

# An Investigation of the Pattern And Environmental Impact of Oil Spillage in Etche Local Government Area of Rivers State, Nigeria

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## ABSTRACT

Sequel to the threat posed by incessant oil spill in the Niger Delta region of Nigeria, this work was conceived with the aim of examining the pattern of oil spillage in Etche Local Government, in Rivers State of Nigeria and the consequent impact on the environment. The study adopted the survey research design. Interviews, questionnaire and observation instruments were employed in data generation and collection. Graphic illustrations and percentage analysis were also employed to describe the relative ratio of each factor to other factors. Result revealed that about 29 oil spill incidents occurred within the period under study (2001-2007). The volume of oil spilled cumulated to 4,270 barrels; with year 2003 having the highest (4171.5 barrels) and year 2005, having the lowest (0.1 barrel). The work concluded by recommending HSE Training (Staff/contractors), Improved asset integrity management (that may include: Flowline replacement, Flowline burial, Flowstation and facilities upgrade, Integrity testing and inspection), emergency response to spill cases, Surveillance by communities, Awareness campaigns, Improved interaction with communities and Presence of Joint Task Force (JTF) for efficient and effective spill management law enforcement.

## 1.1 BACKGROUND TO THE STUDY

Crude oil spill is the unintentional release of liquid petroleum hydrocarbon into the environment as a result of human activity. The term often refers to marine oil spills, where oil is released into the ocean or coastal waters. Most man made oil pollution comes from land-based activity.

Oil spillage occurs due to a number of causes which include the following: corrosion of pipelines, sabotage and oil production operations. Sabotage and oil siphoning has become a major issue in the Niger Delta States as well, contributing of further environmental degradation (Anderson, I. 2005). Damaged lives may go unnoticed for days, and repair of the damaged pipes take even longer. Oil siphoning has become a big business, with the stolen oil quickly making its way into the black market (Human Rights Watch, 1999).

In late December 2006, more than 200 people were killed in the Lagos region of Nigeria in an oil line explosion (CNN, 2006). The 2006 explosion started after the oil line was tapped by people siphoning the oil, with the intention of black market-resale (CNN, 2006).

Many factors – local currents, weather, water temperatures and the composition of the oil itself, among others affect the degree of long-term environmental damage from big oil spills (Maclean, 1993). Heavy oil is more likely to be deposited on shorelines and can be extremely difficult to clean up if washed onto soft, absorbent-sand (Maclean, 1993). Moreover, heavy oils are largely insoluble, forming coherent-masses, which float on the surface or become stranded on the shore, and can thus cause damage at a considerable distance from their point of release (Nelson, 1971). The heavy oil that eventually sinks can cover bottom-dwelling species such as crabs, with a thick film and damage feeding and breeding species.

Oil spillage is a major environmental problem associated with oil exploration and exploitation activities. It has also caused regional crisis in the Niger Delta in onshore areas, most pipelines and flow lines are laid above the ground. Pipelines which have an estimated life span of about 15years are old and susceptible to corrosion. Many of the pipelines are as old as 20 – 25years. Even Shell admits that “most of the facilities were constructed between the 1960s and early 1980s at the then prevailing standards”.

It is indeed a fact to state that the oil sector has immensely contributed to the general development of Nigeria. This is evident in the heavy dependence of the economy on the oil sector, which accounts for 90 – 95% of export revenue, employment opportunities created, provision of funds for take-off of the other industries (e.g. iron and

steel industries, petrochemical and fertilizer industries) and even the provision of various infrastructure in various parts of the country.

Despite the fact that the oil sector has contributed immensely to the development of the nation, it should be emphasized that a lot of catastrophic damage has been done to the environment of the areas of production. Oil spillage has a major impact on the ecosystem into which it is released. Immense tracts of the mangrove forests, which are especially susceptible to oil have been destroyed. An estimated 5 – 10% of Nigeria's mangrove ecosystem has been wiped out due to oil exploration. The rainforest which previously occupied some 7,400sq.km of land has disappeared as well.

Spills in populated areas often spread out over a wide area, taking out crops and aquatic cultures through contamination of ground water and soils. In agricultural communities, often a year's supply of food, can be destroyed by only a minor leak, debilitating the farmers and their families who depend on the land for their livelihood. Drinking water is also frequently contaminated, and sheets of oil is visible in many localized bodies of water. If the drinking water is contaminated, even if no immediate health effects are apparent, they contaminate coastal environmental leading to a decline in local fish production.

The oil industry has been accused of adding to the damage done to the environment by carbon dioxide emission, which contributes to global climate change.

## **1.2 STATEMENT OF THE PROBLEM**

Oil spill poses a major threat to the environment in Nigeria. If not checked or effectively managed, it could lead to total annihilation of the ecosystem, especially in the Niger Delta where oil spills have become prevalent. Life in this region is increasingly becoming unbearable due to the high effects of oil spills and many communities continue to groan under the degrading impacts of oil spills (Oyem, 2001).

The mangrove was once a source of both fuel wood for indigenous people and a habitat for the area's biodiversity, but now oil toxicity has depleted and devitalized the ecology. Oil spill also has had adverse effect on marine life, which has been contaminated in turn having negative consequences for human health from consuming contaminated seafood. Farmlands and drinkable water are destroyed also and cause draw back in fishing of the coastal water. Oil spills in the Niger Delta have been a regular occurrence, and the resultant environmental degradation of the surrounding environment has caused significant tension among the people living in the region and the multinational oil companies operating there.

## **1.3 AIM**

The aim of this study is to examine the pattern of oil spillage in Etche and the consequent impact on the environment.

## **1.4 STUDY AREA**

Etche is the 4<sup>th</sup> largest ethnic group in the present day Rivers State. Etche has two local government areas namely (Etche Local Government Area and Omuma Local Government Area). Etche occupies a land mass of about 1,500sq km and has a population of about 600,000 people. Etche is bounded in the North by Imo State, in the East by Abia State and Oyigbo in Rivers State, in the West by Ikwere Local Government Area and in the South by Obio Akpor Local Government Area. It lies on latitude 4<sup>o</sup>30N and longitude 4<sup>o</sup>35E of the Greenwich Meridian.

## **2.0 LITERATURE REVIEW**

Mc Oliver (1984) noted that oil exploration has caused pollution and destroy many hectares of land in the oil producing areas. Marshes, which constitute an important component of river, estuarine, and coastal ecosystems are extremely sensitive to oil pollution (Gundlach et al, 1977) and can be severely damaged by spills, which block carbon fixation by stifling plant transpiration and, through this mechanism and others can kill marsh vegetation (Pezeshki et al, 2000).

Fuel oil from spills has been known to persist for at least 5 years in marsh sediments, from which it can be released into the marsh water. This persistence is reflected by high hydrocarbon levels in shell fish inhabiting the polluted marsh or exposed to hydrocarbons released there from (Burns and Teal, 1979; Sanders et al, 1980; Maki, 1991; Wade, 1993).

Osuagwu, (1984) examined the impact of petroleum activities on the agricultural sector and observed that although the oil boom attracted economic and political power to Nigeria, it unfortunately led to environmental devastation, socio-economic deprivation and general under development of very oil producing communities. Fishes may be exposed to spilled oil by direct contact. In this case, their gills might get contaminated or their eggs might absorb some components of oil. They may also eat contaminated food without knowing it. Hence they may suffer changes in their heart and respiratory rate. Some may even have enlarged livers, reduced growth, fin erosion, a variety of biochemical and cellular changes, and reproductive and behavioural responses. Furthermore, chronic exposure to certain chemicals found in the oil may cause genetic abnormalities or cancer in some species. This will in turn affect humans (Environmental and Science, 2005).

Studies on crude oil spills from the Idoho production platform to Mobil Qua Iboe Terminal in Akwa Ibom State showed that health conditions normally associated with oil operations like skin disorder like rashes, rashes and discharges were recorded and were linked with oil acne (a kind of skin eruption resulting from exposure to crude oil). Oil field workers have been reported to have skin eruptions as a result of exposure to crude oil, which also is seen among local fishermen who get in contact with incidences of major oil spill. Other disease conditions like gastro-intestinal and respiratory disorders were also linked to the oil spill. Their prevalence rates were slightly higher after the spill. The poor seafood and water supply quality, which were equally attributed to the oil spill also affected the health of the communities negatively (Chinweze, C.U, 2004).

Okpella in Nigeria Edo State suffered its second oil spill in three years when a pipeline belonging to the NNPC (Nigerian National Petroleum Company) a state owned concern ruptured and spilled an as yet undetermined amount of refined crude oil into the environment. The refined crude oil seeped into the underground water supply and then into a stream which provides the villages water. Investigation reveals that more than 53 wells in the town have been polluted as speck of refined crude float in the water (Adetokumbo Abiola 2002).

Fishing, the main livelihood of most residents has also failed to return to pre-oil spill levels even as fisher folks have resumed their fishing activities. Many affected residents especially in the worst affected areas have not recovered from the loss of their livelihood and income (Nestor, P. B. 2007). When oil spill occurs near the shore, the whole adjoining district is invaded by nauseating pungent smell as air current carries volatile components far afield. The risk of fire is high so that ships and boats moored near the harbor are usually warned to leave. Swimming and other recreational activities are suspended (Okonkwo and Eboatu, 1999).

Several studies document cascades of events indirectly affecting individual survival or reproduction after sub-lethal exposures. Oil exposure resulted in lower growth rates, reproductive impairment, abnormal developments in fish, a decline in mating and the appearance of smaller eggs in seabirds, cascades of indirect effects were also present after the oil spill, where indirect interaction lengthened the recovery process on rocky shorelines for a decade or more for example; an initial loss of cover habitat led to losses of important grazers and promoted blooms of unwanted ephemeral green algae and opportunistic barnacles (Peterson et al, 2003).

Kalu (2000) reports that activities of oil exploration impact heavily on wildlife. Reptiles such as crocodiles, alligators and monkeys are driven from their natural habitats through noise of helicopters, noise from explosive used for seismic surveys. A number of them have been killed by pollution of water creeks and swamps due to contamination from oil spillage toxic waste dump. He observes further that further growth in fish biomass in the Niger Delta is bleak as a result of the aggregate threat posed by oil spillage and habitat destruction. Whatever affects fishery resources, affects the economy of the rural communities of Niger Delta. This is because fishing and farming is the major employment of a greater percentage of the region's workforce. Works of this nature has been mainly on regional level and as such this work is concentrating on only Etche community to reveal the expected micro impacts of oil exploration.

### **3.0 RESEARCH METHODOLOGY**

The study adopted the survey research design. This design and approach adopted is mainly because the study is an effort geared towards a specific existing problem in the environmental management discipline "crude oil spillage in Etche – motivated by the need to solve the specific problems of oil spillage in Nigeria". The research

also employed graphic illustration to define factors behind the series of crude oil spillage as well as the major impact this spillage has on the environment. Percentage analysis was also employed to describe the relative ratio of each factor to other factors.

#### 4.0 ANALYSIS DATA PRESENTATION

##### 4.1 OIL SPILLAGE IN ETCHE COMMUNITY

Table 1: Oil Spills in Etche between 2001 – 2007

Year	2001	2002	2003	2004	2005	2006	2007	Total
No. of Spills	6	5	5	5	2	2	4	29

Source (SPDC, 2007).

Table 1 shows total number of oil spills in Etche Community between 2001 and 2007. The data in table 1 are also presented in graphic and pictorial forms in figures 1, 2 and 3.



Fig. 1: Crude Oil Spill on Farm Land

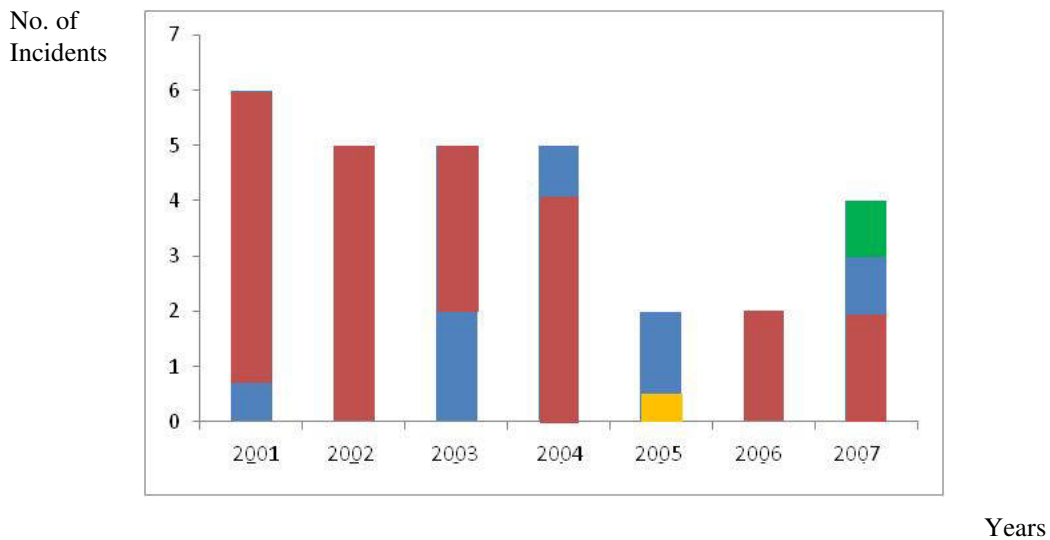


Fig. 2: Bar Chart showing Number of Spills in Etche Community (2001 – 2007)

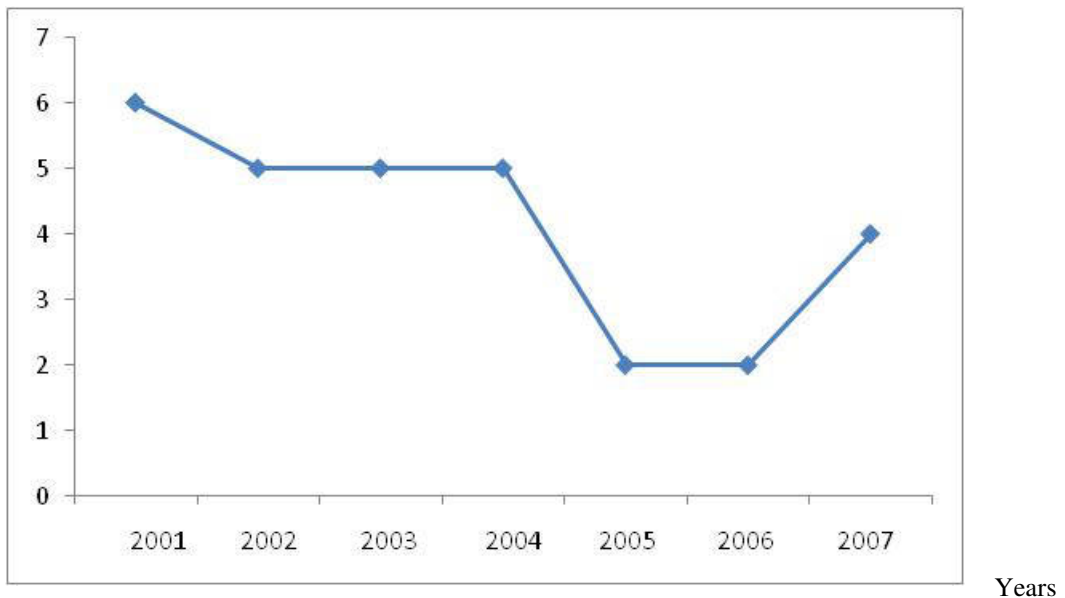


Fig. 3: Graphic Representation of Oil Spill Incidents

Table 1 shows the number of oil spilled in Etche community between 2001 and 2007. From the table, total of 29 oil spill incidents occurred. Fig. 2 shows the number of spill in Etche community represented in a Bar Chart. Within each bar chart represent the major causes of oil spill. Fig. 3 shows the graphical representation of oil spill incidents. The graph shows how number of incident fluctuates.

#### 4.2 Quantity of Oil Spilled in Etche Community

Table 2: Showing Quantity of Oil Spilled between 2001 – 2007

Year	2001	2002	2003	2004	2005	2006	2007	Total
Quantity spilled in barrels	46.1	12	4171.5	12.83	0.1	0.5	27	4,270

Source: (SPDC, 2007).

Table 2 shows the quantity of oil spilled between 2001 and 2007. A total of 4,270 barrels were spilled. These quantities are graphically represented in figures 4.

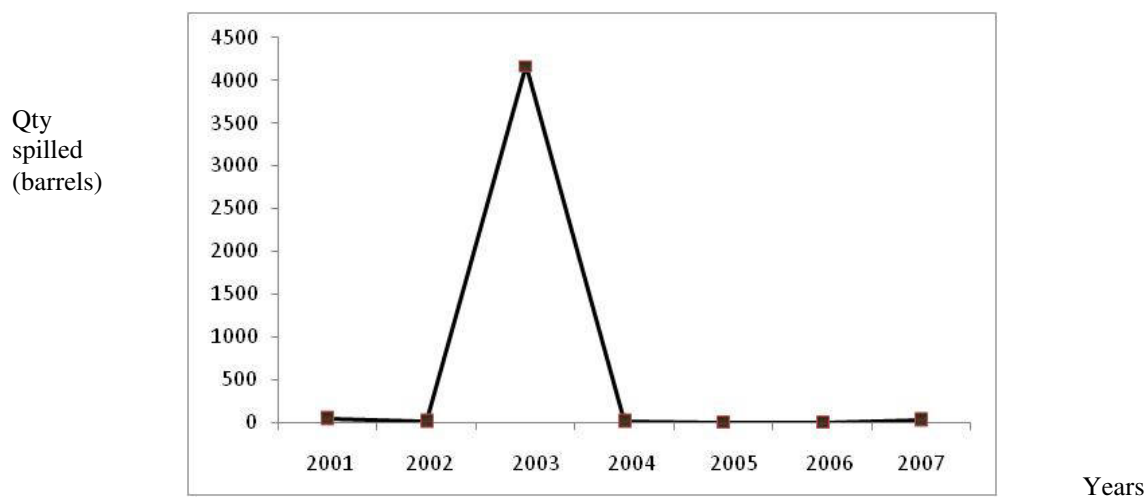


Fig. 4: Graphic Representation of Quantity of Oil Spilled in Etche Community (2001 – 2007)

### 4.3 SOURCES OF SPILLAGE

Table 3: Showing spill causes in Etche between (2001 – 2007).

Year	S	PE	C	O
2001	5	1	-	-
2002	5	-	-	-
2003	3	2	-	-
2004	4	1	-	-
2005	1	-	1	-
2006	2	-	-	-
2007	2	1	-	1

S = Sabotage

C = Corrosion

PE = Pipeline Equipment O = Others

Source: SPDC, 2007.



Fig. 5: (34 cuts made along the trunk line within 2 weeks) – Dec. 2004. Hack-saw cuts on 18” Trunk line.



Fig. 6: Spill caused by removal of Bolts and Knots from Flow Lines with Free Oil February, 2005.

#### 4.4 OIL SPILLAGE IMPACT

The major impact of oil spill include destruction of farm fields; destruction of soil fauna and flora; poisoning of both surface and underground water; destruction of aquatic life and other economic livelihood.



Fig. 7: Shows large hectares of farmland destroyed by oil spills in Etche in November, 2001.



Fig. 8: Shows Destruction of Flora in Etche Community, November, 2003.





Fig. 9: Shows oil spill contribution to fire incident and destruction of aquatic life

#### 4.5 DATA DISCUSSION AND INTERPRETATION

Table 4.1 shows total number of oil spills in Etche Community between 2001 and 2007. A total of 29 spills were recorded; with year 2001 recording six (6) spills, while 2002, 2003, 2004, 2005, 2006 and 2007 had five (5), five (5), five (5), two (2), two (2), four (4), respectively. The year 2001 recorded the highest spills for the year under consideration; while years 2005 and 2006 had the lowest spills.

Although, the year 2003 had the highest quantity 4,171.5 barrels of oil spilled within the seven years under consideration. 0.1 and 0.5 barrels been the lowest spill occurred in the 2005 and 2006 respectively. A total quantity of 4,270 barrels were spilled within the seven year period. On the average, Etche has been witnessing four (4) spills per year with 610 barrels per year. The year 2001 had 46.1 barrels spilled, while the years 2002, 2003, 2004, 2005, 2006 and 2007 had 12 barrels, 4171.5 barrels, 12.83 barrels, 0.1 barrel, 0.5 barrel and 27 barrels spilled respectively. On the causes of oil spill in Etche Community and four (4) major causes were observed. They include: sabotage, pipeline equipment, corrosion and others.

Sabotage caused 22 spills in Etche Community between 2001 and 2007. Pipeline equipment had a share of five (5) incidents, while corrosion and others had one (1) incident each. Sabotage had 75.9% of all the causes of oil spill in Etche Community; while pipeline equipment, corrosion and others shared 17.2%, 3.5% and 3.5% respectively. The year 2001 and 2002 witnessed the highest sabotage with five (5) incidents each. Corrosion and others recorded only one (1) incident each. The year 2003, 2004, 2005, 2006 and 2007 had 3, 4, 1, 2, and 2 spill incidents respectively. Pipeline equipment – recorded one (1) incidents each in year 2001, 2004 and 2007 respectively. Corrosion incident and other causes occurred only once each within 2005 and 2007 respectively.

#### 4.6 DISCUSSION OF FINDINGS

From tables 1, 2, and 3, it was observed that about 29 oil spill incidents occurred between 2001 and 2007 in Etche Community leading to loss of about 4,270 barrels of oil. The outstanding cause of oil spill in Etche Community is sabotage. Etche Community had 75.9% of oil spills due to sabotage either from the villagers, or militants who may want to obtain favour from oil companies or many want to extort money from these companies. Only about 17.2%, 3.5% and 3.5% were caused by pipeline equipment, corrosion and others too insignificant to classify.

From the questionnaire distributed, the major impact of oil spill include destruction of farm land, destruction of soil fauna, and flora; poisoning of both surface and underground water; destruction of aquatic life and other

economic livelihood. Compensation were paid to villagers especially in the year 2004, 2005 and 2006. However, no single compensation has exceeded the sum of ₦20m (twenty million). This inadequate compensation and lack of social infrastructure has made life very unbearable for Etche people. There is no access road, no portable water and no electricity in most part of Etche Community.

## 5.1 SUMMARY, RECOMMENDATION AND CONCLUSION

Oil Company operating within Nigeria territory are mandated to adhere to the following oil company Global Environmental Standard (GES).

- All onshore major installations shall have been assessed for soil and groundwater contamination. Where contamination is detected, risk based mitigation/control measures shall be demonstrably in place.
- Energy use and efficiency shall be actively monitored at all major facilities with a 5 years EMP.
- Waste: Management control system shall be in place in all major installations to minimize waste. Hazardous and non-hazardous waste shall be identified, segregated, appropriately stored and managed.
- Spill response and preparedness: Plans shall be in place to deal with spills arising from the activities of a company/business unit/site.
- Biodiversity conservation.

## 5.1 SUMMARY OF MAJOR FINDINGS

The research treated “crude oil spillage in Etche Community, Rivers State”. The thrust of the problem was on the impacts of oil spillage in Etche Community, while the aim of the study was to examine the impacts of oil spillage on Etche Community between the 2001 and 2007. The objectives of the study include: to examine the oil spillage in Etche and its environs; to identify major sources and cause of oil spillage within the study area; to evaluate the impact of oil spillage on the environment; and recommend appropriate measures with a view to solving the problems of oil spillage in Etche.

Survey research design as well as interviews, questionnaires and observation instruments were employed in data generation and collection. Graphic illustrations and percentage analysis were also employed to describe the relative ratio of each factor to other factors. Result revealed that about 29 oil spill incidents occurred within the period under study (2001-2007). The volume of oil spilled cumulated to 4,270 barrels; with year 2003 having the highest (4171.5 barrels) and year 2005, having the lowest (0.1 barrel).

Other years had their own shares as follows: 2001 – 46.1 barrels; 2002 – 12 barrels; 2004 – 12.83 barrels; 2006 – 0.5 barrels; 2007 with 27 barrels. The major causes of oil spill in Etche as identified include; sabotage taken a lion share of 75.9%, pipeline equipment 17.2%, corrosion 3.5% and 3.5% for others too insignificant to categories. The outstanding impacts of oil spill in Etche include; destruction of farmland, pollution of surface and underground water systems, elimination of sources of income, destruction of soil flora and fauna, as well as health impacts.

Recommendations were made on how to reduce oil spills in Etche Community. And oil companies were urged to make concerted efforts to address legacy issues via poverty reduction, good governance through strategic partnership and increased local content; financial and technical support to Etche Community as well as employment to ensure sustainability of development.

## 5.2 MEASURES EMPLOYED TO REDUCED OIL SPILL

- \* Policies (HSE, Asset management, emergency response)
- \* Training (Staff/contractors)
- \* Improved asset integrity management that may include
  - Flowline replacement
  - Flowline burial
  - Flowstation and facilities upgrade
  - Integrity testing and inspection
- \* Surveillance by communities
- \* Awareness campaigns
- \* Improved interaction with communities
  - Use of community liaison officers;
- \* Presence of Joint Task Force (JTF)

### Oil Spill Response Flow Process

- \* Containment
- \* JIT and recovery
- \* Assessment and clean-up
- \* Remediation/Site restoration
- \* Certification

### Clean-Up Process Flowchart

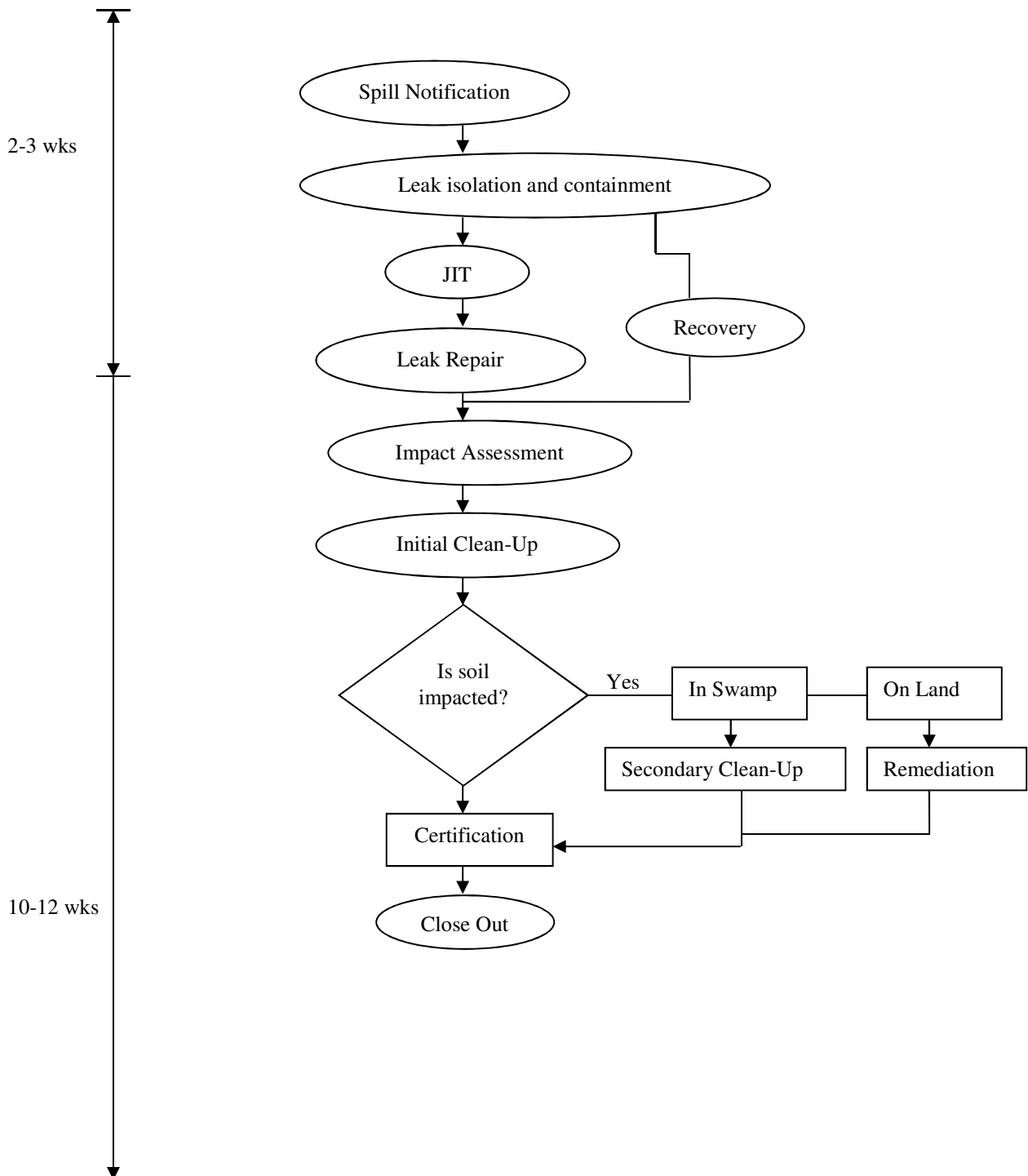


Fig. 9: Clean-up Process Flowchart

## Remediation Techniques

Various remediation options that have been selected and applied in the order of decreasing significance include:

- Remediation by enhanced natural attenuation
- Consisting of bioremediation and land farming (RENA)
- Stabilization by cement fixation; and
- Low temperature thermal desorption unit (LTDU)

## Remediation of Past Impacted Areas

All operational facilities and known past spill sites are being assessed using a Risk Based Corrective Action (RBCA) approach, which evaluates risk by considering the potential sources, pathways and receptors of hydrocarbon contamination.

## Summary of Remediation Performance in Niger Delta

**Table 4: Summary of Remediation Performance in Niger Delta**

Category of Spill	Total No Sites	No Completed To Date	% Completed
Legacy sites	1062	1018	96.0
2005 spills	224	224	100.0
2006 spills	252	193	76.6
2007 spills (End June)	158	38	24.1

Source: (SPDC, 2007).

## 5.4 RECOMMENDATION

- Reduce oil spills
- Sustain ISO 14001 certification program
- Sustain progress in gas flare-down projects
- Continuous stakeholders engagement in environmental programme
- Promote sustainable community development activities
- Grow the EIA practice and build professionalism in the process
- Improve overall environmental performance.

## 5.5 CONCLUSION

Oil Company has an extensive portfolio which extends itself over the full Etche Community. Etche has many different and diverse communities. Etche has difficult accessible land, characterized by mangrove, seasonal swamps and forests. Oil Company like Shell (SPDC) should make concerted effort to address legacy issues. Address poverty, health and local governance challenges through strategies partnership and increased local content. They should provide financial, technical support to whole communities to empower them to take ownership for, and ensure sustainability of development.

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