



The Compliance of Some Selected Industries to Environmental Regulations in Port Harcourt, Nigeria

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ABSTRACT

This research is focused on the compliance of some selected industries in Port Harcourt to environmental regulations on soil, air and water bodies' pollution. It highlighted the importance of environmental regulations to ameliorate the harm caused by the various pollution to the ecosystem and the effect on the people. The materials/methods used include library research, visitation to some detection and protection agencies, oral interview and questionnaires. The data collected was analyzed, and somewhat shows that the compliance status of some industries was low due to lack of control of industrial waste discharge. The study shows a good level of compliance to oil spillage by some companies between Incidence of oil spillage was recorded and the effect of the incidence was remedied immediately during the course of exploration. The study also showed that most companies do not follow "timelines" that is specific time for remediation. Conclusively, strict compliance of industries to environmental regulations will protect human health and the environment; hence enforcement should be given an urgent attention.

KEYWORDS: Compliance, Selected Industries and Environmental Regulations

*Received 10 Jan, 2022; Revised 23 Jan, 2022; Accepted 25 Jan, 2022 © The author(s) 2022.
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I. INTRODUCTION

It has been observed in recent times that the role of the environment is of great relevance to a nation's development process and cannot be relegated to the background, Apart from being the physical surrounding for natural habitats, the environment provides the basis for human exploits for agricultural, industrial, commercial, technological and tourism development in a society. For this and several other reasons, environmental issues now occupy a centre stage in academic discourse and other public at the national and international levels. In Nigeria for instance, environmental issues did not gain official prominence until the 1988 Koko toxic waste dumping saga which also brought to the fore the demanding need to establish the Nigeria Federal Environmental Protection Agency (FEPA), Federal Ministry of Environment and other relevant agencies, ostensibly to tackle environmentally related issues, in the country. These include issues such as environmental pollution, sanitation, depletion of ozone layer, desertification, flooding, erosion, poverty, bush burning, deforestation, soil conservation etc. All these mentioned above are a pointer to the fact that issues of environment and in fact environmental pollution which forms the basis of this paper has taken a centre stage in the nation's (Nigeria's) development process. Environmentally it has been observed further that man through industrial, agricultural and the ever increasing urbanization process, security and terrorist activities tend to directly and/or indirectly pollute the environment. There have been different definitions of the concept of "environment" proffered by different scholars and organized bodies/agencies. However, from whatever angle one perceives the term; "environment", it simply depicts what surrounds us. The Federal Environmental protection Agency (FEPA) Act of 1990, under section 38 also gave a very lucid definition of environment, thus; Environment includes water bodies, air, land and all plants and human beings and/or animals living there in and the interrelationships which exist among these or any of them. From the above definitions, the term „environment“ comprises land, air, water and all the physical structures surrounding us. The concept „ „environment“ refers to the „totality of space, time and socio-cultural settings of man and other living organisms therein. Pollution: the term pollution is a derivation of the word pollutes-which means, to make something dirty or no longer pure, especially by adding harmful or unpleasant substances to it. In another development; the committee on pollution of the United States National Research Council (1965) defined pollution as; an undesirable change in physical, chemical or biological characteristics of our air, land and water that may or will harmfully affect human life or that of other desirable species, our industrial processes, living conditions cultural assets that may or will waste or deteriorate our raw

material resources. Pollution according to the above definition is a disorder within an environment and is a byproduct of energy conversion and the use of resources. The concept, "Pollution" is used to refer to a situation where waste-materials and/or harmful substances which can deplete, wear/tear away and affect the entire environment and cause disorderliness to all living organisms. Furthermore, environmentally minded persons are of the opinion that human activities as well as natural disasters on the environment can pollute the environment beyond reasonable doubts. Environmental pollution is used to mean "an undesirable change in the environment through harmful substances; waste materials and resources, caused by man's activity or natural disaster which also results to the degradation of the environment with its attendant consequences on biodiversity. The word "environment" is commonly used to mean "surrounding". It always refers to a certain object that is surrounded by its environment. Albert Einstein provided a simple definition of environment as "the environment is everything that isn't me". Therefore, the term human environment conveys the sense of the surrounding of human beings. Although this seems to be a fascinatingly simple definition it cannot be used as an operational definition especially in the context of legal issues clearly, for the "environment". The legal definition carries a more specific meaning and is understood to be physical surrounding that are common to human beings including the natural resources of land, air and water bodies. The aggravation of phenomena like climate change, Ozone depletion, and over-exploitation of natural resources, air pollution and toxic wastes are harming the sustainable development of the planet and of the economic system. A logical reason for this liability lays in the fact that companies are definitely the main source of environmental trouble with the increase in the rate of pollution in Port Harcourt Rivers State of Nigeria, it demands the investigation on the compliance of industries to environmental regulation as it implies to land, air and water bodies. This would create information that will be helpful to protection agencies. Weak institutions are a key impediment to advances in well-being in many developing countries. Indeed, an extensive literature has documented many instances of failed policy in these settings and has been unable to identify a consistent set of ingredients necessary for policy success (Banerjee, et al. 2008; Duflo et al. 2012; Banerjee, et al. 2013). The specific question of how to design effective environmental regulations in developing countries with weak institutions is increasingly important for at least two reasons. First, "local" pollutant concentrations are exceedingly high in many developing countries and in many instances are increasing (Alpert, et al. 2012). Further, the high pollution concentrations impose substantial health costs, including shortened lives (Chen et al. 2013; Cropper, 2010; Cropper et al. 2012), so understanding the most efficient ways to reduce local pollution could significantly improve well-being. Therefore, the objectives of this research are: To investigate the level of compliance of industries to environmental regulations in Port Harcourt, also to investigate the individual view of persons on the level of environmental regulation compliance of industries around them.

II. MATERIALS AND METHODS

Data Collection

The methods used for data collection involves two sources, the primary source such as oral interviews and questionnaires administration and the secondary source which entails survey of existing records reports on pollution compliance in Port Harcourt through sources such as Library materials, internet (online) data, industrial pollution data record from environmental agencies etc.

An open-ended questionnaire was used with not more than four options which are the objectives of this study. In each of the locations in Port Harcourt selected, fifty questionnaires were administered to the selected areas forming a total of 400 respondents in the six locations. The first house was selected at the beginning of each street and the next three houses were skipped before the fourth house was sampled. This stratified random sampling pattern was carried out on both sides of the streets, data from each respondent was gotten through the administration of the questionnaires and oral interview.

Data Sampling and analysis

The pollution in an area was evaluated from the questionnaire survey in relation to the size of the population in that particular area. Use of histograms, charts and tables is employed for data analysis. The size of the population is determined using the relation by Yaro Yamine's formula (2001) given as;

$$n = N/I + N(e^2) \dots \dots \dots (1)$$

Where; n = is the sample size

N= is the population i.e. census population figure

e = is the level of precision or sampling error (taken as 0.05)

III. RESULTS AND DISCUSSION

Analysis of Data Collected

Field survey which entails interview of industrial personnel on areas known to be affected with pollutions such areas surveyed are: Industries around Eleme metropolis, Oyigbo and Trans-Amadi, collection of

samples (Water) for tests and analysis. Questionnaires were also employed to achieve the objective of this research. According to Yamane (1967) and Israel (1992), the sampling size of population more than 100,000 persons is 400, a case peculiar to Port Harcourt setting. Using the equation below at +/-5% level of precision;

$$n = N / (1 + N(e^2)) \dots\dots\dots (1)$$

Where; n = is the sample size

N= is the population i.e. census population figure

e = is the level of precision/sampling error

A total of 400 copies of questionnaire were purposively distributed Fifty (50) for each zone (Trans-Amadi, Eleme, Oyigbo, and others) for equal and unbiased representation, using the simple random sampling techniques. The simple random sampling procedure which ensures that every respondent in each zone has a known and equal chance (i.e. equi-probability) of being administered. A questionnaire was adopted in administering the copies of questionnaire, because once a respondent was chosen he/she could not be chosen again. Two hundred (200) copies of the distributed copies questionnaire were retrieved. The total number of responses exceeded 200 because respondents selected either one or more factors as being the causes of air, water and land pollutions in their various zones. Percentages (%) of various pollutions were recorded on various zones and statistical representations of results such as bar charts, graphs, pie charts would be used to present results of findings.

Effect Of Air And Soil Pollution On Compliance

The activities of industries related to oil and gas exploration, cement production, plastics and fabric productions were found to be major contributors to air and land pollutions. Two major industries were interviewed with regards to air and land pollution due to their industrial activities. Data was collected from NOSDRA (National Oil Spill Detection and Response Agency) which reports the percentage of oil spillage and incidence of oil spillage as at September-December 2015 by various Companies as presented below;

Table .1: Oil spillage as at September, 2015

Firms	Incident of oil spillage	Barrels of Oil Explored	% of Oil Spillage
MPN	5	0.10	20%
NAOC	21	123.98	33.33%
SPDC	6	1610	0.00%
Total =	32	1734.08	53.33%

The table .1 shows data collected from NOSDRA on the incidence of oil spillage recorded by Industries (Mobile Petroleum Nigeria Plc, Nigeria Agip Oil Company, Shell Petroleum Development Company) as at September 2015. The table shows the volume of barrels of oil explored and the percentage of oil spillage as a result of the exploration of the barrels of oil. Mobile Petroleum Nigeria recorded five (5) incidence of oil spillage as at September 2015, an oil spillage of 20% during the exploitation of 0.10 volume of oil barrels.

Other Companies recorded their level of oil spillage incidence, % of oil spillage and compliance to oil spillage as seen from table 4.1 above.

Table .2: Oil spillage as at October, 2015

Firms	Incident of oil spillage	Barrels of Oil Explored	% of Oil Spillage
ADDAX	1	12	0.00%

CHEVRON	1	10	0.00%
MPN	6	0.77	0.00%
NAOC	23	108.37	34.78%
SPDC	2	2.40	0.00%
TOTAL	3	11	0.00%
Total =	36	144.54	34.78%

Table .2 shows data collected from NOSDRA on the incidence of oil spillage recorded by Industries (ADDAX, CHEVRON, Mobile Petroleum Nigeria Plc, Nigeria Agip Oil Company, Shell Petroleum Development Company) as at October 2015. The table shows the volume of barrels of oil explored and the percentage of oil spillage as a result of the exploration of the barrels of oil. ADDAX recorded one (1) incidence of oil spillage as at October 2015, an oil spillage of 0.00% during the exploitation of 12 volume of oil barrels, 0.00% was recorded because the effect of the incidence of oil spillage was remedied immediately during the course of the oil exploration.

Other Companies recorded their level of oil spillage incidence, % of oil spillage and compliance to oil spillage as seen from table .2 above.

Table .3: Oil spillage as at November, 2015

Firms	Incident of oil spillage	Barrels of Oil Explored	% of Oil Spillage
CHEVRON	1	0.04	0.00%
NAOC	42	871.85	28.57%
NPDC	1	90	0.00%
PPMC	2	0.00	100.00%
SPDC	3	0.49	66.67%
Total =	49	962.38	195.24%

Table.3 shows data collected from NOSDRA on the incidence of oil spillage recorded by Industries (CHEVRON, Nigeria Agip Oil Company, National Petroleum Development Agency, Pipeline and Product Marketing Company, Shell Petroleum Development Company) as at November 2015. The table shows the volume of barrels of oil explored and the percentage of oil spillage as a result of the exploration of the barrels of oil. CHEVRON recorded one (1) incidence of oil spillage as at November 2015, an oil spillage of 0.00% during the exploitation of 0.04 volume of oil barrels, 0.00% was recorded because the effect of the incidence of oil spillage was remedied immediately during the course of the oil exploration.

Other Companies recorded their level of oil spillage incidence, % of oil spillage and compliance to oil spillage as seen from table.3 above.

Table .4: Oil spillage as at December, 2015

Firms	Incident of oil spillage	Barrels of Oil Explored	% of Oil Spillage
MPN	2	0.00	0.00%
NAOC	15	34.49	60.00%

SPDC	2	22.10	0.00%
Total =	19	56.59	47.37%

Table.4 shows data collected from NOSDRA on the incidence of oil spillage recorded by Industries (Mobile Petroleum Nigeria Plc, Nigeria Agip Oil Company, Shell Petroleum Development Company) as at December 2015. The table shows the volume of barrels of oil explored and the percentage of oil spillage as a result of the exploration of the barrels of oil. MPN recorded one (2) incidence of oil spillage as at December 2015, an oil spillage of 0.00% was recorded due to no exploitation of oil in December, oil spillage was recorded due to existing barrels explored and 0.00% of oil spillage was recorded because the effect of the incidence of oil spillage was remedied immediately during the course of the oil exploration.

Other Companies recorded their level of oil spillage incidence, % of oil spillage and compliance to oil spillage as seen from table 4 above.

Table.5: Acronyms and meaning of some Companies

MPN	Mobile Producing Nigeria Unlimited
SPDC	Shell Petroleum Development Company
NAOC	Nigeria Agip Oil Company
NPDC	National Petroleum Development Company
PPMC	Pipelines and Products Marketing Company

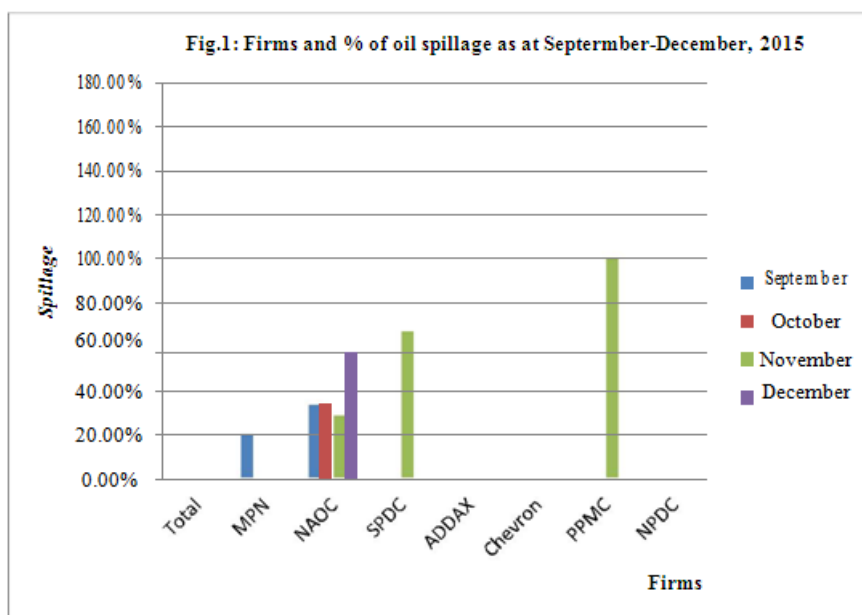
A bar chart of firms against the percentage of oil spillage was plotted to evaluate the firm that is more reliant on the compliance of environmental protection via air, water and land protection as a result of oil spillage. From the data above the percentage of oil spillage of firms can be presented in table 6 below;

Table 6: Report on firms and their % of oil spillage for Sep.-Dec. 2015

Months	Firms % oil spillage							
	TOTAL	MPN	NAOC	SPDC	ADDAX	CHEVRON	PPMC	NPDC
September	0.00	20	33.33	0.00	-	-	-	-
October	0.00	0.00	34.78	0.00	0.00	0.00	-	-
November	-	-	28.57	66.67	-	0.00	100	0.00
December	-	0.00	60.00	0.00	-	-	-	0.00

Source: NOSDRA September 2013-April 2016 oil spillage

Table 6 shows the percentage of oil spillage by various firms and their level of compliance to oil spillage. Firms that recorded 0.00% shows that they remedied the spills of oil during their exploration activities, this shows their level of compliance to oil spillage to the areas where the exploration activities was carried out. As seen from the table as at September, 2015 TOTAL oil company and SPDC recorded an oil spillage of 0.00% which shows a high level of compliance to oil spillage. In October 2015, TOTAL, MPN, ADDAX and Chevron recorded 0.00% of oil spillage as well due to immediate remedy of the oil spillage. In November 2015, Chevron and NPDC recorded 0.00% and in December 2015, MPN, SPDC and NPDC also recorded 0.00% which shows a good compliance to oil spillage.



From table .6 and fig. .1 it can be clearly seen that some firms with 0.00% and lower percentage of oil spillage shows a good compliance with the environmental regulations guideline whereas some are not and are directly related to the level of land, water and air pollutions in the areas of their explorations. Data for September 2013 to April 2016 of oil spillage is presented in Appendix A of this study for reference purposes.

Water Pollution

Water pollution is the contamination of water bodies and other sources that can be used for drinking and other human activities through exploration of natural minerals and discharge of waste water to nearby streams thereby polluting ground water sources. However, the purpose here is not to give definition of water pollution but to present valid data showing areas of water pollution as a result of human and industrial activities in some areas within Port Harcourt metropolis.

From the questionnaires and interviews carried out on areas around Port Harcourt that are believed to be suffering from air and water pollution it is clear that water pollution is caused mainly by industrial activities in these areas coupled with human indiscriminate waste dump around streams and river banks.

Two major areas in Port Harcourt were sampled, Eleme and Oyigbo as record has it that these areas have suffered from various forms of pollution in the past; according to Rivers State Ministry of Environment and Rivers State Environmental Sanitation Authority 2013 and 2014, Oyigbo suffered from air pollution as a result of indiscriminate waste dump around drains which has reduced the ground water quality in the area over time. It has also been recorded by Rivers State Ministry of Environment that the atmosphere of Eleme metropolis is acidified, result from the acidity of the rain water collected from the area shows a pH value of 3.5-5, this is attributed to the level of atmospheric pollution as a result of poisonous gas flares from the industries in these areas - *Adapted from Daily Punch Newspaper 2015, Vol. 7 No.234*. To clarify this finding a result of the questionnaire shows response of indiscriminate refuse dump around these areas as presented in table 4.7 below;

Table .7: Response to waste management in areas of P.H

Areas	No. of proper waste dump sites	Type of waste	Reported Issues	Health
Eleme	Maximum 2 on each street	Industrial/Domestic	Frequently	

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Oyigbo	Maximum of 1 on each junction	Municipal (Domestic)	Frequently
Trans-Amadi	No public dump sites	Industrial	Seldom

Source: Questionnaires and interviews

From the results of the interviews and questionnaires presented above and in Appendix A, it shows that waste management in these areas sampled is poor and it's a factor of various forms of pollution. Furthermore, data of the field survey in these areas also agrees with this result and are presented in table .8 below;

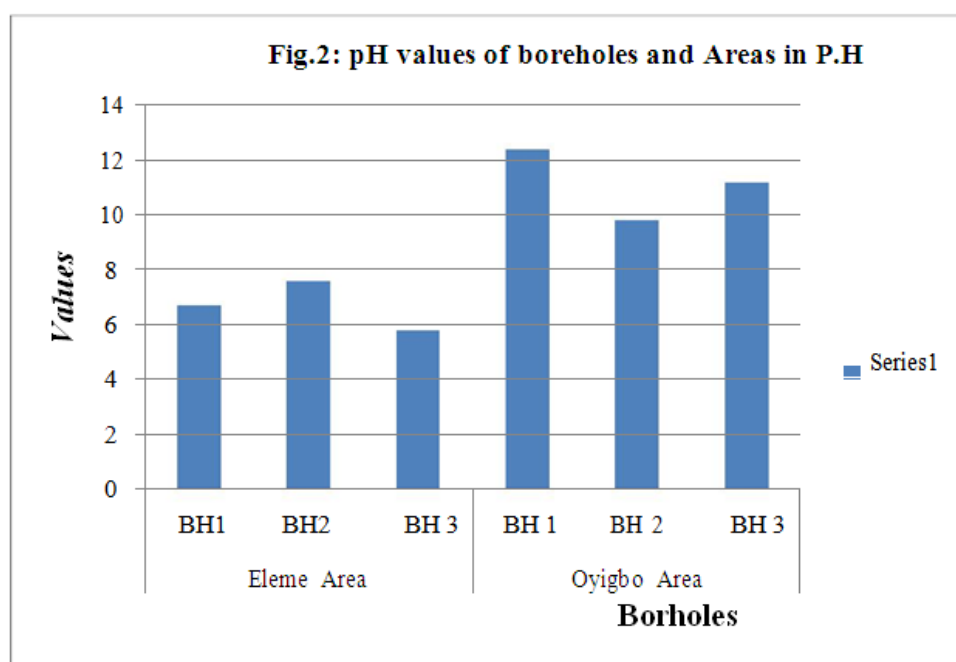
Table .8: Field data showing the pH values of water sources in some areas of P.H

Water Source	Eleme Area			Oyigbo Area		
	pH Level			pH Level		
	Well 1	Well 2		Well 1	Well 2	
Aquifers (Two Local Wells)	5.6	4.6		7.5	8.6	
	BH 1	BH 2	BH 3	BH 1	BH 2	BH 3
Boreholes (Three Boreholes)	6.7	7.6	5.8	12.4	9.8	11.2

Source: Research Field data

This data is achieved from taking samples from two aquifers (wells) in Alode Of Eleme kingdom and Oyigbo community all of Port Harcourt Local Government Area of Rivers State and are used for pH test in the Laboratory of Chemical/ Petrochemical Engineering of the Department of Chemical/Petrochemical Engineering Laboratory RSUST, Port Harcourt.

From the result obtained it was found that the samples contains some dissolved elements such as Lead, Iron and also contains some amount coliforms. This is presented in a bar chart in Fig. 4.2 below;



From the result presented above it is clear that the water source in these areas are polluted as they fall below the required standard of WHO (World Health Organization) to be termed drinkable and for human consumption.

Pollution And Oil Theft

From the questionnaire survey conducted on the course of this research it was found that the level of oil spillage and by and large the rate of pollution as a result of oil spillage is related to a greater percentage of oil bunkering and oil theft in areas where oil pipelines are laid beneath the ground. When these pipelines are vandalized they constitute rapid oil spillage encroaching to nearby rivers, water sources and lands causing land fragmentation, land pollution, water and air pollution etc. data collected from the Shell Petroleum Development Company (SPDC) shows that the level of oil spillage is attributed to oil bunkering and oil theft as the bar charts below shows the incidence of oil spillage for January-December, 2015 and January-May, 2016.

Source: www.shell.com.ng/environment-society/environment-tpkg/oil-spills/data-2015.html

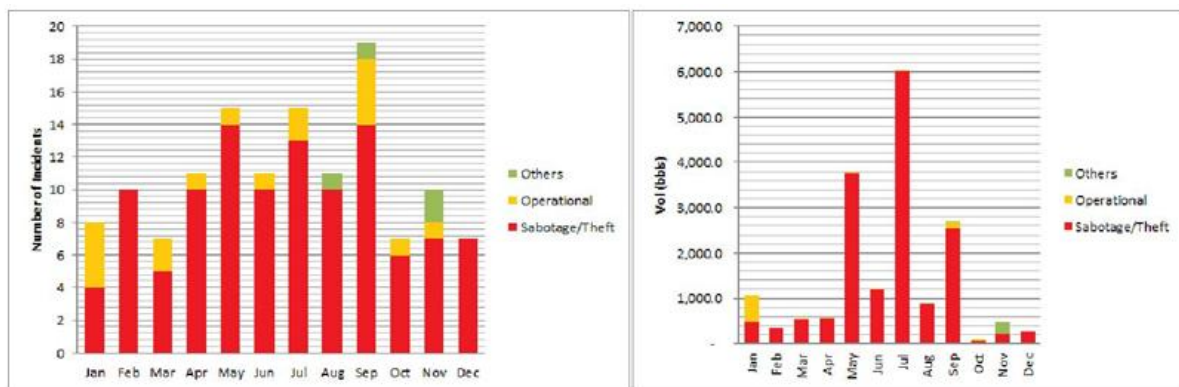


Fig.3: Oil spills in the Niger Delta-Monthly data for 2015

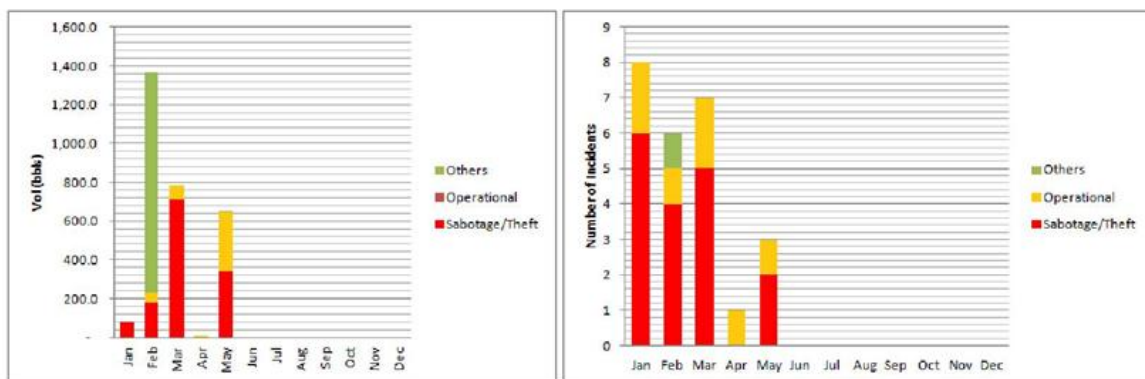


Fig. 4: Oil spills in the Niger Delta-Monthly data for 2016

IV. CONCLUSION

The study revealed that Port Harcourt city is characterized with high level of pollution in various forms ranging from air, water and land pollution. Certainly this has strong health implications for the urban dwellers over the years, for instance studies shows in the developed countries that linked pollution with the prevalence of respiratory diseases (Botkin and Keller, 1998). Pollution is a threat to national development as it retard the socio-economic activities of urban cities which is the heart beat of a nation’s wealth. The control and prevention of pollution is a national issue that constitute not just the effort of the government, firms, NGO (Non-Governmental Organizations) and Environmental Agencies, but it’s a collective efforts that would be successful if individuals have the right attitude towards environmental protection and citizens see the need for proper waste management in the rural and urban setting.

The compliance of firms and industries in Nigeria (Port Harcourt as a case study) should be checkmate as a good number of these firms and industries are adamant and care free in issues relating to environmental protection as seen from the study that a good number of firms in Port Harcourt are low in compliance to the issue of oil spillage and subsequent pollution. Hence the need for Environmental Agencies to checkmate and

control this menace is very imperative.

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