ЗАЩИТА ОКРУЖАЮЩЕЙ СРЕДЫ

OILSPILL RESPONSE ON THE WESTERN REGION OF GHANA: ENVIRONMENTAL MANEGEMENT PROBLEMS

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The research project attempted to investigate, examine, highlight, and understand if prevention of oil spill is better than cure (in management system terms with regards to two oil companies), to ascertain whether improving maintenance and control of facilities goes a long way to reduce the cost of managing oil and gas spillage while evaluating the post spill impacts on the western regional people of Ghana.

This research study was a combination of both qualitative and quantitative research methods. Personal interviews, Observation and Report reviewing were the qualitative research methods that were employed in collecting data. In addition, Questionnaires were the primary quantitative instrument employed in collecting data from the forty five (45) subjects chosen by the researcher for the study.

However, after analyzing and interpreting the collected information and literature, the researchers discovered that although the circumstances surrounding a spill incident are complex and unique, the primary cause of oil spillage in the western region is the failures of the oil companies. Corporate culture remains one that is embedded in risk-taking and cost-cutting. Perhaps there is no clear-cut "evidence" that someone in these companies or in the well- project makes a conscious decision to put costs before safety.

Key words: oil spill, economic and ecological damage, monitoring and control, polluter pay principle

Introduction

Ghana's oil and gas industry has recently become the focus of global interest. In the summer of 2007, Ghana's oil potential first became news, as off-shore exploration yielded commercial quantities of crude and natural gas. As exploration and encouraging discoveries continue, Ghana is positioning itself to become one of the sub-Saharan Africa's top five oil producing nations. Throughout the oil and gas value chain, opportunities abound as the nation seeks to strengthen its existing downstream petroleum industry and become an exporter by 2015. There are, justifiably, optimistic expectations about the role of oil in the development of Ghana. Oil exploration and production is said to become a major contributor to domestic revenue mobilization and provide development financing opportunities that are likely much greater than those of the current sectors.

In July 2007, Tullow Oil and Kosmos Energy discovered oil in commercial quantities in the western region of Ghana. They named the area "Jubilee Field» (Fig. 1). The possible

rewards from the Jubilee field are of great interest to various institutions. Therefore predictions and base cases have been made, although some calculation parameters are very uncertain.

Fig. 1. Situation of main oil and gas sources in Ghana

In geological terms, the Jubilee field is a continuous stratigraphic trap with combined hydro-carbon columns in excess of 600 meters. "Tullow Oil reveals on the companies' website that there are at least 500 mmbo through a most likely 700 mmbo to an upside of 1.000 mmbo recoverable reserves. As shown in the Table 1 below, the production amount depends on the number of drilled wells. The injection wells are especially important, as they maintain the field pressure. It is estimated that the field contains an additional 1.2 trillion cubic feet of gas, which are approximately 162 million barrels of oil equivalent (mmboe). This measurement of gas in the unit of barrel is based on the approximate energy released by burning one barrel of crude oil. Gas is 100% recoverable. *[Tullow Oil, 2010].*

Table 1

Assumed Field Reserves

Assumed Field Reserves	Phase 1 17 wells	Phase 1a with 5-8 additional wells	Phase 1b with 10-20 additional wells	Total Recover-able Field Re-serves
Low estimates	250	60	160	470
Mid estimates	370	100	205	675
High estimates	590	215	260	1065

Source: Tullow Oil, 2010.

Problem description

Prior to the discovery of oil, the western regional people made their living from exploitation of the resources of the land, water and forest as farmers, fishermen, and hunters. Conscious of the critical position of the environment to their sustenance and their future generations, the people of the region were very attached to their environment. The discovery of oil understandably raised the hopes of the people for development.

In their innocence, they believed that the State and the oil companies were equally interested in and committed to their development. However they soon found out that

this was not the case, and that the two shared a common interest in the maximization of profit and the accumulation of capital at any cost, hardly their welfare or development. In recent years the state has poorly managed and controlled environmental issues concerning the exploitation of a natural resource.

The cyanide spillage caused by Goldfields Ghana Limited (GGL) mining operations in 2001 is a classic example of poor environmental management in Ghana. On October 16, 2001, the Goldfields Ghana Limited at Tarkwa, experienced cyanide spills from its pipeline. The spillage drained into two rivers causing the death of fishes and plants. Clearly, oil spills in the petroleum industry in particular have been a major concern because of recorded incidents like the Amoco Cadiz (1978), which spilled 220,000 tons of oil; the Exxon Valdez (1989), spilling 40,000 tons of oil and the Braer (1993), spilling 85,000 tons of oil. Alarmingly, despite these dangers, Ghana is yet to put in place an appropriate and comprehensive legal framework, years into oil production in commercial quantities, to address environmental pollution, especially oil spillage, which is inevitable during exploration and production.

Research objectives / significance

The main purpose of this study is to examine, highlight, and understand if prevention of oil spill is better than cure (in management system terms with regards to oil companies). The research goal was also to ascertain whether improving maintenance and control of facilities goes a long way to reduce the cost of managing oil and gas spillage while evaluating the post spill impacts on the western regional people of Ghana.

This study seeks to make communities and civil societies aware of possible implications of oil and gas extraction on the marine ecology (UN Convention on oil pollution prevention) in Ghana and the implications of indiscriminate land scramble and grabbling on user rights of farmers, agriculture and food security as a whole and the effect of oil and gas on the environment, land policy issues, livelihood and food security.

Research design and methodology

Reviewing of previous research works done by Ministry of Food & Agriculture (Ghana), Centre for Environnemental impact analysais. (Ghana) and General literature review were made prior to sampling.

Random sampling techniques were adopted in selecting three districts within the six frontline oil producing districts in the western region, and then three towns were selected randomly. In each town five people using random sampling techniques were interviewed by questionnaires. Observation as well as personal interviews was useful in the collection of data for this research study. Documentation and company reports were heavily relied on too.

Analysis and results

The frequent accidental release of crude oil into the environment is causing a lot of degradation to the source of livelihood in the Western Region of Ghana. This includes the forest, wetlands, rivers, swamp streams, ponds and fisheries resources. Thus the impact on marine life is compounded by toxicity and tainting effects resulting from the chemical

composition of the oil, as well as the diversity and variability of biological systems on their sensitivity to oil pollution. Main recipients of the damage caused by oil spill and evidence proving effects on soil fertility are shown in the Table 2.

Table 2

Evidence showing effects on soil fertility

Region	Soil pH	% Organic matter	% Total Nitrogen	Available Phosphorus (mg/kg soil)	Available Calcium (mg/kg soil)
Western	3.8-7.1	1.03-5.7	0.06-5.4	0.35-11.25	28-420
Ashanti	5.3-7.8	1.5-3.0	0.2-0.3	0.12-12	50-100
Brong Ahafo	3.5-6.7	0.34-1.69	n.a.	0.12-64.25	16-140.3
Greater Accra	5.4-8.2	0.1-1.7	0.05-0.9	0.8-144	14-470
Upper East	5.1-6.8	1.1-2.5	0.06-0.14	1.75-14.75	43.5-151.5
Upper West	6.0-6.8	0.5-1.3	0.01-0.07	2.0-7.4	52-151.5
Northern	4.5-6.7	0.6-2.0	0.02-0.05	2.5-10.0	45-90

Source: Soil Research Institute, CSIR-Kumasi

The soils in Ghana have predominantly light textured surface horizons in which sandy loams and loams are common. Many soils contain abundant coarse material either gravel and stone, or concretionary materials which affect their physical properties, particularly their water holding capacity. From the table, it is clear that western region has been overtaken by Ashanti region when comparing the properties that makes soil fertile. This is a major cause for concern considering the former region was once acknowledged to have the best soils for cultivation of food crop in Ghana. Scales of food crops production are shown in the Table 2.

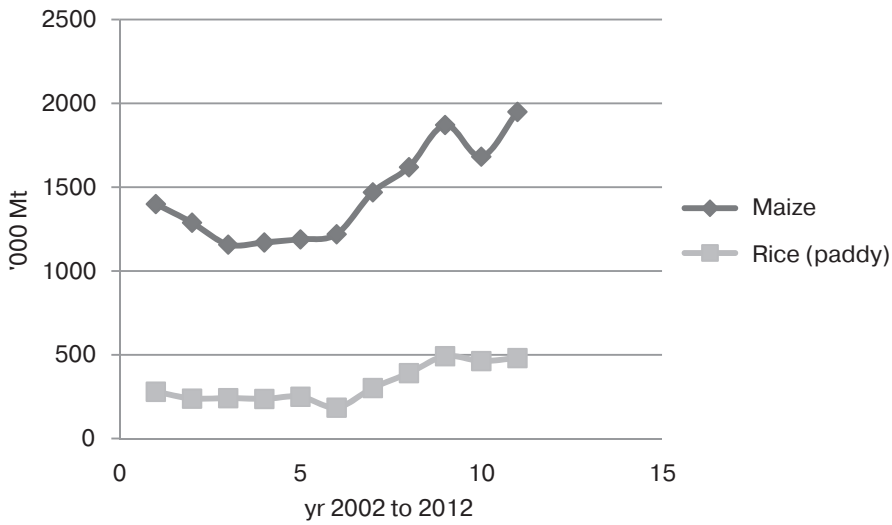

Fig. 2. Effects on production volumes of selected food crops ('000 Metric tons)

Source: SRID, MOFA

Agriculture is the predominant occupation of the economically active population in the Western region of Ghana, accounting for about 60 per cent of the regional GDP and employs about 57 per cent of the total labour force. In the farming communities, most

people are engaged in crop farming, with greater emphasis on household consumption. Most of the changes adversely affected the growth of plants because plants are destroyed or growth considerably retarded in oil polluted soils, the severity increases with the level of oil in the soil. Seeds planted in oil polluted soils generally absorb the oil and get destroyed. The spillage had greatly impacted on food crop production and productivity in terms of quantity and quality.

From the figure, it can be revealed that maize and rice which are Ghana's major food crops suffered declines. This was due to the fact that significant acreage of land was eliminated from regular land use in this case crop production by the oil spill. This elimination is long term and sometimes irreversible.

Fisher folks in the coastal communities of the Western region have complained about the dwindling fish catch due to the negative impact of the oil and gas exploration and production. The operations of the "Jubilee Oil and Gas field" and fishing activities of surrounding communities in the Jomoro District are intertwined. The imposition of a ban on fishing within 500 meters radius of the Jubilee fields has affected the fishermen's catch and income.

A SEND Ghana report on the extractive industry revealed that fishmongers in the Enosie Community in Half Asini, the capital of the Jomoro District have resorted to petty trading and farming for alternative livelihoods, while others do not have any other means of survival aside fish mongering. In the Jomoro District, citizens are concerned that the oil rigs and the Floating Production Storage and Offloading (FPSO) vessel use very high lightening system which crowds most of the fishes around it leaving the fishable areas almost empty. The situation, the fishermen stated is the principal cause of their low harvest making fishing activity unattractive and unprofitable.

From Fig. 3, it can be revealed that marine fishing declined consistently from 2004 to 2007. This was because of the discovery and exploration phase of the oil companies in the country. Also inland fishing started decline from 2007 to 2009 due to the minor and undetected pollution incidents caused by the oil companies.

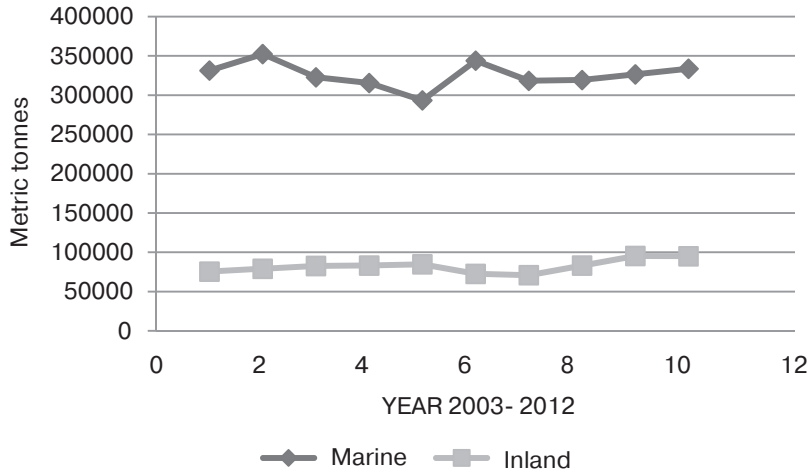

Fig. 3. Effects on annual fish production by source (Metric tons)

Source: SRID, MOFA

Physico-chemical parameters of the water samples show the situation in some water objects of the western region (Table 3 and Table 4).

As one can see from these tables, the pH of the water samples ranges from 7.33 to 8.47 pH units. These values falls in line with the WHO acceptable guideline values for pH for marine, brackish and natural resources. Total dissolved solids (TDS) concentration in the study area ranged from 754 mg/L to 35,695mg/L. TDS concentrations in most cases were generally higher than 1000 mg/l (WHO, 1993) and(WHO, 2006). Water samples with the highest TDS concentrations were sampled from river Ankobra, brackish or marine water in Elembelle, Axim and Half Assini. High TDS in water may produce bad taste, odour and colour, and may also induce unfavorable physiological reactions in the consumer (Spellman and Drinan, 2000). Sodium ion concentration ranged from 216 to 14,680 mg/L as shown in table 1.1 above. Sodium ion concentrations in the study areas were generally higher than the WHO guideline limit (200mg/l). Consumption of water high in sodium is believed to increase one's blood pressure, which may lead to cardiovascular diseases (Baird, 1999). High sodium in drinking water may give unacceptable taste (WHO, 2006). Chloride concentration for water samples in the study area ranged from 315 to 25,212 mg/L as shown in table. Chloride Concentration Rivers Asanta and Ankobra were found to be above WHO guideline value (250 mg/L). Chloride level above the WHO guideline limit can give rise to detectable taste to water (WHO, 2006). Chloride concentrations in marine water samples are generally very high. Sulphate ion concentration in the study area ranged from 54.1 to 394 mg/L. Generally sulphate ion concentration in water samples from the sea water are high, with the exception of one from Elembelle which recorded 57.5 mg/L, others were well above the WHO guideline of 250 mg/L. The high sulphate concentration recorded may be from the geological formation (Birimian rocks) of the area or other water bodies which drains into the sea. High levels of sulphate in drinking water have been found to cause gastrointestinal effects in human. Total iron concentration in the study area ranged from 0.435 to 1.15 mg/L. The prevalence of iron levels above 0.3 mg/l was noticeable in all the water samples collected from the study area. The presence of high iron could be as a result of chemical weathering of the host granitic and metamorphosed rocks, which could have resulted in the dissolution of iron that ultimately, percolate through the overburden to enrich the groundwater in storage (Darko, 2006). Runoffs of water samples from the mining areas in Tarkwa, Prestea, Telezu Bukazo, etc. into river Ankobra which drains into the sea at Axim could also account for the elevated levels of iron. Lead ranged from 0.005 to 0.477 mg/L as shown in table 1.3 above. High concentration in drinking water may lead to damage of the brain, red blood cells and kidneys. Generally the concentration of lead in most cases exceeded the WHO permissible guideline values of 0.015 mg/L. Oil and grease content in the samples were used as a measure of oil pollution from oil and gas exploration activities being undertaken by Jubilee partners. The concentration of oil/grease in the water samples ranges from 6.0 to 44 mg/L as shown in the table above. The highest oil/grease concentrations were found from water samples around the Jubilee rig platform which was found to exceed the Ghana Environmental Protection Agency (GEPA) permissible guideline value of 10.0 mg/L. This suggests that activities of the Jubilee partners are gradually polluting marine water and other water bodies which have serious implications for marine organism and human

beings. Elevated levels of lead found in marine water samples around the Jubilee Rig is an indication of the discharged of low toxicity oil based mud and other drill cuttings which contains these toxic chemicals.

Table 3

Results of physico-chemical parameters in the water samples in some areas of the western region

Sampling Point	pH	Colour	TDS mg/L	NH4-N g/L	Na mg/L	K mg/L	Ca mg/L	Mg mg/L
WHO Guideline Value	6.5 to 8.5	15	1000	0.001 to 1.5	200	30	200	150
Elembele 1 (River Asanta Upstream)	7.23	25	776	<0.001	220	3.46	40.1	34
River Ankobra -Axim	8.43	15	34100	<0.001	8846	120	601	1312
Elembele 2 (River Asanta Downstream)	7.38	20	754	<0.001	216	3.24	48.1	20.6
Half Assini 1 (Sea Water)	8.38	7.5	35695	<0.001	13886	144	441	1433
Half Assini 2 (Sea Water)	8.45	7.5	35640	<0.001	11420	138	481	1409
Sea water- Elembele	8.34	7.5	34100	<0.001	11243	118	441	1215
Brackish water –Elembele	8.38	7.5	34265	<0.001	7654	132	521	1336

Table 4

Results of physico-chemical parameters in the water samples in some areas of the western region

Sampling Point	Cl^- mg/L	$(SO_4)^{2-}$ mg/L	Fe mg/L	Pb mg/L	Oil/grease mg/L
WHO Guideline Value	250	250	0.3	0.015	—
GEPA Guideline Value					10
Elembele 1 (River Asanta Upstream)	54.1	57.5	0.772	0.005	6.0
River Ankobra — Axim	342	342	0.657	0.414	12
Elembele 2 (River Asanta Downstream)	315	329	0.754	0.005	18
Half Assini 1 (Sea Water)	24,517	335	0.684	0.184	10
Half Assini 2 (Sea Water)	20,943	370	0.563	0.216	28
Sea water — Elembele	19,356	394	1.15	0.372	40
Brackish water — Elembele	15,286	343	0.754	0.477	8.0

Comparative analysis of oil companies' environmental management ("Kosmos energy Ghana" & "Tullow oil Ghana")

The most commonly used framework for an EMS is the one developed by the International Organization for Standardization (ISO) for the ISO 14001 standard. Established in 1996, this framework is the official international standard for an EMS. For the purpose of this research the basic assumption is that this increased control and monitoring will improve the environmental performance of the company and perhaps prevent oil spills.

Similarities

In alignment with the business principles, both "Kosmos Energy" and "Tullow Oil" plan to ensure Health, Safety, Environment and Security (HSES) are a high priority during all phases of their operations. Both companies plan to embody the principles of environmental stewardship with a goal of sustainable development as well as practice their corporate social responsibility.

Also both companies are committed to assessing and minimizing risks that could lead to incidents or that could lead to adverse environmental or social impacts, reducing emissions and waste, being prepared to use energy and other natural resources efficient and to effectively respond to emergencies.

Differences

"Kosmos Energy Ghana" and "Tullow Oil Ghana" companies have striking differences when it comes to checking and monitoring as well as corrective action. One of the hypotheses of this study is that monitoring and maintenance goes a long way to prevent oil spill and the table below is evidence of why "Tullow Oil" has not had a major oil spill incident yet but "Kosmos Energy" has within just few years of exploration in Ghana (Fig. 4).

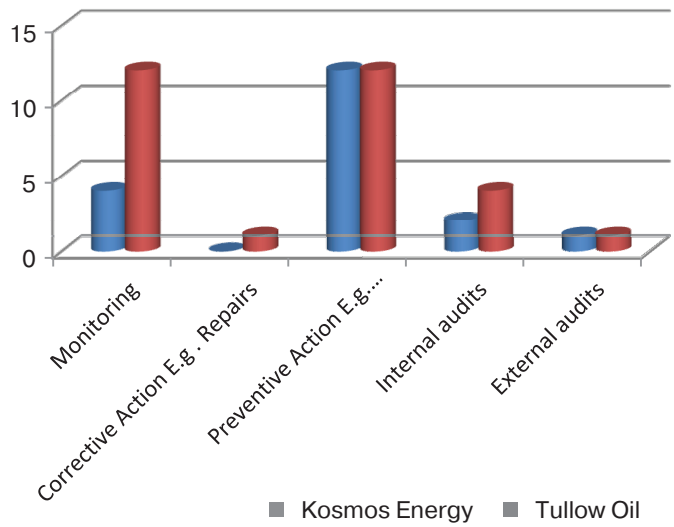

Fig. 4. Total frequency in checking per year (2008—2012)

Conclusion and recommendations

This study investigated if prevention of oil spill is better than cure (in management system terms with regards to two oil companies) to ascertain whether improving maintenance and control of facilities goes a long way to reduce the cost of managing oil and gas spillage while evaluating the post spill impacts on the western regional people of Ghana. Also from the research which inclusively concerns the impact of oil spillage on agricultural production in the western region, it was found that the impact of oil spillage on the agricultural production in the communities of study is huge. Another element of

discussion was the economic burden associated with oil spillage on the people and the economy as a whole. The regional trends reflected on the national trends with regards to production of food crops and fish. The up and down spiral of agricultural production trends affects stability of the nation's import and exports since Ghana's economy depends mainly on agriculture.

Based on the above findings, the following recommendations are made to different parties involved in oil matters. These include the oil companies and the government, since all contribute directly and indirectly to the cause and effect of oil spillage in the community.

The oil companies should, enhance, as well as operate active Environnemental management standards. The implementation of active environmental policies is achieved through Regionalization, adaptation, Energy savings, Waste minimization, and Precautions. Also the oil companies should preventative measures to mitigate or minimize the risk of oil spills, like investing the adequate and regular maintenance of their oil installations and the replacing of old pipes, as well as improving the security agencies guarding their various installations (to prevent the vadalization of pipelines).

Government should ensure that domestic regulations and relevant international standards are rigidly enforced to protect and safeguard our environment. This can be achieved by passage into laws of all pending bills in the oil and gas industry and all relevant environmental conventions ratified by Ghana are incorporated into domestic laws.

In all cases, it is suggested that a multi-sectorial approach to disaster management, which includes preventing the risk of disasters, mitigating the severity of disasters, emergency preparedness, a rapid and effective response to disasters, and post–disaster recovery and rehabilitation (Disaster Management Act, Number 57 of 2002), be integrated or adopted by the government of Ghana.

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ЛИКВИДАЦИЯ РАЗЛИВОВ НЕФТИ В ЗАПАДНЫХ РАЙОНАХ ГАНЫ: ПРОБЛЕМЫ УПРАВЛЕНИЯ ОКРУЖАЮЩЕЙ СРЕДОЙ

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В исследовательском проекте предпринята попытка ответить на вопрос о том, являются ли меры по предотвращению разливов нефти эффективнее, чем ликвидация последствий (на примере анализа системы экологического менеджмента двух нефтяных компаний). Чтобы установить это, необходимо было также ответить на вопрос: так ли необходимо постоянно улучшать техническое обслуживание и контроль объектов, чтобы снизить затраты на предотвращение утечек нефти, или дешевле продолжать ликвидировать и оценивать последствия воздействия разливов на жителей западных регионов Ганы.

В исследовании использованы качественные и количественные методы оценки, а также проведен анализ данных анкетирования жителей (всего опрошено 45 респондентов), наблюдений, обзоров и отчетов о состоянии окружающей среды.

После анализа и интерпретации собранной информации и литературных данных, установлено, что все случаи разливов нефти в западных регионах Ганы прямо или косвенно связаны с деятельностью нефтяных компаний, хотя в каждом конкретном случае необходимо учитывать сложность и уникальность сложившихся обстоятельств.

Корпоративный подход в двух изученных компаниях основан на вложениях в рискованные решения, направленные в основном на снижение затрат. Конечно, нет четких «доказательств», что кто-то в этих компаниях принимает сознательные решения о снижении расходов за счет безопасности.

Ключевые слова: разлив нефти, экономический и экологический ущерб, мониторинг и контроль, принцип «загрязнитель платит»