Crude oil and refined products spill incidence impact evaluationin Eleme, Rivers State, Nigeria

Abstract

This study aimed to assess crude oil and refined products spill incidence and perceived impacton livelihood of inhabitants in Eleme, Rivers State, Nigeria. The research adopted questionnaire, interview and survey methodology. The population of the study is 4648 being the total persons living around and about crisscross of pipelines and facilities, size of 368 selected at random from the study sites. The primary data, questionnaires and oral interview were major instruments deployed and used for data collection and simple percentages were used in analyzing the data collected from the questionnaire. The major cause of spill was identified as pipeline sabotage, followed closely by pipeline rupture.Preponderance of the respondents strongly agreed that the magnitude of crude oil and refined products spill had impacted negatively on livelihood of inhabitants, that there are consequences associated with crude oil and refined product spill on soil and water in the study area, that there are mitigation and measures of curtailing crude oil and refined products spill in the study area, and that crude oil and refined product spill have a significant effect on the study area.Prevention should be adopted as arisk management strategy in addressing soil and water pollution in Eleme, arising from Crude oil spill.

Keywords: Crude oil, livelihood,mitigation;prevention, refined products

1.0 Introduction

Nigeria is Africa's main producer of oil and has the second largest oil reserve in Africa [1]. This simply explains that Nigeria is richly blessed with lots of natural resources/minerals. Some of these minerals includes but not limited to crude oil (petroleum), iron, limestone, gold, tin and columbite. These resources have been exploited, explored, and mined in several ways for the growth and development of the nation by government and private companies. Among the exploited resources, the exploration of crude oil (petroleum) appears to be on a high side because of its domestic, national, and international values and demands. Thus, making it the primary source of revenue for the country.

Oil spillage has become a perennial problem in the oil-rich Niger Delta. Records from the Department of Petroleum Resources [2] stated that within the period 1976–2015, a total number of 16,476 spills occurred at different occasions and approximately 3 million barrels in total spilled into the environment. Farmers in Rivers State are the most affected judging by the death of marine and terrestrial organisms usually involved in oil spill incidents and the hazardous effect of gas flaring [3,4].

Eleme an oil rich community has unfortunately remained the site crude oil and refined products and suffers the adverse consequences of oil and gas exploration.The Environmental Assessment of Ogoni land and surrounding areas covers contaminated land, groundwater, surface water, sediment, vegetation, air pollution, public health, industry practices and institutional issues [5], and has remained the most comprehensive study of the phenomenon to date. According to the UNEP Report, the pollution of soil by petroleum hydrocarbons in

the area is extensive in land areas, sediments, and swampland. Most of the contamination is from crude oil although contamination by refined product was found at many locations. The study further revealed that there is no continuous clay across the area, thus exposing the ground water to hydrocarbons spilled on the surface. UNEP 211 reported that in more than 49 cases hydrocarbons was observed in soil at depths of at least 5 m and has major implication for remediation required.

At two-thirds of the contaminated land sites close to oil industry facilities which were assessed in detail, the soil contamination exceeds Nigerian national standard as set out in the Environmental Guidelines and standards for the Petroleum Industries in Nigeria (EGASPIN). At 41 sites, the hydrocarbon pollution has reached the groundwater at levels more than the Nigerian standards as per the EGASPIN legislation [5].

Recent studies [6] indicated that efforts to clean up a polluted area is usually slow and late and sometimes the clean-up is non-pragmatically done as no one is handy to question the effectiveness of the clean-up exercise. Therefore, prevention of spills must be pursued with a determination to avert adverse outcomes in the environment. Until now after several clean-up exercise carried out on Ogoni land and part of Eleme by UNEP the place has remained largely without conscious systematic information on the large-scale contamination and destruction of the ecosystem. This study aims to assess the perceived impact of the enormity of crude oil and refined product contamination in Eleme, Rivers State.

2.0 Materials and Methods

2.1 Study Area

Eleme Local Government Area is located within latitude 4^0 60'' – 4^0 35'' N and longitude 7^0 – 7^0 15'' E with a total land area of about 140 km^2. The Local Government Area is about 30 km from Port Harcourt the state capital and shares boundary with Oyigbo in the north, eastern boundary with Tai, western boundary with Elelenwo and southern boundary with Okrika/Ogu/Bolo Local Government Area. The headquarters is located at Nchia and made up of two development areas namely Odido and Nchia. It also has 10 towns namely; Ogale, Alesa, Alode, Agbonchia, Aleto, Akpajo, Onne, Eteo, Ekporo and Ebubu. There are other settlements including; Agbeta-Ebubu, Okerewa, Njuru, Ejama-Ebubu, Akpakpa, Ollorte, Wuwu, Agborta, Okori, Ngejolowa, Oku-beke, Nsi-Okulu and Ekpan-eta. The major tribe is Eleme but highly populated by Igbo, Effik and Urhobo immigrants. Eleme Local Government has a 2006 population of about 200,000 persons.

2.2 Population for the Study

The population for the study comprises of residents in Eleme LGA, which includes fishermen and farmers.

2.3 Sample Size

A sample is a sub-set of population selected for a study. The sampling method used for this study is purposive sampling selected from the sample population. The total sample size for this study is 368 respondents, adopting the Yamani (1964) formula.

$$n = \frac{N}{1 + Ne\text{^}2}$$

Where, n = sample size

N = Population
e = Degree of Tolerance Error
1 = Constant
Since the level of significant is 5%, the confident level become 95%

2.4 Methods of Data Collection / Instrument

The methods of data collection to be used in this study will include reconnaissance survey, observation and administration of questionnaire. The questionnaire was designed to get information on effect of crude oil and refined products and consequent presence of oil related chemicals/heavy metals in soil and water on health, livelihood, agriculture and the socio – economy of the host community. The questionnaire design was closed ended and a total of 368 copies were administered, at the study area.

Discussions was held with host communities, related government agencies, environmental practitioners and petroleum production practitioners to ascertain spill incidents. This is to allow participants answer questions at ease and in their own words.

2.5 Reliability of the Instrument

The instruments for this research including questionnaires and other interview were subject to R-test. The instrument was given to selected people for comments and the process was repeated after one week interval to determine if their initial response would conform to their later comments. All variable are reliable since their Cronbach's alpha is greater than 0.5. The closeness of this value to 1 indicates that the instrument is very reliable.

Data analysis

Results were summarized in tables using descriptive statistics.

3.0 Results

Table 1 shows reported crude oil and refined products spill sites in Eleme between 1979-2023, the major cause of spill was identified as pipeline sabotage, followed closely by pipeline rupture.

Table 1: Reported crude oil and refined products spill sites in Eleme

Year	spill location	Product	Cause of spill
1979	Ajenokpori-Akpajo	Crude oil	Blow - out
1982	Aleto	Petrol	Pipeline rupture
1988	Onne	Crude oil	Pipeline rupture
1996	Ebubu	Crude oil	Blow - out
1999	Alode	Petrol	Pipeline rupture

2003	Ogale	Crude oil	Sabotage
2003	Nsisioken-Akpajo	Diesel	Sabotage
2006	Oken	Crude oil	Pipeline rupture
2008	Ebubu	Crude oil	Sabotage
2010	Ochani-Ebubu	Crude oil	Sabotage
2010	Ogale	Crude oil	Sabotage
2010	Ebubu	Crude oil	Sabotage
2011	Oken-ogban	Crude oil	Refinery operations
2012	Alesa	Diesel	Refinery operations
2012	Alode	Diesel	Sabotage
2012	Alesa	Petrol	Refinery operations
2013	Ogale	Crude oil	Sabotage
2013	Ogale	Crude oil	Sabotage
2013	Alode	Diesel	Construction work
2023	Aleto	Crude oil	Pipeline rupture
2023	Ebubu	Crude oil	Pipeline rupture

Table shows community assessment of the impact of crude oil and refined products pollution in Eleme. Preponderance of the respondents strongly agreed that the magnitude of crude oil and refined products spill had impacted negatively on livelihood of inhabitants, that there are consequences associated with crude oil and refined product spill on soil and water in the study area, that there are mitigation and measures of curtailing crude oil and refined products spill in the study area, and that crude oil and refined product spill have a significant effect on the study area.

Table 2: Community assessment of the impact ofcrude oil and refined products pollution in Eleme

Community assessment	Strongly Agree	Agree	Strongly Disagree	Disagree
The magnitude of crude oil and refined products spill had impacted negatively on livelihood of inhabitants in Eleme	57.51%	22.36%	10.54%	7.37%
There are consequences associated with crude oil and refined product spill on soil and water in the study area	62.30%	22.36%	13.74%	1.60%
There are mitigation and measures of curtailing crude oil and refined products spill in the study area	61.66%	23.96%	11.82%	2.56%
Crude oil and refined product spill have a significant effect on the study area	60.70%	18.80%	12.80%	7.70%

4.0 Discussion

Crude oil and refined products spill incidents in Eleme between 1979-2023, were majorly caused by pipeline sabotage, followed closely by pipeline rupture. Pipeline cannibalism for theft of crude, sustains the artisanal refineries that are scattered across several locations in the

Niger Delta and rupture of old pipelines, are the commonly reported causes of repeated crude oil and refined products spillage in the Niger Delta [7-11].

Eleme has unfortunately remained the site crude oil and refined spillage since 1976.The UNEP report of 2011 categorically stated that, it will take over 1 billion dollars to clean up Ogoni land spanning over 30 years of remediation and recovery [5]. According to the UNEP Report [5] the pollution of soil by petroleum hydrocarbons in the area is extensive in land areas, sediments, and swampland. Most of the contamination is from crude oil although contamination by refined product was found at many locations. The most serious case of water and soil contamination is at Nsisioken Ogale, in Eleme Local Government Area, close to the Nigerian National Petroleum Company product pipeline where an 8 cm layer of refined oil was observed floating on the ground water which serves as community wells [5].

The consequences of crude oil and refined product spill on soil and water is not limited to the recurrent nature of typhoid, polluted under groundwater, surface water, polluted soil and bloating, soot, polluted air, absorption of poisonous chemicals into food web, damage to kidney, lungs, stomach ulcer, malaria. Thus, the livelihood of inhabitants of this area is under severe threat

On community assessment of the impact of crude oil and refined products pollution in Eleme, preponderance of the respondents strongly agreed that the magnitude of crude oil and refined products spill had impacted negatively on livelihood of inhabitants, that there are consequences associated with crude oil and refined product spill on soil and water in the study area, that there are mitigation and measures of curtailing crude oil and refined products spill in the study area, and that crude oil and refined product spill have a significant effect on the study area. This corroborates the finding by other researchers that oil spill is worsening the fragile ecosystem of the Niger Delta, occasioned by many years of oil and gas exploration [1,12-14].

In Nigeria, crude oil pollution is a major concern and is perceived to have a significant impact on the country's environment, health, and economy. The perception of crude oil pollution in Nigeria is primarily negative, as it is associated with environmental degradation, loss of biodiversity, and the destruction of livelihoods. The Niger Delta, which is home to vast oil deposits, has suffered from decades of oil spills, pipeline leaks, and illegal oil bunkering. These incidents have led to the contamination of waterways, farmlands, and fishing grounds, causing severe damage to ecosystems and natural resources.

Communities living in the Niger Delta have directly experienced the devastating consequences of crude oil pollution. Local residents rely heavily on fishing, farming, and other traditional livelihoods, which have been significantly disrupted due to the pollution of rivers, creeks, and fertile lands. The loss of these resources has undermined food security and resulted in economic hardships, exacerbating poverty levels in the region [15-18].

One of the most visible and immediate impacts of crude oil pollution is the devastation it causes to ecosystems. The long-term effects of crude oil pollution are equally concerning. Despite cleanup efforts, residual oil can persist in the environment for years, leaching toxic chemicals and pollutants into the soil and water [6,10,19].

Conclusion

The present study has shown the prevalent nature of oil spill in Eleme, majorly caused by pipeline vandalism and rupture of oil pipelines. Monitoring and assessment are crucial

components of risk management for soil and water pollution in the Eleme, given the region's history of environmental degradation from oil and gas operations and other industrial activities. Prevention should be a crucial risk management strategy in addressing soil and water pollution in Eleme.

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