Environmental Challenges of Oil Spillage for Families in Oil Producing Communities of the Niger Delta Region

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Abstract
This paper examines oil spillage as an environmental issue and considers its relatedness to family living in the Niger Delta Region. It further isolates types of oil spillage, overview of oil spills in the Niger Delta and causes of the oil spills. The environmental and economic effects of oil spills on the livelihood of the people are reviewed to include marine contamination, soil contamination, impact on crop production, impact on the health of family members and general socio-economic effects. Techniques that should be utilized to prevent and control the situation are suggested, and possible recommendations made.

Introduction
The Niger Delta Region belongs to the South-South geopolitical zone of Nigeria. It is the most endowed deltas in the world in terms of both human and material resources. Before the discovery of crude oil, agriculture was the dominant occupation of the people. Crude oil was discovered in commercial quantity in the region specifically in the present Bayelsa State in 1956. Since then oil exploration has continued resulting into what is termed environmental destruction due to neglect and negative attitude of the multinational companies in environmental management in the area. The world today recognises the significance of environmental sustainability to the development of the nations. In fact, one of the cardinal objectives of the Millennium Development Goals is to ensure environmental sustainability. It then implies that there should be reduction in environmental pollution (Eregha & Irughe, 2009).

The Niger Delta region is dominated by rural communities that depend solely on the natural
environment for sustenance living and non-living livelihood (UNDP Report, 2006). Environmental degradation issues are of topical concern to communities in the Niger Delta as it is a major cause of productivity losses. (Opukri & Ibaba, 2008). This is the main reason why oil and gas extraction impact on the Niger-Delta has consequences for the declining productivity of the region which is predominantly based on fisheries and other agricultural activities as farming, and timber businesses. Oil production has definitely worsened environmental disaster in the region (Worgu, 2000).

Oil is a general term used to denote liquid petroleum products which mainly consists of hydrocarbons. The release of oil into the natural environment is termed oil spill. The extraction, refining, transportation and storage of oil are accompanied by seepages and spills by operations or accidents. Deliberate act such as sabotage, oil bunkering, lack of maintenance of engineering equipment, tanker accidents cause oil spill. Oil spill can also occur naturally through natural disasters like hurricane and earthquake, movement of tectonic plate and inadequate trap system.

Oil spill affects the environment negatively. The most damaging and well documented effects of petroleum spillage are the oiling and tarring of beaches, death of seabird, and the destruction of intertidal marine communities. The economy is also affected because of the cost of clean-up exercise, loss of the revenue that would have been generated by the spilled oil and also death of fishes (Zabbey, 2004).

Different clean up exercise are used to remedy oil spills and these depend largely on the type of oil spilled and the prevailing weather conditions at the time of spill. However, no clean up exercise leads to complete remediation of an oil spill. The challenge today is to prevent oil spill through upgrade of flow station, pigging and cathodic protection to minimize internal and external corrosion of pipelines respectively, tank rehabilitation, flow line bundwall rehabilitation and upgrading the oil spill response system.

This paper deals with:

**Types of Oil Spillage**

Oil spill is categorized into four groups namely:

- **Minor spill** occurs when the volume of the spilled oil is less than 25 barrels in inland water or less than 250 barrels on land; offshore or coastal water that does not pose a threat to public health or welfare
- **Medium spill** takes place when the volume of the spill is 250 barrels or less in inland waters or 250 to 2500 barrels on offshore and coastal waters
- **Major spill** occur when the oil discharged to inland water is in
excess of 250 barrels in offshore or coastal waters.

- Catastrophic spill refers to any uncontrolled well blowout, pipeline rupture or storage tank failure which poses an imminent threat to the public health or welfare.

**Overview of oil Spills in the Niger Delta**

Since the discovery of oil in Nigeria in 1956, the country has been suffering the negative environmental consequences of oil development. Oil incidents have occurred in various parts and at different parts along our coast. In Nigeria, 50% of oil spills is due to corrosion of pipelines and tanker accidents, 28% is due to sabotage, and 21% are due to oil production operations while 1% of the oil spill is due to engineering drills, inability to effectively control wells, failure of machines and inadequate care in loading and unloading oil vessels. Oil bunkering is also a source of oil spill.

Oil spills have caused a lot of environmental problems in the Niger Delta. Oil spills have degraded most agricultural lands in the area and have turned hitherto productive areas into wastelands. With increasing soil infertility due to the destruction of soil micro-organisms, and dwindling agricultural productivity, farmers have been forced to abandon their land, to seek non-existent alternative means of livelihood. Aquatic life has also been destroyed with the pollution of traditional fishing grounds, exacerbating hunger and poverty in fishing communities (Gbadegeisin, 1997).

In a study of the socio-economic impact of oil pollution, stated that crude oil exploitation has had adverse environmental effect on soils, forests and water bodies in host communities in the Niger Delta. Farmers have lost their lands, and are consequently forced to emigrate to other communities in search of livelihood exerting additional pressures on natural resources in such areas (Omofonmwan & Odia, 2009). It is noteworthy that, the devastating consequences of oil spill in Niger Delta region with its eventual hazards on both aerial and terrestrial environs tantamount to an irreversible chain effect on both the bio-diversity and safety spills in populated areas affect crops and agriculture through contamination of the groundwater and soils. Spills also contribute to the contamination and death of fishes which affects the economy and human health adversely.

Table 1 shows analysis of oil spill incidences in the Niger Delta:
Table 1: Analysis of Oil Spill incidences in the Niger Delta

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Spill</th>
<th>Quantity Spilled (in barrels)</th>
<th>Quantity Recovered (in barrels)</th>
<th>Quantity Lost to the Environment (in barrels)</th>
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<tbody>
<tr>
<td>1976</td>
<td>128</td>
<td>26157</td>
<td>7135</td>
<td>19021.5</td>
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<tr>
<td>1977</td>
<td>104</td>
<td>32879.25</td>
<td>1703.01</td>
<td>31176.75</td>
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<tr>
<td>1978</td>
<td>154</td>
<td>48929.75</td>
<td>391445</td>
<td>97849.75</td>
</tr>
<tr>
<td>1979</td>
<td>157</td>
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<td>63481.2</td>
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<td>42416.83</td>
<td>558094.2</td>
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<tr>
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<td>5470.2</td>
<td>37252.3</td>
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<td>257</td>
<td>42841</td>
<td>2171.4</td>
<td>40669.6</td>
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<tr>
<td>1983</td>
<td>173</td>
<td>48351.3</td>
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<td>38564.2</td>
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<tr>
<td>1985</td>
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<td>11876</td>
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<td>12905</td>
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<td>12358</td>
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<tr>
<td>1987</td>
<td>129</td>
<td>31866</td>
<td>25757</td>
<td>25757</td>
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<td>1988</td>
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<td>3803</td>
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<td>1990</td>
<td>166</td>
<td>14150.35</td>
<td>2785.96</td>
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<tr>
<td>1991</td>
<td>258</td>
<td>108367.01</td>
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<td>105912.05</td>
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<tr>
<td>1992</td>
<td>378</td>
<td>51187.9</td>
<td>1476.7</td>
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<tr>
<td>1993</td>
<td>453</td>
<td>8105.32</td>
<td>2937.08</td>
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<tr>
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<td>1995</td>
<td>417</td>
<td>63677.17</td>
<td>3110.02</td>
<td>60568.15</td>
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<tr>
<td>1996</td>
<td>158</td>
<td>39903667</td>
<td>1183807</td>
<td>38716.87</td>
</tr>
<tr>
<td>Total</td>
<td>4647</td>
<td>2369470</td>
<td>549060.38</td>
<td>1820410.5</td>
</tr>
</tbody>
</table>

*Source: Uyigue & Agho in Eregha & Irughe (2009)*

**Causes of Oil Spill**

Oil spills can be caused by natural and man-made reasons: 

*Natural Causes*

- Oil spill can be caused by natural seepage, especially in the ocean.
As tectonic plates shift, they may release oil from reserves trapped deep such as drilling beneath the ocean floor.

- Underwater pipeline, when ruptured or cracked by the movement of tectonic plates.
- When petroleum forms at depth, it slowly fills the tiny holes within nearby porous rocks, known as reservoir rocks.

**Mannmade Causes**

Oil spills can occur due to manmade reasons which include:
- Carelessness (such as oil bunkering, sabotage and oil siphoning).
- Oil siphoning.
- Terrorism and
- Accidents (such as tanker accidents and accident during production operation).

**Oil Spill Effect On The Livelihood Of People.**

**Marine Contamination**

The impact of oil spill on marine life depends largely on the physical and chemical characteristics of the particular oil and the way these changes with time, a process known as 'weathering'. The specific gravity, viscosity, chemical composition and toxicity of the pollutant are the main properties which determine the likely impact of oil on sea organisms. The type of environment oiled is also important, e.g. sandy, rocky, salt marsh or mangrove. When oil spills into the ocean, it's especially likely to harm animals and plants at two interfaces (places where different things come together): (i) Near the surface of the water, where water and air meet, and (ii) Along the shore, where water and land meet.

According to Akpofure (2008) the oil activities in the area has resulted to situations whereby complete polluted water is bequeathed to the children. The communities’ shorelines have been washed away or eroded due to the high volume of deep-sea exploration and exploitation activities. With the expansion of oil production, the incidence of oil spills has greatly increased.

Available records show that a total of 6,817 oil spills occurred between 1976 and 2001 with loss of approximately three million barrels of oil in the region. Approximately twenty-five percent spilled in swamps and sixty-nine in off-shore (UNDP Report, 2006). Besides oil spills as source of water pollution, canalization and wastes discharged into freshwater swamps and into the sea are other sources (Akpofure, 2008). In an attempt to shorten travel time and improve access to oil fields and production facilities, oil companies have constructed canals that in some cases have caused salt water to flow into freshwater zones destroying freshwater ecological systems. The toxic effects of oil on marine life depend on the duration of exposure.
and oil concentration in the environment. The presence of toxic components does not always cause mortality, but may induce temporary effects like narcosis and tainting of tissues, which usually subside over time. Oil spills in the ocean destroy small sea organisms, fish, seabirds, sea mammals, shorelines and may contaminate the ocean floor for many years after the event.

In Ibeno, Akwa Ibom State, where Mobil’s operations have reportedly led to the loss of fish populations along the coast, fishing is available only to those who can afford large boat engines and trawlers to venture into the high seas. The rest of the population must buy “ice fish” (frozen fish) from commercial fishermen, a practice totally unknown a few years back. Since market prices are constantly on the rise, many villagers have to go without fish. Only a small sector of the local population in Ibeno finds employment in Mobil’s facilities, and thereby earns money to buy food.

**Fresh water and groundwater contamination**
In fresh waters, oil contamination can result in severe impacts on the habitat because the movement associated with water is minimal, as compared to marine environment. Stagnant water bodies cause the oil to remain in the environment for long, resulting in prolonged exposure of the plants and animals (Chindah, 2000). In the case of flowing streams and rivers, the oil not only tends to collect on plants and grasses growing on the banks but also interacts with sediments, thereby affecting the organisms. In cases where a stream that provides potable water is affected by a spill, the people in the area will suffer the problem of obtaining potable water.

**Soil contamination**
Oil hamper proper soil aeration as oil film on the soil surface acts as a physical barrier between air and the soil. Oil pollution affects the physicochemical properties of the soil such as temperature, structure, nutrient status and pH.

**Impact on crop production**
Oil spill on crops causes great damage to the plant community due to high retention time of oil occasioned by limited flow. Oiled shoots of crops like pepper and tomatoes may wilt and die off due to blockage of stomata thereby inhibiting photosynthesis, transpiration and respiration. In fact the germination, growth performance and yield of these crops are stifled by oil spillage.

The environmental consequences of oil pollution on the inhabitants of Niger Delta are enormous. Oil spills have degraded most agricultural lands in the State and have turned hitherto productive areas into wastelands. With increasing soil infertility due to the destruction of soil microorganisms, and dwindling agricultural productivity, farmers have been
forced to abandon their land, to seek non-existent alternative means of livelihood (Chindah, 2000).

**Effect on Human Health**
The main problems with oil spill are the negative effects of ingesting toxic metals. Most of the oil spill contaminated sites containing appreciable amount of heavy metals and other contaminants that could affect the health of people living in the neighbourhood of such disaster area. The concentration of trace elements like Cr and Ba detected in oil spill sites of the Gulf war were higher than permissible safe limits. Skin contact with certain chromium compounds can cause skin ulcers. Ingesting large amounts of chromium can cause stomach upset and ulcers, kidney and liver damage and even death. The health effects of barium depend upon the water-solubility of the compounds. Small amounts of water-soluble barium may cause a person to experience breathing difficulties, increased blood pressures, heart rhythm changes, stomach irritation, muscle weakness, changes in nerve reflexes, swelling of brains and liver, kidney and heart damage. Serious respiratory problems witnessed in many communities can be linked to environmental pollution. According to Omofonmwan & Odia, (2009) respiratory problems, coughing up blood, skin rashes, tumours, gastrointestinal problems, different forms of cancer, and malnourishment, were commonly reported ailments in many communities.

**Economic Impact**
Most studies regarding the effects of oil spillage on family living in the Niger Delta Region focus on the socio-economic activities of the people. Gabriel (2007) in his study on environmental issues and challenges in the Niger-Delta focuses on its impact on women economic activities in the area. He employed a theoretical approach to highlight the emerging effects of the environmental hazards on the region and concluded that it has adverse effects on women activities. Also contamination of coastal amenity areas is a common feature of many oil spills, leading to interference with recreational activities such as bathing, boating, angling and diving. Hotel and restaurant owners and others who gain their livelihood from the tourist trade can also suffer temporary losses.

**Remediation Techniques And Prevention/Control Measures**
Oil spills pose an immediate threat to the environment and require quick and thorough responses. The remediation of oil spill has to do with getting rid of the oil in order to avoid or reverse environmental damage. It is important to start removing oil promptly from contaminated areas because as time passes and the oil weathers, it causes more damage to the resources in its path. The various
methods employed in the removal of oil from the natural environment are usually referred to as clean-up techniques. Almost all clean-up techniques have the potential to cause additional damage but care has to be taken in employing any remedial method so as not to make matters worse. Zabbey, (2004) asserts that the clean-up technique(s) applied for a particular spill depend largely on the type of oil, and the conditions present at the location and during the time of the spill. The various remediation processes can thus be broadly divided into two categories:

- Long term process
- Short term process

Both these categories are the result of the kind of techniques used for treatment of oil spills and the various advantages and disadvantages of these techniques.

Short term processes

Short term processes, as the name implies, are clean-up techniques that are brief. They include the following:

- Containment and recovery with booms and skimmers: This is usually the first measure used to attempt to clean up after an oil spill. Booms are long, floating plastic or rubber barriers placed around floating oil for the purpose of containing (limiting further spreading) and concentrating the oil for recovery. In addition, booms may be used to divert and channel oil slicks along desired paths, making them easier to remove from the surface of the water.

After the oil is contained using booms, ‘skimmers’ or boats that skim spilled oil from the water surface are used. Skimmers are floating devices used to recover oil from water. They come in different designs. The simplest skimmers are suction devices which remove oil from the water surface directly or via a weir, although these tend to pick up a lot of water at the same time (Uyigue & Agho, 2007).

- Use of dispersants: Dispersants are a group of chemicals designed to be sprayed onto oil slicks to promote the formation of tiny oil droplets, and delay the reformation of slicks. Significant environmental and economic benefits can be achieved, particularly when other at-sea response techniques are limited by weather conditions or the availability of resources. In certain situations, dispersants may provide the only means of removing significant quantities of surface oil quickly, thereby minimizing or preventing damage to important sensitive resources.

- In-Situ Burning: In-situ burning is the term given to the process of burning oil slicks at sea, at or close to the site of a spill. Burning may be seen as a simple method which has the potential to remove large amounts of oil from the sea surface.
The decision whether or not to burn a slick at sea is often contentious. Issues such as the distance of the oil from the damaged vessel or from a populated area; the potential toxicity of the resultant smoke; the nature of the oil; the likelihood of the burn being successful; and the fate of any unburned residues all require careful attention before attempts are made to ignite the oil (Akpofure, 2008).

- **Absorption**: Absorption is the technique employed in choppy or fast moving waters, when methods like containment and removal fail. In this method, sorbent materials such as talc, straw, sawdust and synthetic absorbents are added to the oil slick and then removed when they have soaked up some of the oil. These sorbent materials act like a big sponge, removing oil but contaminated absorbent materials must be treated as toxic waste and present disposal problems. Also, straw and sawdust can become waterlogged and difficult to remove.

**Long term remediation processes**

Long term remediation processes takes longer time than short term processes.

Bioremediation (B1) is the only long term clean-up technique known. This involves the use of microorganisms, such as bacteria, to remove environmental pollutants from soil, water, or gases. In other words, it is a process that uses microorganisms to transform harmful organic compounds, like oil, into nontoxic and less dangerous compounds such as fatty acids and carbon dioxide.

**Prevention/control measures**

Oil spills remain a persistent cause for concern, damaging the environment, posing health hazards and disrupting production (Uyigue & Agho, 2007). The petroleum industry undertakes a good number of measures in order to reduce the likelihood of oil spills. The measures include:

- **Upgrade of flow stations**: This has to do with the improvement of the quality, standard or performance of the facilities in the station in order to prevent oil spill. Bundwalls surround flare pits in flow stations. Flow station bundwall repairs ensure that the stations retain liquids carried in their flare pits until they are evacuated. Also important are rehabilitation/repairs, replacement and burial of flow lines.

- **Pigging**: This is the removal of debris from pipelines in order to minimize internal corrosion.

- **Cathodic protection**: This is the prevention of electrolytic corrosion of a metallic material by making it the cathode in an electrolytic cell.

**Rehabilitation of tanks**

To reduce the rate of oil incidents
along the Nigerian coast particularly as a result of vandalization, the Federal Government through an act of the National Assembly created the Niger Delta Development Commission (NDDC). Part of the responsibilities of the commission is to develop a master plan for the development of the Niger Delta, provide infrastructure and create an enabling environment for industrialization and employment. There are also several other laws dealing with issues related to oil pollution in the environment.

One of the socio-economic control measures could be prompt payment of compensation to the affected communities. Oil companies rarely accept to pay compensations promptly. Even when the oil companies do provide compensation for damage caused by spills and leaks, their system of assessment and payment are often very cumbersome and unsatisfactory (Akpofure 2008).

**Conclusion**

Oil spill is harmful to the environment and thus, requires quick intervention. No remediation technique results in total removal of all spilled oil and there are substantial drawbacks for each method. Ultimately, prevention is the best method to limit oil spills.

Several measures have been taken by the petroleum industry, governmental and nongovernmental organizations in Nigeria and worldwide, to reduce the likelihood of oil spills. So far, the measures are yielding good result even though there are still human sabotages here and there.

**Recommendations**

To minimize the occurrence of oil spill in the oil producing areas, the following recommendations are made:

- The causative factors should be taken care of.
- Sabotage and oil bunkering can be stopped through proper engagement and empowerment of the youth and women groups and also through proper and adequate monitoring of pipeline and oil installations/facilities.
- Corrosion can be prevented by pipeline and flow line replacement, routine pigging and application of cathodic protection systems, which are regularly monitored and upgraded where necessary.
- Oil spill response system should be upgraded.
- Major flow stations should be stocked with first-line response materials (such as booms, absorbents and tanks) that enable field operators to respond promptly and effectively to spills.
- The creation of regional spill response centres along coastlines will help in managing oil spill problems.
- In order to reduce the response time and qualify the decision-
making process, application of Geographic Information Systems (GIS) as an operational tool has been suggested. Information on the exact position and size of the oil spill can be plotted on maps in GIS and a priority of the combat efforts and means according to the identified coastal sensitive areas can be carried out.

References


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