## **6. Recommendations**

- As prescribed by EGASPIN, the relevant pollution regulations on production operations are provided under Sections 25 and 36 of the Petroleum (Drilling- and Production) Regulations, 1969 must be totally complied with to achieve the primary objective of the guidelines and standards to regulate the environmental management practices in the production and discharge of oily wastes and accidental spills of oils from oil and gas production installations within the territory and territorial waters of the Federal Republic of Nigeria in particular the Niger Delta Region.
- Establish legislation to promote the ratification of relevant international Conventions;
- Designation of authority with clarity in roles and responsibilities for oil spill response. (command and control structure).
- Plan for the possibility of a worst-case oil spill scenario, and adopt all available engineering and management measures to prevent such an incident from occurring.
- Conduct ecological and environmental studies of the Niger Delta Region to understand the marine ecosystem, and its sensitivity to oil spills.
- The public or inhabitants (Farmers, Traders, women groups, school children and the youths) of the Niger delta should be enlightened on the negative effects of pipeline sabotage on the environment and the issues of health and safety hazards of oil when it spills by communicating with them through various seminars, conferences and workshops and engaging them in security and surveillance activities and duties.

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