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Prevention and combat of a spillage after Ghana's oil and gas discovery: is Ghana ready to face an environmental threat?

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PREVENTION AND COMBAT OF A SPILLAGE AFTER GHANA'S OIL AND GAS DISCOVERY – IS GHANA READY TO FACE AN ENVIRONMENTAL THREAT?

By

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DECLARATION

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

Signature: 

Date: SEPTEMBER 18, 2017

Supervised by: PROFESSOR GEORGE THEOCHARIDIS

World Maritime University

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ABSTRACT

Title of Dissertation: **Prevention and Combat of a Spillage after Ghana's Oil and Gas Discovery – Is Ghana Ready to face an Environmental Threat?**

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The lacuna in international law to regulate the exploitation of crude oil brings into sharp focus the need for exploiting regimes to enact laws and establish measures and procedures to prevent and/or combat a spillage during exploitation activities, in order to forestall the grave damage the product can cause to the environment in the event of a spill. Nation states which exploit crude oil have variously enacted laws to protect their environment, but these appear to be woefully inadequate as the laws have invariably held the exploitation companies liable for preventing accidents, and for combating any spill in order to prevent environmental damage.

Ghana, in 2007, struck oil in commercial quantities, and began commercial exploitation in 2010. Being a relatively new entrant on the oil extraction scene, it is evident that there was **not much regulation to protect the environment from extraction activities**, and the nation had to contend with regulating the industry **after** commercial production had commenced. Again, there was a **deficit in laid down procedures to prevent and/or mitigate the effects of a spill** should it occur during exploitation. The *Deepwater Horizon* incident in the Gulf of Mexico re-focused attention on the need to regulate the exploitation industry, to curtail the unbridled influence of the extraction companies in the provision of measures to combat an accidental spill at the drill sites.

As a new entrant on the extraction scene, Ghana also did not have procedures in place to **streamline the efforts of agencies** who would be called upon to help combat a spill should it occur, and a compensation regime for damage due to a spill is also virtually non-existent. Lines of authority and responsibility for the regulatory agencies are not clear-cut, leading to confusion on who to take charge of combating a spill, and how to go about compensating those affected by a spill.

This dissertation looks at the **preparations so far towards addressing these identified shortcomings**, and attempts to proffer suggestions to enhance the effectiveness of these preparations, as well as other measures that need to be put in place to protect Ghana's marine environment from the debilitating effects of a spillage of oil due to exploitation activities.

Due to the very nature of the research, the population for this research was selected from **institutions which are actively involved** in regulating and exploiting the oil, and those servicing these institutions, as well as responsible institutions for providing security in Ghana's maritime domain.

The researcher attempts to answer the question of whether Ghana is ready to join the ranks of oil exploitation countries, specifically considering her preparedness to combat environmental damage due to an oil spill as a result of exploitation activities.

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ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
BALEX	Baltic Exercise
BBC	British Broadcasting Corporation
BOP	Blow Out Preventer
CCME	Central Command for Maritime Emergencies
CLC	International Convention on Civil Liability for Oil Pollution Damage
EEZ	Exclusive Economic Zone
EHS	Environmental Health & Safety
EPA	Environmental Protection Agency
FEPA	Federal Environmental Protection Agency
FUND	International Fund for Compensation for Oil Pollution Damage
GMA	Ghana Maritime Authority
GNPC	Ghana National Petroleum Corporation
GPHA	Ghana Ports & Harbours Authority
HNS	International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea
IMCO	Inter-governmental Maritime Consultative Organisation
IMO	International Maritime Organisation
MARPOL	International Convention for the Prevention of Pollution from Ships
NESREA	National Environmental Standards and Regulations Enforcement Agency
OILPOL	International Convention for the Prevention of Pollution of the Sea by Oil
OPITO	Offshore Petroleum Industry Training Organisation
OPRC	International Convention on Oil Pollution Preparedness, Response and Cooperation
OSRL	Oil Spill Response Ltd
RMU	Regional Maritime University
SCE	Safety Critical Element

SDG	Sustainable Development Goal
TEN	Tweneboah, Enyira and Nntome
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
WWF	World Wildlife Federation

CHAPTER 1

1.0 INTRODUCTION

1.1 Background to the Research

Crude oil originates from ancient fossilised materials having been converted into oil over millions of years through geochemical processes. It is found in the subsoil of the earth and oceans, and drilled in unrefined form, to be processed into petroleum products for use. Crude oil is useful for various industries, and its products are utilised for both domestic and industrial use. However, due to the very nature of the formation of crude oil, it is exploited from pressurised fields, and unregulated discharge or spillage of crude oil can have dire consequences for the environment into which it is spilled.

Exploration for oil and its exploitation on the African continent began many years ago, and consequently, spillages of oil into the environment, both marine and terrestrial, is no new occurrence. Nigeria, the largest oil exporter in Africa and the 8th largest in the world (Workman, 2017), is Ghana's closest neighbour in English speaking West Africa, and has been exploiting oil for over half a century. They have had their fair share (or perhaps more than their fair share) of spillages, some due to accidents, many due to sabotage and ineffective maintenance of equipment, including pipelines. Nigeria is thus a test tube case for Ghana in her quest to regulate the new oil and gas exploitation industry, and to seek to prevent an environmental disaster from happening.

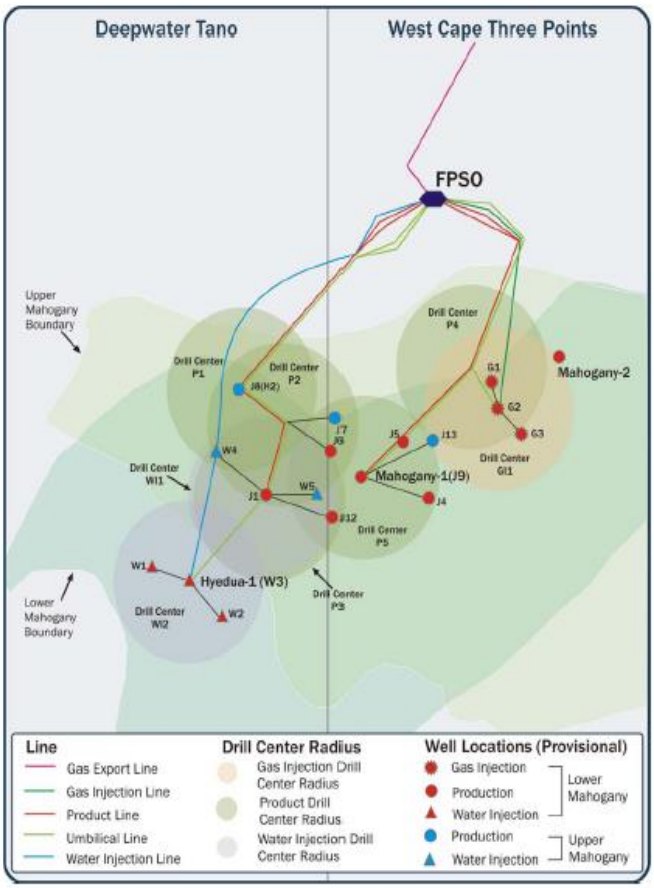
Ghana began commercial exploration for oil in the 1950's with the establishment of the Ghana National Petroleum Corporation (GNPC), but it was only in 2007 that oil was found in commercial quantities by Kosmos Energy and their partners, in an area offshore Ghana's west Cape Three Points, dubbed the Jubilee Field, in Ghana's geophysical Tano basin block. Initial exploration in the East Cape Three Points basin

encountered non-commercial hydrocarbon shows (Tippee, 1999). Commercial exploitation of oil in Ghana began in December 2010.

1.2 Statement of the Problem

> "The discovery of oil in Ghana in commercial quantities in 2007 and the commencement of production in 2010 is expected to have a positive impact on the economy. On the other hand, the discovery raises a number of crucial and critical questions regarding the extent to which relevant policies, regulatory and monitoring mechanisms, and, particularly, environmental measures have been put in place to effectively respond to any eventual oil disaster" (Otoo, 2012).

The GNPC, in executing its mandate of developing a national petroleum service industry, and in a bid to derive maximum benefit for the people of Ghana, embarked on accelerated promotion of the country's hydrocarbon potential from the mid 1990's, with the involvement of international partners, including Tullow Ghana Ltd, Kosmos Ghana H C, Anadarko W C T P Co, Sabre Oil and Gas, and the E O Group. Tullow Ghana was designated Unit Operator under a Unitisation and Unit Operating Agreement with the Ministry of Energy, and the project design and execution was led by Kosmos Ghana as the Technical Operator (Irvin, de Jong and Armah, 2009). In 2007, the partners found oil in commercial quantities in the West Cape three Points and Deepwater Tano blocks, and commercial production of Ghana's oil began in December 2010. The oil blocks, located 60 km from the nearest coast, was christened the Jubilee Field (Irvin, de Jong and Armah, 2009). Phase one of the exploitation of the oil comprised the completion of 17 wells, made up of 9 production wells, 6 water and 2 gas injection wells to re-inject water and gas back into the reservoir for pressure maintenance and enhancing oil recovery (Irvin, de Jong and Armah, 2009) (see Fig 1).



Source: Tullow Ghana Ltd 2009

Figure 1: Drill Centre Locations and Associated Flow Lines, Injection Lines and Umbilicals

Due to the fact that the oil is being drilled offshore, any accident which causes a spillage can have disastrous effects, as evidenced in the *Deepwater Horizon* incident in the Gulf of Mexico in April 2010, and it is imperative that the country guards against such an occurrence. In fact, upon the commencement of commercial drilling of oil in Ghana, "just as the events in the Gulf Coast unfolded, reports had it that KOSMOS, the company exploring oil in Ghana's Jubilee Field, has spilled 699 barrels of (drill) mud which contains poisonous heavy metals on three occasions that could affect Ghana's ecosystem" (Egbefome, 2011).

The International Maritime Organisation (IMO), the international body vested with the mandate of ensuring the safety and security of shipping and preventing marine

pollution, has adopted various conventions, codes and protocols in executing its mandate. However, there is no international regulation specifically protecting the marine environment with regards to exploitation activities, as almost all the conventions, codes and protocols lay emphasis on maritime transportation. It is thus left to individual countries to protect their marine environments when it comes to exploitation of marine resources. With offshore exploitation being so capital intensive, most oil producing nations in Africa are rather "soft" on such regulations as they do not have the wherewithal to engage in exploitation themselves, leading to various pollution incidents with little or no sanctions for the polluting companies, and little efforts to stem the tide.

In Nigeria, "on May 1, 2010, a raptured Exxon Mobil pipeline in Akwa Ibom state spilled more than a million gallons into the delta over 7 days before the leak was stopped. Within days after this spill, thousands of barrels were spilled when the nearby Shell Trans Niger pipeline was attacked by rebels" (Vidal, 2010). These and several other spillages in Nigeria have apparently gone under the radar of the international community with regards to pollution of the environment. "One report compiled by World Wildlife Federation (WWF) UK, the World Conservation Union and representatives from the Nigerian federal government and the Nigerian Conservation Foundation calculated in 2006 that up to 1.5 million tons of oil – 50 times the Exxon Valdez disaster – has been released into the Niger Delta alone over the past half century" (Vidal, 2010).

Chad, also an African country, discovered oil in the 1970's with the Chadian basin containing a proven reserve of 1 billion barrels of oil, and a potential 5 billion barrels (Oil & Gas Journal, 2000), but due to political unrest, it was only in the 2000's that commercial exploitation began, but they have already began experiencing spillages, though not on as wide a scale as Nigeria. In 2013, Chad suspended the Chinese state-run China National Petroleum Corporation, which was prospecting for, as well as producing oil in Chad, blaming the company for "oil spills in several sites near a forest" causing "destruction to trees" (BBC, 2013). In 2009, Schwartz and Nodem report that there was so much environmental damage affecting farmlands and fishing communities along the 1,080 km Chad-Cameroon Oil Pipeline Project since its

construction from 2000, yet authorities and Exxon, the operators, had done little to curb the wanton destruction – perhaps due to lack of regulation? (Schwartz and Nodem, 2009).

These are but a few examples in Western and Central Africa which should send signals to the Ghanaian authorities to properly put in place measures – including regulations – to ensure that any looming environmental disaster is first and foremost guarded against through preventive measures, or where prevention fails, combated efficiently and in good enough time to prevent massive damage to the environment in which the exploitation is taking place. Much attention has been paid to the discovery of the oil and the use to which the revenue generated from its exploitation could be put, but little attention has been paid to what **preventive and combative measures** need to be put in place, by both the drilling companies and the regulatory agencies, to forestall an environmental disaster. This dissertation therefore seeks to draw attention to the urgent need for both regulators and operators in Ghana's oil fields to put in place regulations and measures to prevent and combat the deleterious effects of a spillage, should it occur.

1.3 Aims and Objectives

Crude oil is an essential commodity in everyday life, and much can be benefited from exploitation of crude oil. However, for some countries, the exploitation has caused as much havoc as it has brought blessing, as it has left the environment damaged and the populace without their traditional source of livelihood. Ghana's crude oil find in commercial quantities came with much euphoria for the citizens, and much is expected of the government in the utilisation of the revenues to be accrued from its exploitation. However, little thought seems to have been given to the potential disaster looming on the advent of exploitation of crude oil in Ghana's waters.

This research aims to bring to light the measures that have been put in place to forestall any environmental disaster after the commencement of exploitation of crude oil, if any, and to highlight to what extent these measures can, or what measures need to be put in place, to help prevent or combat such a disaster should it occur. The research will also proffer some pointers on what measures have been used in other

exploitation regimes, and how effective these measures have been, and attempt to highlight which of these measures may be applicable to the local conditions to reap the most benefits out of them, and address shortfalls in the measures already in place. The report will also seek to solicit the help of the local population in putting in place and implementing such measures, in a bid to ensure protection of the marine environment and sustainability of the source of livelihood of the people.

1.4 Research Questions

The research will seek to answer the following questions in a bid to help prevent and combat a spillage during exploitation activities in Ghana's oil fields:

- ✓ Whether Ghana has the legal regime to enforce prevention of environmental damage due to exploitation activities;
- ✓ Whether Ghana has the legal regime to enforce combating of a spillage due to drilling activities;
- ✓ Whether proactive measures are actively in place at the drill sites in order to prevent a spillage of grave environmental consequences;
- ✓ Whether such measures can be effective considering local conditions, and whether they are in use in other exploitation regimes;
- ✓ Whether measures have been put in place to combat a spillage should it occur, with a view to minimising environmental damage;
- ✓ Whether such measures can be effective in minimising environmental damage;
- ✓ Which national provisions have been put in place to engage international help in the event of a spillage likely to cause grave environmental damage;
- ✓ Whether a compensatory regime has been put in place to facilitate securing international aid in combating a spillage;
- ✓ Whether specific onus has been laid on parties responsible for financial burden in the event of environmental pollution through a spillage;
- ✓ Whether the indigenous population have been conscientised on their role in preventing and combating an environmental disaster should it occur at the oil fields.

For the purposes of analysis, these research questions were contracted into the following criterion, in order to elicit the required information to answer the research topic:

- ✓ Whether Ghana has the legal regime to enforce prevention and/or combating of environmental damage due to exploitation activities;
- ✓ Whether proactive measures are actively in place at the drill sites to prevent and/or combat a spillage should it occur during exploitation activities;
- ✓ Whether national provision had been made to call in international aid in combating a spillage should it occur;
- ✓ Whether a compensatory regime was in place in case of a spillage during exploitation activities, and whether such regime, if established, places specific onus and/or sanctions on any party or organisation;
- ✓ Whether local conditions and the local population have been factored into any preventive, combative or compensatory regime in place with regards to a spillage during exploitation activities.

1.5 Key Assumptions and Limitations of the Study

The major assumption for this study is that Ghana, as an oil producing nation, will exploit to the fullest extent, the oil reserves found in its Jubilee and Tweneboah, Enyira and Nntome (TEN) fields, and any other oil finds that may be discovered in the future, and that this exploitation will be for commercial purposes, and not only to feed the local oil and gas demands, i.e., it will be exploited for sale, whether refined or in the crude form, on the world market.

The minor assumption for this study is that all responses to questionnaire and interviews will be given by respondents and interviewees as dispassionately as possible, without any bias towards the organisation of the respondent or interviewee, and these responses are given of the respondents' and interviewees' own free will, without any duress whatsoever.

The major limitation to this study is time constraints, as it had to be undertaken within a limited time frame, and alongside other academic work which prevented the

researcher from dedicating his full time to the research work in the initial stages of the research.

This research would also be limited to actual participants in the extraction of oil and gas in Ghana's waters, and to regulators who have a direct bearing on this extraction, and the protection of Ghana's marine environment. Questionnaire would be administered to senior officials of the Ghana Navy, who are entrusted with protecting Ghana's waters, the Environmental Protection Agency (EPA) of Ghana, and the Ghana Maritime Authority (GMA), as regulatory bodies over Ghana's marine environment. Questionnaire would also be administered to senior officials of the extraction companies, and offshore supply companies servicing the oil and gas industry. Interviews would be conducted with leaders of local communities directly affected by the activities in the oil fields. Questionnaire would also be administered on lecturers at the Regional Maritime University (RMU), which is entrusted with training local content for the oil and gas industry.

Due to the fact that the industry is a relatively new one in Ghana, there is not much published text regarding exploitation of oil and gas in Ghana, so the researcher would depend a lot on publications from other jurisdictions, as well as opinions of industry experts in Ghana.

Research would be made to ascertain what pertains in other oil producing countries and juxtapose that against what pertains locally, taking into consideration local conditions and those international "best practices" which can be adapted to suit local conditions.

1.6 Organisation of the Research

This research is structured into 4 chapters after an introduction to the research problem, which gives a background and states the problem actually being researched on. Chapter 1 is the methodology used in gathering data, and will also give the data collection procedure, the study area and population sample and the data analysis procedure.

Chapter 2 is a critical review of literature in the area of this study, and examines what others have posited within the scope of the study, as well as industry standards and what pertains within the industry with regards to the problem identified in Chapter 1.

Chapter 3 gives the findings from the data gathering and analysis derived from the data gathered.

Chapter 4 then concludes the research, and proffers recommendations based on the findings from the research.

1.7 Methodology and Data Collection

1.7.1 Methodology

This research will look at what pertains on the global scene with regards to prevention and combat of pollution through exploitation activities at the oil fields, and compare them with what pertains on the local scene, to ascertain the level of local preparedness with regards to prevention and combat of environmental pollution. The research will also look at recommended practices and preventive methods and ascertain to which level same is being implemented. The research will look at what pertains locally which may not be implemented globally but are ideal for local conditions to prevent and combat an environmental disaster.

The research data will be gathered using secondary sources for what pertains on the global scene – in order to have an idea as to what should prevail on the local scene. This research will then use primary sources – primarily questionnaire and interviews – to ascertain what pertains on the local scene, in order to compare it with what has been known to work in other jurisdictions.

1.7.2 Data Collection

Divergent and diverse data was collected in order to put into perspective what pertains in other jurisdictions where oil exploitation is taking place, and what may be at least the basic desirable in the local environment of Ghana's oil and gas exploitation. Though there is a dearth of international regulation regarding exploitation of oil and gas and its deleterious effects on the environment, a few international and regional

agreements seem to have partially covered pollution emanating from other sources, apart from the transportation of oil, and pollution from exploitation activities can be covered under these, though not to a great extent.

> "As a result of the "Pallas" incident in 1998, Germany set up the Central Command for Maritime Emergencies (CCME) (Havariekommando), which is responsible for monitoring an oil spill and marine pollution response, and for fire-fighting at sea.
>
> After the Bonn Agreement in 1969, signed 2 years after the Torrey Canyon, in which Belgium, Denmark, France, Germany, the Netherlands, Norway, Sweden and the U K signed the Agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, there was a lack of well-coordinated plans for a systematic response to major oil spills, and the division of responsibilities remained unclear.
>
> It took over a decade, up to 1983 when the European Union and other European countries acceded to the Agreement for any proactive preparations to be made towards combat of a spillage, and it was only a few years ago that the division of responsibilities became clear" (World Ocean Review, 2014, p. 43).

These clearly indicate that in order for a pre-emptive and successful combat of a major spillage, definite structures and laws/regulations need to be put in place to ensure a coordinated combating of any pollution which might occur.

The Abidjan Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region (Abidjan Convention) and its protocol, covers cooperation in combating pollution in cases of emergency, spanning a marine area from Mauritania to South Africa, a coastline of just over 14,000 km, and came into effect on August 5, 1984. However, how has this Convention been implemented

with regards to responsibilities of nation states, and has it fared any better than the Bonn Agreement?

Under the Helsinki Convention which entered into force in 2000, the states bordering the Baltic Sea, whose waters this Convention seeks to protect, hold an oil spill response exercise every summer, known as the Balex (Baltic Exercise) in a different area of the Baltic every year (World Ocean Review, 2014, p. 43).

These agreements, however, at least lay the framework for further collaboration in the quest to prevent and combat pollution should it occur in the marine environment, be it accidentally or otherwise, though the concentration is on the transportation of the oil, and not the actual drilling.

The London Anti-Dumping Convention – The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 – seeks to "protect the marine environment from waste due to human activities. It has been in force since 1975, and seeks to promote effective control of **all** sources of marine pollution, and to take practicable steps to prevent pollution of the sea by dumping of wastes and other matter" (IMO, 2017). In 1996, the London Protocol was agreed to further modernise the Convention and eventually replace it, and the Protocol prohibited all forms of dumping, except for possibly acceptable wastes on a so-called "reverse list" (IMO, 2017). The Protocol entered into force in 2006, and spells out prohibitions to dumping including:

> "any deliberate disposal into the sea of wastes or other matter from vessels, aircraft, **platforms** or other man-made structures at sea" (Article 1 (4) (1);
>
> "any abandonment or toppling at site of platforms or other man-made structures at sea, for the sole purpose of deliberate disposal" (Article 1 (4) (4) (IMO, 2017).

These two provisions appear to look at decommissioning of wells, and not specifically pollution occurring as a result of actual operations of oil wells. The Convention and

Protocol therefore only places onus on the operators to prevent actual **dumping** at sea during their operations.

Apart from these few regional agreements, there is a lack of international regulation when it comes to regulating oil exploitation regimes, especially when compared to regulations regarding the transport of oil. This lack of international regulation is highlighted in the case of developing countries, which, in addition to addressing the economic and governmental challenges that an oil boom brings, also have to contend with the environmental risks and challenges (Moreno, 2009).

> "Regions made up of developing countries often do not have the resources and governmental structures required to create and manage a legal framework for the prevention of environmental harm from offshore oil and gas exploration and production activities. This particular scenario is unfolding in the Gulf of Guinea. The countries in the Gulf of Guinea, in an area in the West and Central African coast, are either currently producing offshore or are exploring for offshore oil. However, the region currently lacks a comprehensive environmental protection plan to address offshore oil and gas exploration and production" (Moreno, 2009, pp. 421 – 422).

This calls into sharp focus the need to streamline regulations for the industry, as well as put in place measures and cooperative efforts to combat a spillage should it occur, perhaps along the lines of the Balex and the Bonn Agreement.

1.7.3 Study Area

Data collected for this study will primarily be restricted to the waters offshore Ghana, in the West African sub-region. Specifically, data will be collected on offshore exploitation activities in Ghana's oil fields offshore Cape Three Points. Though some data would be collected from governmental and regulatory agencies based in Accra, the capital of Ghana, the data would be specific to activities in the oil fields, in the Western Region of Ghana. The immediate environs of the exploitation activities are the waters at Ghana's Cape Three Points, with notable towns being, Princess Town, Miamia and Dixcove. Cape Three Points itself is a small village at the southernmost

tip of Ghana – though activities since the oil find may soon turn it into a booming oil town, or at least a sizeable settlement. The inhabitants of these towns are mostly fisher folk, engaged in fishing and fish processing (primarily smoking and drying).

1.7.4 Population Sample

Due to the very nature of the data needed for this research, it would have been impracticable to use a large population sample for the research. The sample was therefore restricted to actual participants in the oil exploitation, vis-à-vis the exploitation companies, as well as governmental institutions and agencies involved or likely to be involved in prevention and combat of a spillage should one occur at the exploitation site, and some service providers to the operators at the oil fields. The sample size was therefore restricted to the following organisations:

- ✓ The Exploitation Companies
- ✓ The Ghana Navy
- ✓ The Environmental Protection Agency (EPA)
- ✓ The Ghana Maritime Authority (GMA)
- ✓ The Ghana Ports & Harbours Authority (GPHA)
- ✓ The Regional Maritime University (RMU)
- ✓ The local population.

Apart from the RMU and the local population, all other organisations would be involved in the prevention and the combat of oil pollution at the oil fields. The RMU, which is the premier institution for training local content for the oil fields, were included because their training would contribute towards prevention of pollution, since some of their trainees would ultimately be involved in the oil fields. The local population was included because activities at the oil fields directly impact on them, and their fishing activities would also impact directly on the operations at the oil fields, therefore they would also be instrumental in the prevention of a disaster at the oil fields – even if only by their absence at the oil fields, which was their traditional fishing grounds.

Respondents from the organisations were from the rank of Deputy Director and above for the governmental agencies, and Lieutenant Commander and above for the Navy, due to the sensitive nature of the information needed. For the exploitation companies,

respondents were the Drill Environmental Health & Safety Supervisors (Drill EHS Supervisors) of the respondent companies. Random sampling was made with the local population, which samples included the Assembly Members of each area and chief fishermen of each town/village, as well as some leaders amongst the fishmongers.

1.7.5 Data Collection Methods

Questionnaire were mainly used to collect data for this research, and were administered on the selected respondents. The questionnaire were organisation-specific, to elicit exact data on what each selected organisation's role was in the prevention and combat of a spillage at the oil fields. Structured interviews were conducted for the local residents, largely due to their level of education, and also in order to have an organised response. An interview was also conducted with the GMA, though based on the same lines as the questionnaire for that organisation.

Secondary data from publications, Conventions and Laws were also used to set the backdrop for determining best practices and regulations regarding protecting the marine environment from pollution due to the exploitation activities, and combating of an oil spill to prevent further environmental damage to the environment. Data was sourced from the IMO, international journals and established organisations in the oil and gas exploration and exploitation fields, as well as reputable sites on the internet, and published books and articles on the subject.

1.7.6 Data Analysis

Qualitative analysis was used in the analysis of the data, as this was considered the best type of analysis to achieve the desired result, in order to highlight any shortfalls or potential shortfalls in the prevention and combat of an oil spill in Ghana's waters during the exploitation of oil. Emphasis could then be placed on what measures needed to be implemented by the various organisations engaged in Ghana's oil and gas industry at all times. Similar but organisation specific questions were asked of the selected organisations to elicit information to answer the Research Questions.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Commercial Oil and Gas Drilling in Ghana

Ghana struck oil and gas in commercial quantities in 2007, and commercial drilling begun in 2010. Oil is a potential pollutant of the environment, so it is important to put in place measures to forestall and combat a spill, if one should occur, which cannot be ruled out in any environment where commercial exploitation takes place, due to the potential harm it will cause the environment if left unchecked.

The United Nations Convention on the Law of the Sea, 1982 (UNCLOS 1982), in Article 1 (4), has defines pollution of the marine environment as

> "The introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing, and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities". (IMO, 1982, p 2).

Exploitation for oil and gas have been on-going for over a century under various regimes, both on-shore and off-shore. For on-shore exploitation, to a large extent, it is possible to control the potential of a spillage such that it does not cause much damage to the environment. In the Middle East, notably Saudi Arabia, Jordan, Yemen, Sudan and Libya, as well as in Siberia in Russia, much damage has not been caused to the environment because most of the exploitation is on-shore, and apart from the activities of saboteurs, as in the case of Sudan and Nigeria, it is relatively easy to control oil spills. However, when left uncontrolled, grave damage can be caused to the environment in which it is spilled. In May 2010, an ExxonMobil pipeline

in the Niger Delta in Nigeria was ruptured, and reportedly spilled more than a million gallons of oil into the delta over a week before the leak was stopped (Vidal, 2010).

As noted in the World Ocean Review, 2014,

> "Offshore gas and oil production began more than a century ago. With many shallow-water fields already exhausted, these natural resources are now being extracted at ever greater depths. Production rates are higher than ever, while oil pollution is decreasing. However, this (decrease) is largely due to the stringent regulations applicable to shipping: the explosion at the *Deepwater Horizon* oil rig clearly demonstrated that safety is a long-neglected issue in the oil (extraction) industry" (World Ocean Review, 2014).

Some control measures used to combat oil spills on-shore have been to cap wells and replace pipelines. In Nigeria, much of the spillages on-shore (in the Niger Delta area) has been caused by sabotage or old and leaky pipelines. Thus, for on-shore drilling, prompt and efficient measures put in place to combat spills have been largely effective.

It is much more difficult to control oil spills that occur offshore. Arguably, many of the world's oil exploitation regimes take place offshore – the Falklands in the United Kingdom, the Atlantic Ocean in the United States and Canada, the Arctic Ocean and the Atlantic Ocean off the Coast of Africa. What pose a difficulty in the management of oil spills offshore are the elements. Offshore, nature is much more difficult to harness, and the actions of the tides and waves, as well as wind and current actions carry any spillage to great distances, thus making its control more difficult and causing more pollution than on-shore spillages. The situation gets worse when the spillage is accidental and comes directly from the source of the oil, as in a blow-out.

The need to guard against spillages at exploitation sites cannot be over-emphasised: the *Ixtoc I* spilled about 475,000 tonnes of oil, the *Deepwater Horizon* spilled over 700,000 tonnes of oil before they could be brought under control. Both these spills far outweigh spills from ships: the *Atlantic Express* spilled 287,000 tonnes, the *ABT Summer* spilled 260,000 tonnes, the *Castillo de Bellver* spilled 252,000 tonnes, the

Amoco Cadiz spilled 223,000 tonnes, the *Haven* spilled 144,000 tonnes, the *Odyssey* spilled 132,000 tonnes, the *Torrey Canyon* spilled 119,000 tonnes, the *Sea Star* spilled 115,000 tonnes, the *Prestige* spilled 63,000 tonnes, the *Exxon Valdez* spilled 37,000 tonnes (World Ocean Review, 2014).

It can be seen that though spillages from ships have been the catalysts for Conventions to be adopted, spillages at exploitation sites are far more devastating to the marine environment in terms of quantities spilled. The necessity to address spillages from exploitation sites is highlighted when one considers the fact that "there are currently around 900 large-scale oil and gas platforms around the world" (World Ocean Review, 2014).

To ensure that the marine environment is not unduly polluted and to hasten response to pollution due to oil spillage, the United Nations (UN) and the IMO have adopted various Conventions and Protocols to protect the marine environment by prescribing ways to prevent and combat spills that do occur. However, these conventions, though seemingly adequate in addressing pollution arising from the transportation of oil in various modes, have been woefully inadequate in the area of actual exploitation activities.

The Ghana Shipping Act 2003, (Act 645), was passed to enhance the development of merchant shipping in the country, but failed to cover issues relating to marine pollution, oil pollution liability and compensation regimes, though these aspects are covered in international conventions which Ghana is party to.

Relevant laws with regard to marine pollution in Ghana, before the commencement of commercial exploitation of oil and gas, were the Oil in Navigable Waters Act, 1964, the Environmental Protection Agency Act, 1994, and the Ghana Maritime Security Act in 2004. These laws, however, were deficient in prescribing legislation to regulate exploitation activities in Ghana's waters which may lead to pollution.

The Ghana Maritime Authority (GMA) was established under Act 630 of 2002 and charged with the responsibility of monitoring, regulating and coordinating activities in

the maritime industry. As part of its mandate, it has the duty to *ensure in collaboration with such other public agencies and institutions as the Board may determine the prevention of marine source pollution, protection of the marine environment and response to marine environment incidents.* Due to the paucity of legislation to regulate the marine environment with regards to oil and gas exploration and exploitation, the GMA in October 2010, presented to Parliament the Marine Pollution Bill, amendments to the Ghana Maritime Authority Act and the Ghana Maritime Security Act, and other legislations to regulate the oil and gas industry (http://www.ghanamaritime.org/ind.php?news=1&pndet=23). This paper looks at how adequately or efficiently Ghana's laws, as well as the established practices and procedures of organisations engaged in Ghana's oil and gas industry, can prevent and/or combat an environmental damage due to spillage at the actual drill site, and not just in the transportation of the oil.

2.2 What is a Blow Out?

The Illustrated Petroleum Reference Dictionary defines a blowout as an "Out of control gas and/or oil pressure erupting from a well being drilled; a dangerous uncontrolled eruption of gas and oil from a well; a wild well" (Langenkamp, 1985). An A-Z of Offshore Oil & Gas also defines a blowout as "A sudden, violent, uncontrolled escape of gas/water/oil, with mud, at high pressure from a well" (Whitehead, 1983), and goes on to explain that

> "blowouts occur when the formation pressure exceeds the hydrostatic head of the drilling fluid, and have caused extensive damage to, and even loss of, drilling rigs and equipment. They are also dangerous to life, and at best cause costly delays in the drilling programme" (Whitehead, 1983).

The Schlumberger Oilfield Glossary defines a blowout as an "uncontrolled flow of formation fluids from a well, the wellbore or into lower pressurized subsurface zones (underground blowout)" (Schlumberger, 2017).

From the above definitions, blowouts are accidental and uncontrollable, in a controlled (pressurized) environment, and usually cause much damage to the environment into which the effects of the blowout is released. This is because due to the accidental

nature of the occurrence, a blowout is difficult to bring under control immediately, and would usually spill a lot of the contents of the well before it is brought under control. The Santa Barbara oil spill caused by a blowout on Platform A of Union Oil spilled an estimated 3 million gallons of oil before it was brought under control (Clarke and Hemphil, 2001). For the Deepwater Horizon Oil Spill, also the result of a blowout, an estimated 3.19 million barrels of oil was spilled before the well was finally successfully capped (Ocean Portal, 2017). Many drilling wells now have blowout preventers (BOPs) which are specialized valves to prevent blowouts, or at least give an early enough signal for measures to be taken to prevent blowouts.

Blowouts are different from blow-ups in that blowouts occur during actual drilling operations on the well or pipe, whilst blow-ups occur during transportation of the product by vessel or pipeline, either accidentally, usually caused by fire or a ruptured pipeline, or by controlled explosions to sink a stricken vessel.

2.3 What Causes Blowouts?

The enormous pressure of the rock formations around an oil reservoir is the underlying cause of blowouts (Petro Industry News, 2014).

> Oil naturally occurs over a period of millions of years, during which all of the water is compressed and pressurised out of the carbon-based substance (normally life-forms of one type or another) by the layers of sediment that form on top of it. When drilling, this pressure is counteracted by the use of mud around the drilling site, which helps to balance the hydrostatic pressure. If this balance is upset, water, gas or oil can infiltrate the wellbore or even the drill itself – a phenomenon known as a “kick” – and this can quickly escalate into a blowout if not promptly identified and addressed. (Petro Industry News, 2014)

The use of the wrong set of ‘rams’ to shut in the well can also be a catalyst for blowouts (northdakotaoillawyers.com, 2013). In drilling oil and gas, various means are used to prevent the escape of same into the environment, a major one of which is a Blow Out Preventer (BOP).

> The BOP stack usually consists of two sets of Rams and one “annular” preventer. The stack consists of “pipe rams” which are the main means of preventing hydrocarbons from escaping, ‘blind” rams which are used when no drill pipe is in the hole and completely shuts in the well, and “shear” rams which cut away the heavy drill pipe and completely shut in the well. Blowouts can be caused by the use of the wrong set of rams to shut in the well. There are times the pipe rams are not effective to shut in the well, but are used by the drill crew because they mainly train with pipe rams. Blowouts, explosions and serious injuries occur when the BOP’s are closed and the well is supposed to be shut-in. Unfortunately, down hole pressures can exceed the rated pressure of the BOPs. In addition, the BOPs have to be activated to shut-in the well. (North Dakota Oil Lawyers, 2013)

Migration of oil or gas into the drill well or hole may also cause blowouts (North Dakota Oil Lawyers, 2013).

> “Trip tanks” are used to measure the amount of drilling mud that is being returned to the surface. If mud volume is increasing at too fast a rate, it is an indication that a blowout may be about to occur. The increased volume of mud means that gas or oil is migrating into the hole, and the well may be about to blow out. When the well is being drilled and the crew is tripping in or out of the hole, mud volume is lost. If that mud is not replaced the down-hole pressure may overcome the mud weight, and a blowout can occur. (North Dakota Oil Lawyers, 2013)

Risking controlling the hydrocarbons that enter the drill well or hole without adequate precautions also cause blowouts (North Dakota Oil Lawyers, 2013).

> By far, the most common cause of blowouts is drilling “underbalanced” – taking the risks of controlling the hydrocarbons that enter the hole by circulating them out while drilling. Safe drilling practices require the mud to be “weighted” up to hold back the pressure, but operators get in a hurry to produce the well, and

time is money, so they drill underbalanced and lose control of the well. (North Dakota Oil Lawyers, 2013)

The above indicates that the causes of blowouts are all human-induced. The natural setting of the oil itself makes extraction difficult, therefore extra caution and skill needs to be applied in its extraction. However, due to the expensive nature of oil exploitation, companies and individuals may want to avoid as much cost as possible, and thus pay less attention to safety details as they should, giving rise to many of the blowouts which have occurred world-wide. "In its final report, published in December 2011, a US Committee of experts concluded that a series of technical failures and flawed decisions led to the disaster of the *Deepwater Horizon*" (World Ocean Review, 2014). This is what the oil industry needs to guard against.

2.4 Types of Blowouts

There are three main types of blowouts identified over the years (Petro Industry News, 2014):

- *Surface Blowouts*: During a surface blowout, the drill string is ejected out of the well, and the force with which the oil or gas escapes from the well may cause damage to the drilling rig, with a fire being the most dangerous and costly. These are the most common types of blowouts, and risk damaging the surrounding terrain in addition to the rig itself (Petro Industry News, 2014).
- *Underground Blowouts*: These are situations where oil or gas escape from a well in high pressure area to a low pressure area (Schlumberger, 2017). This type of blowout may not cause serious damage to the environment immediately, as the flow does not escape above ground. However, it might have effects on other wells in the area due to the change in pressure.
- *Underwater Blowouts*: These occur under water (sub-sea), mainly due to equipment failure, and are the most difficult to deal with (petro-online, 2013). They are situations where oil or gas escape from the well into the sea, and have the most deleterious effects on the marine environment. They are the most difficult to deal with, and may persist for the longest time. The biggest and deepest underwater blowout in history is that of the *Deepwater Horizon* in the Gulf of Mexico in 2010 (Petro Industry News, 2013).

2.5 Some Deleterious Effects of Blowouts

Oil spills are very harmful to the environment within which the oil is spilt, in that "the damage caused by such spills is permanent and takes a long time to clean up" (Conserve Energy Future, 2017). Being a hydrocarbon compacted and accumulated over millions of years, oil does not easily mix with the environment within which it is spilled. If oil is spilled on land, it negatively affects the soil in which it is spilled, and renders farmlands and other agricultural lands unusable for those purposes. Oil spilled on land also seeps into rivers and other water bodies and contaminates them such that they can no longer be treated for use by humans, or at the very best, treatment of such water bodies for human consumption becomes very expensive, as the oil contains cancer-causing compounds such as benzene.

> The Mingubalak Oil Spill, also known as the Fergana Valley Oil Spill, was caused by a blowout on Well No. 5 in the Mingubalak Oil Field, Fergana Valley, Uzbekistan, on March 2, 1992, and is widely known as the largest accidental terrestrial oil spill (after the intentional burning of Kuwaiti oil fields during the Gulf War). An estimated 285,000 tons (about 88 million gallons) of oil was lost, released into the environment. There was no clean up, and the oil seeped into the ground, and totally destroyed the agricultural sector of the economy. It had a negative effect on wildlife as well, birds were covered with oil which was so heavy it made them unable to fly (Mikucki, 2013).

In November 2016, "Britain's High Court began hearing lawsuits filed by the Ogale and Bille people of Nigeria against Shell, alleging that decades of oil spills have fouled the water and destroyed the lives of thousands of fishermen and farmers in the Niger River Delta, where a Shell subsidiary has operated since the 1950's" (Al Jazeera, 2016). Local communities in Nigeria have been fighting the Oil majors for decades for compensation, due to the deleterious effects of oil spillages into their lands and water bodies, destroying their means of livelihood. Cleaning up spillages on land can take up to a quarter of a century, and is very costly in terms of financial resources and time, and it is yet to be made known how long the soil would take to replenish its fertility (Mustoe, 2016).

Figure 2: Water bodies and farmlands in Nigeria polluted by oil
Source: http://www.aljazeera.com/news/2016/11/shell-sued-uk-decades-oil-spills-nigeria-161122193545741.html

Some residents have claimed that drinking the contaminated water from the rivers and water bodies is "causing strange diseases in the communities, skin diseases, sudden deaths, impotence and low sperm counts (Al Jazeera, 2017).

When oil is spilled into the oceans, it has no less deleterious effects. Marine and aquatic life suffocate because the oil prevents fishes from getting oxygen in the water, killing millions of them and may even threaten some species. Plankton and other aquatic species also die off, hampering the development and growth of fishes and other marine life, which depend on plankton for survival.

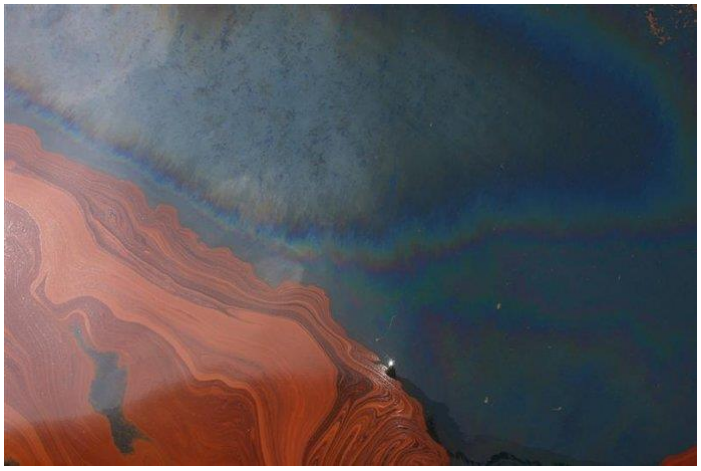


Figure 3: View of the Deepwater Horizon oil spill taken from above in June, 2010
Source: http://ocean.si.edu/ocean-photos/oil-spill-above

Marine mammals and aquatic birds such as seagulls and pelicans also feel the negative effects of the spills – their feathers get all oiled up and renders them unable to fly, they do not get enough to eat, and the little they get to eat are contaminated, thus posing a danger to their health as well.

Figure 4: An oiled seabird was found dead on the beach at Alaska, November 1997. (NOAA)
Source: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/how-oil-harms-animals-and-plants-marine-environments.html

The effect of a spillage on the economy of a community is also negative, in that it renders beaches unusable for recreational activities, mostly because the waters are unusable for recreational activities, as well as the unpleasant odour coming from the dead fishes and other mammals at the contaminated areas. In Ghana, a spillage of mud in 2010 caused the communities to be unable to fish for some weeks because of the contamination (Bedgley, 2012).

Therefore, from a myriad of angles, oil spills caused by blowouts or other activities related to extraction of the oil have negative effects on the environment and inhabitants, with very little positive effects.

2.6 How Can Spillage Due To Blowouts Be Prevented

The most common method of preventing blowouts is the use of Blow Out Preventers (BOP) on the well during drilling. BOPs are high pressure wellhead valves designed to shut off the uncontrolled flow of hydro-carbons (COGIS, 2017). The Illustrated Petroleum Reference Dictionary also defines a BOP as “A stack or an assembly of heavy-duty valves attached to the top of the casing to control well pressure”

(Langenkamp, 1985). There are several types of BOPs like single ram and double ram preventers. They are mostly monitoring devises on the drill well to monitor the ingress and egress of water and mud from the well and sound an alarm when the rate of ingress or egress exceeds the set rate.

Figure 5: Image of Ocean Drill BOP being deployed
Source: http://www.drilltech.cn/info/Ocean-drilling-BOP-137-1.htm

The BOPs are used to give advance warning of an impending blowout, to enable preventive or corrective action to be taken before it reaches the critical pressure point when the blowout will occur. At all times, a critical monitoring of the BOP would be the best means of preventing a blowout.

Being able to recognise underground blowouts is also a major pointer to an impending blowout, and immediate corrective action can prevent the underground blowout from escalating into a surface blowout. Due to its very nature, underground blowouts can be difficult to recognise, therefore experience in drilling wells is key in recognising such types of blowouts, in order to take corrective action to prevent it developing into a surface blowout.

Well capping has also been used to prevent blowouts. However, this may only be effective at the early stages of a blowout, if the pressure mounts to a certain degree, capping the well may be too late to prevent a blowout. In the *Deepwater Horizon* incident in the Gulf of Mexico, initial attempts at capping the affected well did not yield the desired results because the blowout had degenerated to such an extent that capping the well alone could not prevent it. The well was only successfully capped after 87 days, having released an estimated 3.19 million barrels (Ocean Portal, 2017) to 4.9 million barrels (Ebinger, 2016) of oil into the ocean.

From the *Deepwater Horizon* blowout "which raised questions about the safety of deep water drilling, the adequacy of the corporate response to the disaster and of governmental regulation of offshore drilling" (Allin, 2016), lessons can be learnt on preventive measures to be taken in order to prevent blowouts. The lessons learnt point to vigilance in monitoring, and the need to use and maintain proper equipment in order to prevent equipment failure and forestall a blowout. The *New Scientist* lists 8 failures that caused the Gulf Oil Spill:

- Dodgy cement used at the bottom of the borehole, which did not create a seal;
- Valve failure at the bottom of the pipe which were designed to stop the flow of oil and gas but failed;
- Misinterpretation of pressure tests by the crew;
- Not spotting the leak soon enough;
- Valve no. 2 failure in the blowout preventer;
- An overwhelmed separator which was not designed for the quantity of oil and gas as well as drill mud which were diverted into it;
- Failure of the on-board gas alarm; and

- A flat battery which should have enabled the BOP to kick in automatically once control through the main lines were lost due to the explosion (New Scientist, 2010).

Careful attention paid to these pointers can help prevent future blowouts on other rigs.

2.7 Where Have Spillage Due To Blowouts Been Known To Occur

The *Deepwater Horizon* blowout is the one which wreaked the most havoc in US waters, and arguably the largest accidental oil spill in history, spilling an estimated 5 million barrels of oil into the Gulf of Mexico (Allin, 2016). It was caused by a blowout on the exploratory Macondo 252 well "as the drill hole had been – or was being – cemented to seal the well so that the drill pipe could be removed and the *Deepwater Horizon* could be moved to a new location" (Allin, 2016). The *Deepwater Horizon* was drilling oil in the Gulf of Mexico, which oil was located 3.5 km below the sea floor and 7 km below the drilling platform (Allin, 2016). The immediate cause of the blowout was the failure of the cement used to seal the well, and the failure of the BOP, which was designed to cut through the drill casing and seal the well in case of an emergency (Allin, 2016).

Quite recently, in 2015, an oil well owned by Oasis Petroleum Inc. experienced a blowout and was out of control for nearly three days, spilling more than 1,667 barrels of crude oil and 2,000 barrels of brine (Oil Spill Intelligence Report, 2015).

The *Ixtoc I* exploratory well blew out on June 3, 1979 in the Bay of Campeche in Mexico, and by the time it was brought under control, had spilled an estimated 140 million gallons into the Bay (Congressional Digest, 2010). This blowout has also been recorded as one of the worst oil spills in history.

The Mingubalak Oil Spill, also known as the Fergana Valley Oil Spill, was caused by a blowout on Well No. 5 in the Mingubalak Oil Field, Fergana Valley, Uzbekistan, on March 2, 1992, and is widely known as the largest accidental terrestrial oil spill.

From the foregone, there can be no gainsaying the fact that blowouts which have occurred in history have had very damaging environmental effects on the ecology into which the oil has been spilled. It is also evident that blowouts, due to their very nature, are difficult to bring under control, thus their propensity to spill a lot and cause much environmental damage before they are brought under control – or empty the contents of the well on which the blowout occurred.

2.8 How Can Spillage Due To Blowouts Be Controlled

Due to the very nature of blowouts, they cannot be controlled once they occur. The effects of the blowout is to leave an oil well gushing out its contents into the environment, and the only way any form of control can be implemented to curb greater environmental damage is to cap the wellhead – i.e., seal the well which is gushing out the oil. Unless and until the wellhead is capped, the effects of the blowout cannot be controlled, since the oil gushing out is coming from a pressurised region into a less pressurised one. To cap a wellhead, cement is usually used in varying degrees, and if the well has experienced a blowout, it is normal to cap the wellhead permanently, using blocks of cement which can weigh up to 5,000 tons. Wells which experience blowouts are not usually used again, but subsidiary wells are drilled if the same reserve is to be exploited again.

2.9 Does The Real Possibility of a Spillage Due To Blowout in Ghana's Waters Exist?

Development and production of Ghana's oil and gas in commercial quantities is a long term activity, spanning 15 – 25 years for the Jubilee Field along, with longer time span for the TEN (Tweneboah, Enyira and Ntomme) Fields, which contain larger reserves (GNPC, 2016). Thus, a Development Plan has been crafted out which ensures that the development and production will be done in such a way as to have minimum adverse impact on the environment (GNPC, 2016). The Plan covers all phases from Development through Production to Abandonment. A third Field, the Sankofa Gye-Nyame Field, has also been discovered, and exploratory works are currently on-going on this field. Commercial exploitation of the Jubilee Field started in 2010, and that of the TEN Fields started in 2016 for Oil, and 2017 for Natural Gas. The TEN fields are

estimated to have in excess of 300 million barrels of oil and 360 billion cubic feet of gas – this field holds Ghana's major gas reserves (GNPC, 2016).

With the production of oil and natural gas projected into 2033 and beyond (GNPC, 2016), it is evident that the real possibility of a blowout exists in Ghana's oil and gas exploitation activities. This is buttressed by the fact that the Jubilee Field is located 60 nautical miles offshore, and the TEN and Sankofa Gye-Nyame Fields extend even further, creating the environment for a blowout if extra care and attention is not paid to exploitation activities.

Again, blowouts are accidental occurrences and need to be adequately guarded against, but with oil exploitation taking place in a pressurised environment, especially offshore, blowouts are a real possibility in Ghana's oil and gas industry.

2.10 How Can Pollution From Blowouts Be Combated

The most basic and urgent demand resulting from a spillage due to blowout is to identify the source of the blowout and take immediate measures to prevent or reduce further spillage. Initial reports of the spillage must be reported to the appropriate authority and a contingency plan immediately activated to prevent major damage to the environment.

An Oil Spill Contingency Plan is a requirement in all incidents of oil spills, and the IMO has published a Manual on Oil Pollution – Contingency Planning, which "provides guidance to governments, particularly those of developing countries, on ways and means of establishing a response organisation and preparing contingency plans" for oil spillages (IMO, 1995). The Contingency Plan adopted "takes into account the OPRC, 1990", and also has a section on Combating Oil Spills, published separately from the Contingency Plan. Ghana factored the tenets of the Manual into the Maritime Pollution Act, 2016, which prescribes setting up a National Coordinator to prepare a National Contingency Plan for preparedness and response in cases of oil spills.

In combating the oil spill, and as part of the information to be provided by those at the source of the spill, the "type of oil together with an estimate of the quantity spilled" should be disclosed (IMO, 2005, p 41). This information would be necessary to

determine the type of combating to be used to manage the spillage. Spilled oil is normally “carried by the currents and blown by the wind, so immediate measures should be taken to combat the spill to minimise pollution damage to the marine environment” (IMO, 2005, p 51).

One option in combating a spill is to use “containment booms to localise the spillage and prevent the oil from further drifting as skimming devices are used to recover the oil from the sea surface” (IMO, 2005, p 51). Alternatively, other methods such as positioning booms in places where floating oil will naturally collect, either in open waters or more commonly close to shore, ready for recovery using skimmers and pumps (IMO, 2005, p 51). These methods demand that containment booms be readily or easily available at the site of the spillage – i.e., at the drilling site, in order to be immediately deployed to forestall grave environmental damage, and may only be effective for relatively minor spillages. However, for spillages due to blowouts, this method may be inadequate, unless the wellhead can be immediately capped to forestall a major spill.

Spillages from blowouts can also be combated using chemical dispersants. “Wave action and turbulence due to tides and currents causes some of the oil to break down into small droplets which can be carried down into the water column, a process known as dispersion. This process can be enhanced by the application of chemical dispersants” (IMO, 2005, p 101). Dispersants are chemical agents that alter the physical behaviour and properties of oil on the sea surface, thereby enabling penetration of the dispersant into the oil and increasing the rate of droplet formation and assimilation of the oil into the water column.

Dispersants can be used to combat oil spillages from blowouts – and in fact, were used in the cases of the *Ixtoc I* and *Deepwater Horizon*. However, in deciding to use chemical dispersants, environmental issues should be taken into consideration, especially the effect that dispersants would have on marine life. This is because the dispersants themselves are potentially damaging to the marine environment, and they don’t get rid of the oil but rather breaks the oil down for it to assimilate into the water column, thereby still maintaining, albeit to a lesser degree, the pollution the oil will

cause to the marine environment. Dispersants may be applied or sprayed from shipboard sources or from light aircraft, and therefore the decision to use dispersants would entail having available or easily available the logistics to deploy them in the event of a spillage.

Another method of combating a spillage is *in situ burning*, i.e., the intentional burning of the oil on the surface of the water – this method was also initially tried during the *Deepwater Horizon* oil spill. Under ideal conditions, this can be an effective way of removing large quantities of oil in a relatively short period of time (IMO, 2005, p 119). In the *Deepwater Horizon* case, incendiary bombs were initially used to try to set the oil ablaze. However, for *in situ* burning to be completely successful, the oil needs to be thick – an ideal situation in the event of a spillage due to blowouts – and the thickness maintained during the burning. In actual burning of oil on water surface, as the oil burns, the thickness reduces, and therefore the fire point of the oil, thereby naturally pushing the fire to a natural death. In order to ensure that all the oil is burned, there is the need to maintain the thickness through containment, so the oil can all burn off the surface of the sea. This containment is done through the use of fire-resistant containment booms.

Again, before *in situ* burning can be utilised, consideration must be given to its effects, i.e., the thick black plume of smoke it will generate, and the residues of materials that remain after the burning has stopped (IMO, 2005, pp 121 – 122). Another initial issue before *in situ* burning can be considered is that the fire does not flash back to the source of the oil – e.g., the wellhead, which will create an even bigger explosion and catapult the spillage out of control.

For spillages on land, washing or flushing using high pressure hot water (as is used in tank cleaning on oil tankers) can also be used to combat the effects of the spillage. However, this method may also only be useful in the case of small spillages, and may be ineffective to combat the effects of a blowout.

2.11 Current Situation In Terms of Legislation

The United Nations Convention on the Law of the Sea (UNCLOS), 1982 defines pollution of the marine environment in Article 1(4) as

> *The introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality of use of sea water and reduction of amenities* (IMO, 1982)

Article 145 of the same UNCLOS also requires that necessary measures be taken to protect the marine environment with respect to pollution from exploration and exploitation activities in the "Area", which is "the seabed and ocean floor and sub soil thereof, beyond the limits of national jurisdiction" according to Article 1(1) (UNCLOS, 1982). Article 192 of UNCLOS states that "states have the obligation to protect and preserve the marine environment" (UNCLOS, 1982). Article 194(1) requires states to

> *"individually or jointly, as appropriate, take all measures consistent with the Convention as are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and to harmonise their policies in this connection"* (IMO, 1982).

Article 194 (3) (c) particularly states that measures taken pursuant to dealing with all sources of pollution of the marine environment shall be designed to minimise to the fullest extent possible

> *"pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulating the design, construction, equipment, operation and manning of such installations or devices"* (IMO, 1982).

Article 195 requires that states, "in taking measures to prevent, reduce and control pollution of the marine environment, shall act so as not to transfer, directly or

indirectly, damage or hazards from one area to another, or transfer one type of pollution into another" (IMO, 1982).

Articles 207 and 210 relate particularly to the activities states should take in order to prevent pollution, either from land based sources or from seabed activities, and activities in the area, as well as from dumping, which will harm the marine environment.

In the 1950's, the world was not yet overly concerned with major oil spills. The precursor of marine pollution prevention conventions was the International Convention for the Prevention of Pollution of the Sea by Oil, 1954 (OILPOL 1954), which mainly dealt with operational discharges from ships (Kuokkanen, Couzens, Honkonen and Lewis, 2016). The OILPOL 1954 was the first well set out international convention on marine pollution, which Ghana ratified and gave effect to by virtue of the Oil in Navigable Waters Act, 1964, Act 235 (Mbiah, 2009). The OILPOL 1954 convention was mainly to deal with ship source pollution, mostly from normal operational discharges, as ships usually just discharged their oily wastes into the oceans at the time of the passage of the OILPOL 1954. The OILPOL 1954 was, however, soon overtaken by events and other developments in the maritime transport industry, and though it went through various amendments and updates in 1962, 1969 and 1971, it was woefully inadequate to address the new challenges in protecting the marine environment from pollution by oil.

The Inter-governmental Maritime Consultative Organisation (IMCO) – the precursor to the IMO – Conference in 1969 therefore adopted the International Convention on Civil Liability for Oil Pollution Damage 1969 (CLC 1969), which brought bout significant changes to the OILPOL 1954 regime (Mbiah, 2009). In 1969, the IMCO Conference completed the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969 (Intervention Convention 1969), which entered into force on May 6, 1975. However, in the 1970's, environmental concerns were so heightened that it became evident that the CLC 1969 compensation limits were inadequate to meet serious marine pollution incidents. Due to these concern raised, the IMCO developed a supplementary regime to the CLC 1969, the

International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 (FUND 1971), which entered into force on October 16, 1978, and has also been ratified by Ghana (Mbiah, 2009).

However, the CLC 1969 and the FUND 1971 were still not adequate enough to address all the concerns of the international community with regards to the environment. This then led to the development of the most comprehensive instrument to date, the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which was designed to supersede the OILPOL 1954, and entered into force on October 2, 1983. Ghana has incorporated the relevant provisions of the MARPOL 73/78 into the Maritime Pollution Act, 2016 and also the Ghana Shipping Act, 2003 (Act 645) (Mbiah, 2009). Ghana has also ratified other International Conventions on protection of the marine environment from pollution, including the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) 1990, which Ghana ratified in 2010 and has incorporated into its laws, including the Maritime Pollution Act, 2016.

Arguably, these appear to be the main international law provisions towards the prevention of pollution of the marine environment through exploitation activities, and their coverage of the subject matter leaves much to be desired.

The IMO has other conventions that seek to prevent the pollution of the marine environment due to transportation activities, most notably the MARPOL 73/78, and the HNS Convention, as well as activities relating to maritime transport, notably the Ballast Water Convention and the Anti-Dumping Convention, but there is no international convention relating purely to pollution of the environment through exploitation activities. However, the dearth of international conventions and regulations with regards to pollution due to exploration and exploitation activities should not lead to rampant pollution of the environment due to these activities. It is the responsibility of nation states to enact and implement regulations which will prevent and combat pollution in the marine environment due to exploration and exploitation activities.

The MARPOL 73/78, the main IMO Convention relating to marine pollution by oil, in Article 1, enjoins states parties to "undertake to give effect to the Convention and Annexes, on order to prevent the pollution of the marine environment by the discharge of harmful substances or effluences containing such substances in contravention of the Convention" (MARPOL 73/78). In relation to pollution through exploration and exploitation activities, however, Article 3 (ii) expressly stipulates that 'Discharge does not include release of harmful substances directly arising from the exploration, exploitation and associated offshore processing of seabed mineral resources" (MARPOL 73/78). The MARPOL is thus specifically geared towards the transportation of substances that can potentially harm the marine environment, and not necessarily the exploration and exploitation of such substances.

2.12 Specific Legislation Protecting the Marine Environment

Ghana's closest neighbour in English-speaking West Africa, Nigeria, has been drilling oil for over half a decade, since its first export in 1960, and is the largest exporter of oil from Africa (Nuhu, 1997). According to Daniel Workman, Nigeria was the 8th largest exporter of crude oil in 2016, exporting about US$ 27 billion worth of crude oil, accounting for about 4% of global crude oil exports (Workman, 2017). In Nigeria, due to the long period of exploitation of oil, and the deleterious effects of pollution of the environment through spillages, whether accidental or through sabotage or deliberate discharges, several laws have been passed to regulate the protection of the environment, through prevention and combating of pollution due to the activities of the exploration and exploitation companies. The Agency mandated to protect the environment of Nigeria is the National Environmental Standards and Regulations Enforcement Agency (NESREA), under the ministerial supervision of Nigeria's Ministry of Environment. The NESREA was established by an Act of Parliament, the National Environment Standards and Regulation Enforcement Agency (NESREA) Act of 2007, which replaced the Federal Environmental Protection Agency (FEPA) Act. The NESREA Act is the embodiment of laws and regulations focused on the protection and sustainable development of the environment of Nigeria and its natural resources (ELRI, 2017).

Ghana and Nigeria are partners in the West Africa Gas Pipeline Project, and have other collaborations regarding supply of oil and gas along the West African coastline. Ghana appears to have contemplated something in the regions of the NESREA in the Marine Pollution Act, 2016, in establishing the Office of the National Coordinator, and the National Contingency Plan. However, Ghana's Office of the National Coordinator seems to be rather inadequate, as by law, the Office is to coordinate the establishment and execution of a National Contingency Plan, instead of being a full agency responsible for protection of the marine environment with specific regard to exploitation activities.

The NESREA has the task of ensuring compliance with various environmental laws which come under its mandate, with the following being specifically relevant to oil and gas exploitation:

- Environmental Impact Assessment Act
- The Land Use Act
- Hydrocarbon Oil Refineries Act
- Associated Gas Re-Injection Act
- Oil Pipelines Act
- Petroleum Act (ELRI, 2017).

Specifically, the NESREA Act 2007 gives the mandate to the NESREA to regulate the Nigerian environment through 3 sections:

- Section 7 provides the NESREA with the authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitory and regulatory measures.
- Section 8 (1) (k) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution and sanitation.
- Section 27 prohibits, without lawful authority, the discharge of hazardous substances into the environment.

Since its inception, the NESREA is implementing existing regulations, and has also passed, through Parliament, regulations to enable them execute their mandate, including but not limited to:

- National Effluent Limitation Regulations
- National Environment Protection (Pollution Abatement and Industries and Facilities Producing Waste) Regulations, 1991
- Federal Solid and Hazardous Waste Management Regulations 1991
- Environmental Impact Assessment (EIA) Act, CAP E12, LFN 2004
- Land Use Act, CAP 202, LFN 2004
- Harmful Waste (Special Criminal Provisions) Act, CAP H1, LFN 2004
- Hydrocarbon Oil Refineries Act, CAP H5, LFN 2004
- Oil in Navigable Waters Act, CAP 06, LFN 2004
- Associated Gas Re-Injection Act, CAP 20, LFN 2004
- Oil Pipelines Act, CAP 07, LFN 2004
- Oil Pipelines Regulations
- Petroleum Act, CAP P10, LFN 2004
- Petroleum Drilling and Production Regulations
- Petroleum Refining Regulations
- Petroleum Products and Distribution Act, CAP 12, LFN 2004
- Mineral Oil Safety Regulations and Crude Oil Transportation and Shipment Regulations
- Environmental Sanitation Law
- Environmental Pollution Control Law. (ELRI, 2017)

From the above, it can be seen that Nigeria has passed various Laws and Regulations to regulate the environment, including the marine environment, with specific regards to the exploration and exploitation of oil and gas, in the quest to prevent and control pollution of the environment, especially due to oil spillages. This can be attributed to the fact that Nigeria has been drilling oil for quite a long time, and has thus had the opportunity to develop laws from their experiences, in order to forestall and combat environmental damage due to spillages.

Ghana, on the other hand, is a relatively new entrant on the oil and gas exploitation scene, having discovered oil in 2007 and begun commercial production in 2010. Before the discovery of oil in commercial quantities, the specific laws of Ghana which sought to control and regulate pollution of the marine environment were:

- Ghana Maritime Security Act, 2004, Act 675
- Ghana Shipping Act, 2003, Act 645
- Environmental Protection Agency Act, 1994, Act 490
- Oil in Navigable Waters Act, 1964, Act 235.

These laws were mainly with regards to the transportation of oil through Ghanaian waters and in Ghanaian ports, and had little or no relevance to exploration and exploitation activities, though Ghana had been prospecting for oil since the GNPC was incorporated in the 1960's. These applicable laws were therefore inadequate to protect Ghana's marine environment in the event of a spillage during exploitation activities for oil and gas.

In order to upgrade the laws of Ghana with specific regards to exploration and exploitation of oil and gas in the advent of commercial drilling, the Ghana Maritime Authority, enjoined by law to see to the protection of Ghana's waters, in 2010 presented the Maritime Pollution Bill to Parliament for enactment. After several reviews, the final Bill was presented to Parliament in October 2015 for enactment into law. The Maritime Pollution Bill was "An Act to provide for the Prevention, Regulation and Control of Pollution within the Territorial waters of Ghana and other maritime zones under the control of Ghana, and for other related matters" (Maritime Pollution Act, 2016). The Bill was finally passed into law in 2016, but is yet to receive presidential assent. According to the former Deputy Minister of Transport, Mrs Joyce Bawa Mogtari, the Bill took a long time to pass because "It was initially based on the MARPOL, but had to be fine-tuned to include other necessary inputs at the request of the Environmental Protection Agency (EPA), (Mogtari, 2015).

The Maritime Pollution Act is the most comprehensive Bill to date that incorporates most of the Marine Pollution Conventions ratified by Ghana, and is the only Act (Law) in Ghana that has a chapter on Oil Pollution Preparedness, Response and

Cooperation – Part 4, Chapter 8 (Maritime Pollution Act, 2016), as well as Liability and Compensation for Pollution Damage – Part 5, and specifically Liability for Oil Pollution – Part 5, Chapter 1. It also incorporates the tenets of the London Convention 1972, the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972.

The Maritime Pollution Act, 2016 also for the first time specifically rests the responsibility for the regulation of Ghana's maritime domain in the Ghana Maritime Authority (GMA), but enjoins the Authority to collaborate with the EPA in the exercise of this mandate – Article 2 (1), (2), (Maritime Pollution Act, 2016). Again, the Act creates a potential conflict between two governmental agencies in the regulation of Ghana's maritime domain, and such potential conflicts are a common feature in Ghana's laws, thereby creating a lag in ultimate responsibility amongst state institutions in the execution of their mandate.

In fairness, however, for the implementation of the tenets of the Act, a specific provision is made for the Act to apply to "an offshore installation" – Article 1 (a) (iii), a new introduction to the laws regulating Ghana's maritime domain. The Act, in Article 6, enjoins the GMA in collaboration with the EPA and other relevant agencies to, "in relation to maritime pollution activities within the purview of the IMO;

(a) Directly or through the IMO, observe, measure, evaluate, and analyse by scientific methods recognised by the IMO the risks or effects of pollution of the marine environment; and
(b) In particular keep under surveillance the effects of any activities which it permits or engages in for the purpose of determining whether these activities are likely to pollute the marine environment".

The Act therefore makes provision for the monitoring of offshore activities against pollution of the marine environment.

Chapter 8 of the Act spells out the conditions for Oil Pollution Preparedness, Response and Cooperation. Article 184 (2) enjoins "an operator of an offshore installation within the territorial waters or Exclusive Economic Zone (EEZ) of Ghana to have an oil pollution emergency plan

(a) Coordinated with the system established … and
(b) Approved in accordance with procedures established by the National Coordinator." (Maritime Pollution Act, 2016)

Article 187 (1) establishes a "national system for the prompt and effective response to oil pollution incidents" (Maritime Pollution Act, 2016). This is to ensure that spillages are promptly and effectively dealt with to minimise pollution, and Article 187 (3) enjoins the National Coordinator to "prepare a national contingency plan for preparedness and response" (Maritime Pollution Act, 2016), in accordance with the tenets of the Contingency Planning Manual on Oil Pollution adopted by the IMO. Sub section (4) of Article 187 requires that the National Coordinator also establishes, "either unilaterally or through bilateral or multilateral cooperation, and in cooperation with the oil and shipping industries, port authorities and other relevant entities;

(a) A minimum level of pre-positioned oil spill combating equipment;
(b) A programme of exercises for oil pollution response organisation and training of relevant personnel;
(c) Detailed plans and communication capabilities … regarding an oil pollution incident;
(d) Mechanisms and arrangements to coordinate response to an oil pollution incident" (Maritime Pollution Act, 2016).

This chapter therefore clearly contemplates oil pollution incidents during actual exploitation, and attempts to safeguard the marine environment by prescribing preventive and combating measures in case of a spillage. However, no specific responsibility is laid on the operators of the oil fields to prevent or forestall any such spillage, and they are also not held to strict combative measures to be put in place during exploitation activities.

2.13 Regulatory Framework for Drilling Operations

Nigeria, Ghana's closest West African Neighbour with extensive operations in the exploitation of oil and gas, "operates a command and control regulatory framework in their oil and gas sector, which framework was prevalent in the United States and Britain during the 1970's and 1980's. However, factors such as red tape, over-

regulation and regulatory capture are some criticisms of this type of regime" (Ekhator, 2016), and it is not surprising that so much pollution is prevalent in Nigeria's waters and land, despite the command and control regime.

For the environment to be protected from pollution due to actual drilling operations, there must be concrete measures put in place by the exploitation companies themselves **on site** to prevent and combat any spillage before they get out of hand. Experience has shown that a process-based pollution prevention method can work very well when implemented properly. Such a process is "a framework to help a business identify pollution prevention opportunities, analyse their cost effectiveness, identify areas for improvement and develop action plans for implementation" (Oil Conservation Division, 2000). It will also entail analysing what type of combating equipment to have on site, depending on the type of risk identified, in order to be most effective in combating a spillage, should it happen.

Over the last 2 to 3 decades, emphasis has shifted from pollution control (waste management) to pollution prevention (waste minimisation) (Oil Conservation Division, 2000). Pollution prevention methods have been found to be most effective in forestalling environmental disasters, and more and more, companies are perfecting their systems and efforts at preventing pollution from their exploitation activities. Thus, more management commitment to processes of pollution prevention are advocated and practiced, and organisations have found this to be very effective in protecting the marine environment. Organisations have developed their own systems approaches and incorporated them into the organisational plans so that they are implemented alongside normal organisational goals.

Following the Macondo Well blowout on the Deepwater Horizon in April 2010, several reports have been produced after investigations from various organisations, including regulatory agencies, and among the recommendations from the Bureau of Safety and Environmental Enforcement was the following:

- That "the responsible parties, including the lessee, operator and drilling contractor, **be required** to effectively manage all safety critical elements (SCE's) – technical, operational and organisational – thereby ensuring their

effective operation and reducing major accident risk to As Low As Reasonably Practicable (ALARP)" (Final Report: Macondo Investigation Report, 2016)

- This requirement includes "requirement for all responsible parties, including contractors, to conduct monitoring for continuous active assurance of all identified safety critical elements through each SCE's lifecycle" (Final Report: Macondo Investigation Report, 2016)

The American Petroleum Institute (API) also recommended, amongst others;

- "development and implementation of a safety critical element (SCE) management system that includes the minimum necessary "shall" requirements in the standard, to establish and maintain effective safety barriers to prevent major accidents", (Final Report: Macondo Investigation Report, 2016)
- "methodologies for the identification of SCE's and the development of performance standards of each SCE, including its functionality, availability, survivability and interactions with other systems", (Final Report: Macondo Investigation Report, 2016).

The Final Report on the Macondo Well blowout actually places the onus on the operators and contractors to ensure that preventive measures (e.g., BOPs) are in place on site, and are constantly monitored to ensure their operational effectiveness.

The recommendations also prescribe combat readiness for accidental spillages at the drill sites, including the provision of containment booms and containment chambers, as well as chemical dispersants on site to combat spillages, though these are standard practice, but woefully inadequate in case of a blowout, as the effects of a blowout cannot be adequately predicted in order to provide adequate combative equipment. Therefore, from all indications, preventive measures or a preventive system is the best method of protecting the environment from the debilitating effects of a spillage in actual drilling activities.

2.14 Legislating Drilling Operations in Ghana

The Maritime Pollution Act, 2016 does not have any specific provisions requiring particular preventive or combative equipment of the drilling companies during actual drilling. They are only required to cooperate with the National Coordinator in preparing the National Contingency Plan for preparedness and contingency. Thus, the law does not place any onus on drilling companies with particular respect to containment booms, containment chambers, chemical dispersants or other such combating equipment. Neither does the law place any onus on drilling companies with regards to testing or effectiveness of safety measures and equipment such as BOP's, or even prescribe actual "safety drills" on site to ensure that all crew concerned know what to do and are able to effectively perform their various roles in the event of a spillage. There is therefore the need to promulgate regulations to give effect to the Act when it receives presidential assent.

The EPA, entrusted with the protection of Ghana's environment against pollution, has in the meantime developed a National Oil Spill Contingency Plan, 2015, which seeks to address some of the gaps which the law does not specifically address with regards to actual drilling operations. The Plan prescribes the role of the EPA as one of "coordination and provision of technical advice on logistics, maintenance, materials and equipment, and training", and requires operators to "develop tactical oil spill contingency plans at their facilities" (EPA, 2016). The Plan specifically identifies risks of marine pollution resulting from "collisions, stranding, **blowouts** and other marine accidents" (EPA, 2016) in Ghana's waters subsequent to commencement of exploitation activities in the oil fields, and the deleterious and "disastrous effects such an incident could have on the ecological as well as socio-economic resources alongside the coastline of Ghana" (EPA, 2016).

The Plan is therefore, in addition to other objectives, to "delineate responsibilities for the preparation and operational response to incidents, which could re result in spillage of oil into the marine, as well as coastal environment (EPA, 2016) of Ghana, and designates the EPA with the "overall responsibility to deal with any incident involving oil installations, oil pipelines or shipping" (EPA, 2016).

The Plan is intended to also “provide a framework for coordination of an integrated response to protect the marine environment from deleterious effects of pollution from spillages of oil substances” (EPA, 2016); and to “promote and ensure the development of local plans to prepare and respond to such incidents in accordance with best practices” (EPA, 2016).

The Oil in Navigable Waters Act, 1964 failed to address the issue of marine pollution due to exploitation activities, thus the Maritime Pollution Act, 2016 seeks to address this anomaly. Ghana does not have any other legislation relating to protection of the marine environment with regards to actual drilling; though the EPA Act 1994 enjoins the EPA to protect the environment of Ghana, it does not specifically address the issue of oil exploitation, and damage to the environment due to such exploitation.

CHAPTER 3

3.0 FINDINGS

3.1 Introduction

This chapter looks at the findings from the administered questionnaires and interviews conducted[1]. The chapter groups the research questions into 5 broad categories as mentioned earlier, and the analysis is made along these categories.

3.2 Existence of Legal Regime in Ghana to Prevent/Combat a Spillage from Exploitation Activities

3.2.1 The International Scene

On the international scene, there is a paucity of Conventions/Protocols that relate particularly to prevention of pollution from exploitation activities, though much has been done with regards to prevention of pollution through transportation. Although an attempt has been made through regional Conventions and Protocols like the Abidjan Convention, these look at prevention of pollution in general, thus pollution from exploitation activities have not been particularly catered for. In a seeming attempt to address this shortfall, guidelines have been developed for the prevention and combat of spillages, from both transportation and exploitation activities. These guidelines, however, do not have the force of legally binding conventions and protocols, and thus fall short of addressing the specific problem of pollution from exploitation activities.

3.2.2 The Ghanaian Situation

Respondents for this question were drawn from the GMA, EPA and the exploitation companies. In order to answer this question, 3 criteria needed to be met for a positive conclusion to be drawn to the question. They are:

[1] Samples of the Questionnaire and Structured Interviews for the respondents are included in the research as Appendices

- ✓ Whether there was a law available or in place
- ✓ Whether there was a designated institution to see to the implementation of the law
- ✓ Whether the law was being implemented.

Responses from the institutions polled are indicated in the tables and graphs below:

Table 1: Existence of a Law to Prevent/Combat an Oil Spill due to Exploitation Activities

QUESTION	ORGANISATION		
	GMA	EPA	Exploitation Companies
Is there a law in Ghana to prevent/combat an oil spill due to exploitation activities?	Yes	Yes	Yes

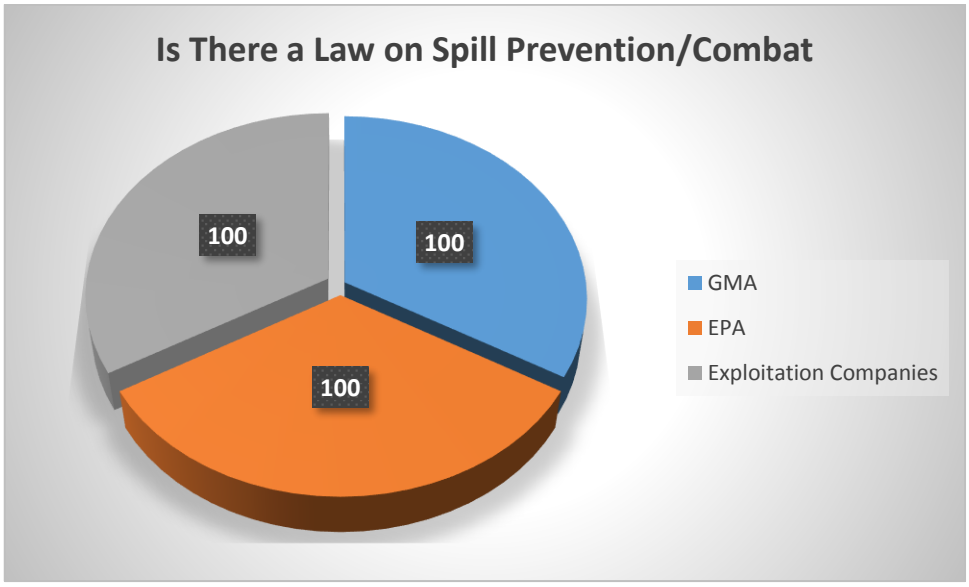


Figure 6: Existence of a Law to Prevent/Combat an Oil Spill due to Exploitation Activities

From the above responses, all the respondents agreed that there is indeed a legal regime to prevent/combat a spill due to exploitation activities.

Table 2: Existence of Designated Institution to Implement the Law

QUESTION	ORGANISATION		
	GMA	EPA	Exploitation Companies
Is there a designated institution in Ghana to implement this law	Yes	Yes	Yes

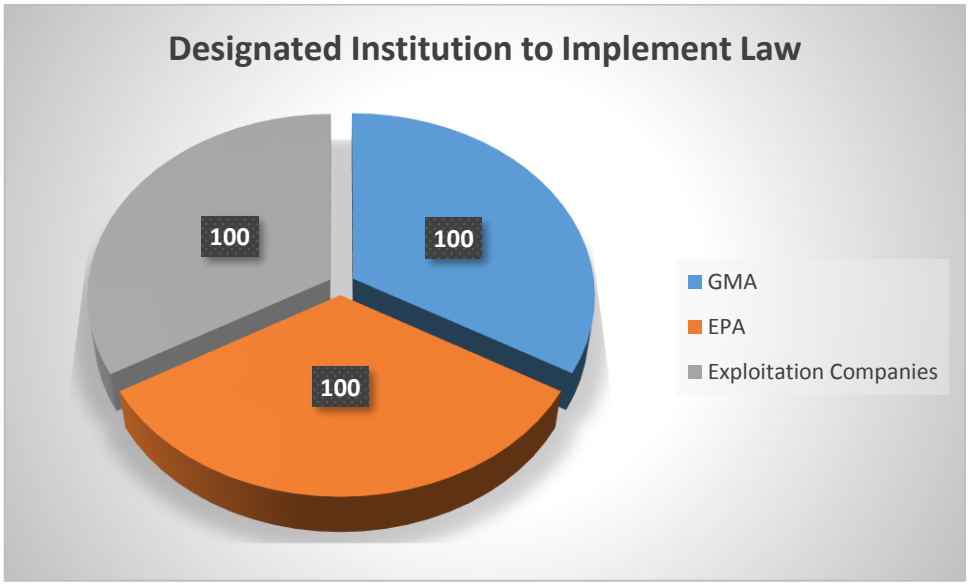


Figure 7: Existence of Designated Institution to Implement the Law

Again, from the responses, all the institutions polled agreed that there was a designated institution to implement the law with regards to prevention and combat of a spillage due to exploitation activities.

Table 3: Is the Law Being Implemented

QUESTION	ORGANISATION		
	GMA	EPA	Exploitation Companies
Is the law being implemented	Yes	Yes	Yes

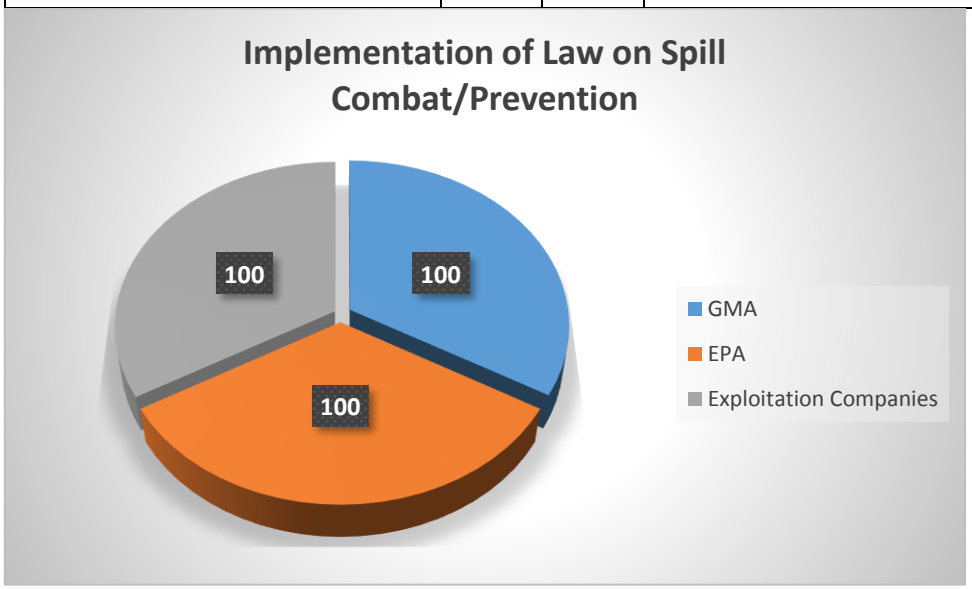


Figure 8: Implementation of the Law

The institutions polled believe that the law on prevention and combat of a spillage due to exploitation activities was being implemented.

From the responses received, the institutions polled believe that Ghana had a legal regime in place to prevent and/or combat a spillage should it occur during exploitation of oil from Ghana's oil fields.

3.3 Existence of Proactive Measures to Prevent and/or Combat a Spillage

To find out whether proactive measures actually existed to prevent and/or combat a spillage should it occur during exploitation activities, the entire population of the selected organisations and institutions were polled. These comprised the GMA, EPA, Exploitation Companies, Ghana Navy, GPHA and the RMU. The RMU was added as they were the premier institution training local content to work in the oil fields, and would have to include in their training proactive measures to prevent and combat a spillage. To answer this question, it was further sub-divided into the following criteria:

- ✓ Whether there were proactive measures in place to prevent/combat a spillage
- ✓ Whether the measures adhered to any laid down procedure
- ✓ Whether the stakeholders were trained in preventing/combating a spillage due to exploitation activities
- ✓ Whether there was a Stipulated Plan to prevent/combat a spillage
- ✓ Whether there was a designated Lead Organisation in prevention/combat of a spillage
- ✓ Which organisation was the Lead Organisation responsible for prevention/combat of a spillage
- ✓ Whether there are available equipment to stakeholder institutions to prevent/combat a spillage
- ✓ Whether there were periodic drills on prevention/combat of a spillage

The responses received from the respondents are indicated in the tables and graphs below:

Table 4: Existence of Proactive Measures to Prevent/Combat a Spillage

QUESTION	ORGANISATION					
	GMA	EPA	NAVY	GPHA	Exploitation Companies	RMU
Are there proactive measures to prevent or combat a spill?	Yes	Yes	Yes	Yes	Yes	Yes

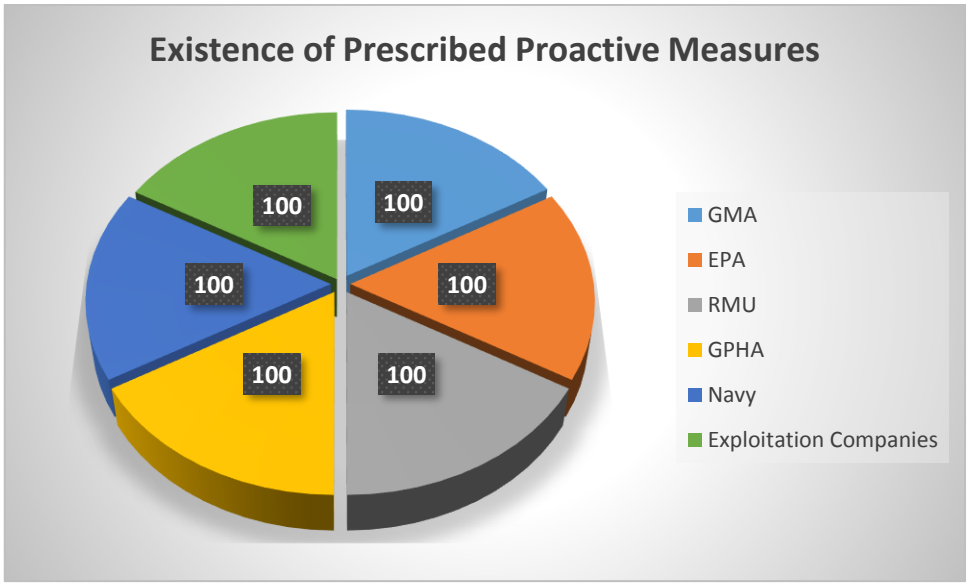


Figure 9: Existence of Proactive Measures

From the responses received on the above question, all the organisations agreed that there were indeed proactive measures to prevent and combat spillages in the oil fields in Ghana.

Table 5: Do Measures Adhere to Laid Down Procedure

QUESTION	ORGANISATION					
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)	RMU (%)
Do the measures adhere to laid down procedure?	30	100	14	20	100	0

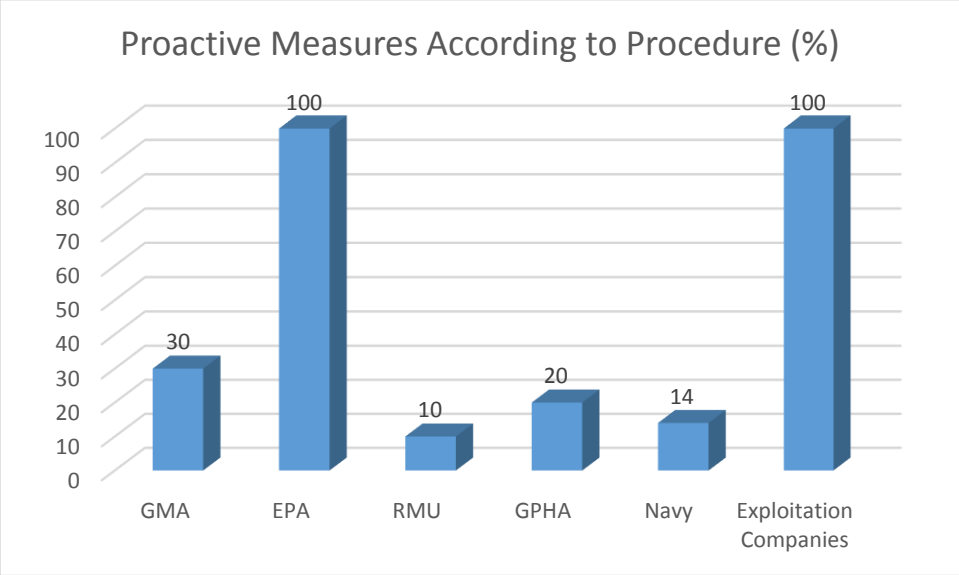


Figure 10: Do Measures Adhere to Laid Down Procedure

From the responses received, only the EPA and Exploitation companies attest to the fact that the measures prescribed to prevent and combat a spillage adhere to laid down procedure. The GMA indicated that the appropriate laid down procedure was yet to be backed by regulation, the Navy indicated that they had little or no knowledge of any laid down procedure, the RMU indicated that they were training students based on internationally recognised standards (OPITO), but not according to any standards set by local laws, the GPHA, as the major supplier to the oil fields, indicated that their procedure was based on industry standards. The Exploitation companies, though agreeing that there was a laid down procedure prescribed for them by the EPA, indicated that they adhered to their own industry standard, which they believed was higher than that set for them by the EPA. Based on the responses, it is difficult to conclude that all the stakeholders are on the same page with regards to measures and procedures for preventing and combating a spillage. If indeed the EPA, which all agree is the implementing agency for the law on protecting the environment has such a procedure, it should be made standard for all the stakeholders, to ensure that they all adhere to the same procedure with regards to prevention and combating of a spill.

Table 6: Are Stakeholders Trained in Preventing/Combating a Spillage

QUESTION	ORGANISATION					
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)	RMU (%)
Are your staff trained in preventing and combating spills?	0	0	57	100	100	100

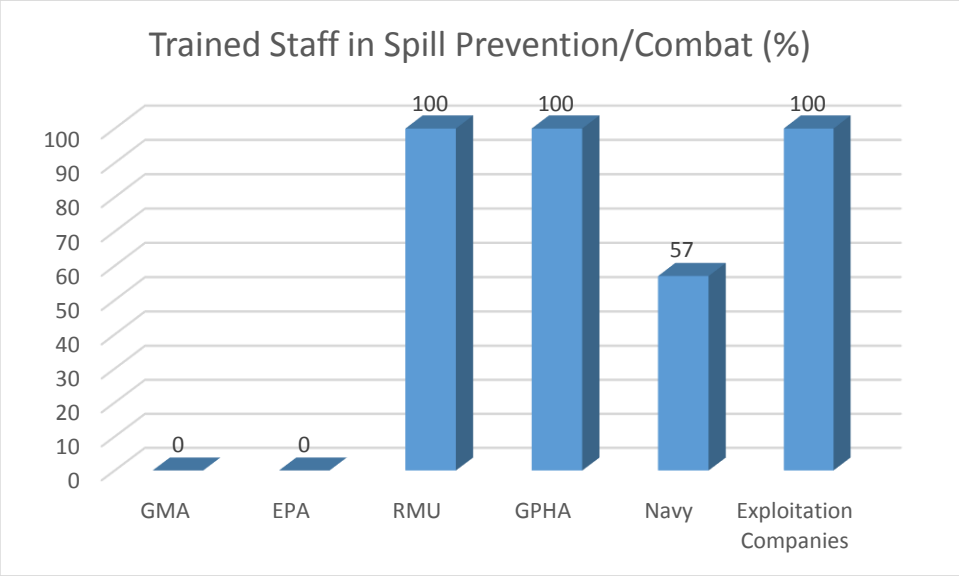


Figure 11: Are Stakeholders Trained in Preventing/Combating a Spillage

Respondents from the EPA and GMA indicated that their staff were not trained to prevent or combat a spill. However, the GPHA agreed that their staff were trained, and 57% of respondents from the Ghana Navy indicated that they were so trained, whilst the RMU indicated that they were training their students as well in the prevention and combat of a spillage. The exploitation companies all maintained that their staff were well trained in preventing and combating spills. It must be noted here that the local residents also indicated that they had no knowledge of prevention or combat of a spillage, and no training or sensitisation had been given them in this regard as well. This indicated that the regulatory agencies, as well as the Navy, which is primarily for security, are not trained in the prevention and combat of a spillage, but rather the exploitation companies and the service providers (GPHA) do have that training, because they deal directly with the exploiting of oil from the oil fields.

Table 7: Existence of a Stipulated Prevention/Combat Plan for a Spill

QUESTION	ORGANISATION					
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)	RMU (%)
Is there a stipulated Plan for preventing or combating a spill?	100	100	42	100	100	100

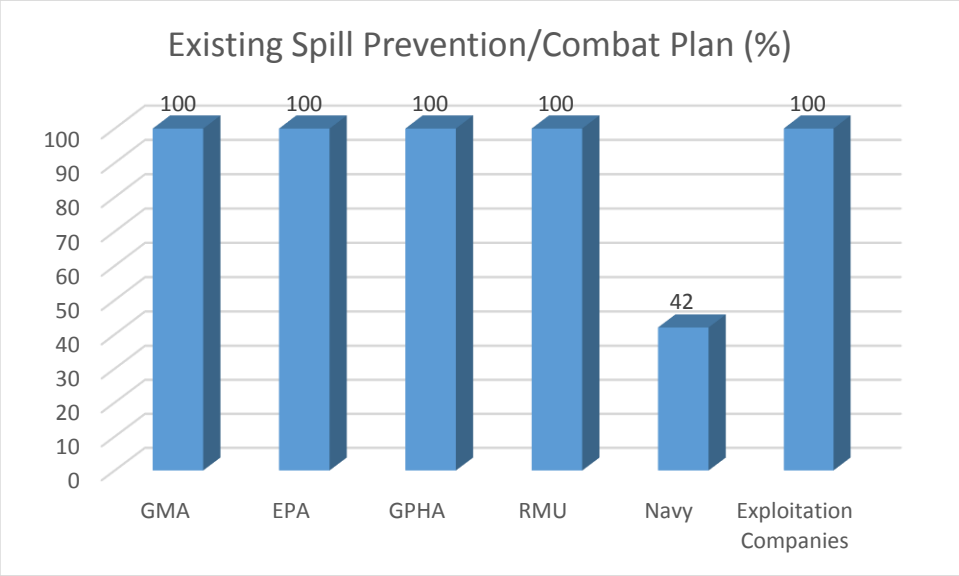


Figure 12: Existence of a Stipulated Prevention/Combat Plan for a Spill

42% of respondents from the Navy indicated that they were aware of an existing Spill Prevention and Control Plan, and the RMU indicated that they were indeed training their students according to a Plan on Oil Spill Prevention and Combat. The other organisations indicated that indeed there was an existing plan to prevent oil spills at the exploitation sites, and to combat one if it should occur. This Plan is the National Contingency Plan for Oil Spill Preparedness and Response, enshrined in the Maritime Pollution Act, 2016, which was to be established by the National Coordinator as part of the duties of that office.

Table 8: Existence of a Designated Lead Organisation in Spill Prevention/Combat

QUESTION	ORGANISATION					
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)	RMU (%)
Is there a designated organisation to lead or coordinate the prevention and combat of a spill?	100	100	100	100	100	100

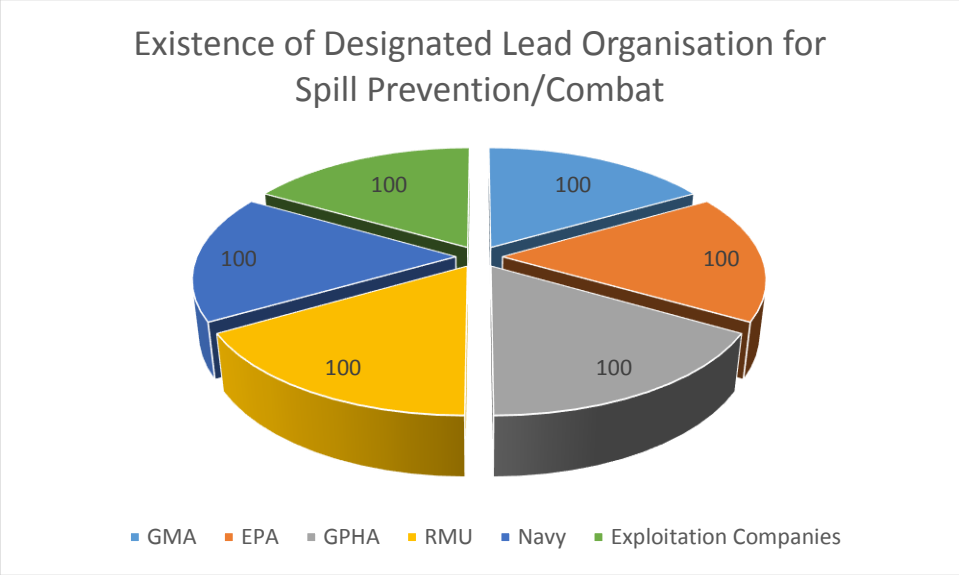


Figure 13: Existence of a Designated Lead Organisation for Spill Prevention and Combat

Responses from all the organisations polled indicated that there was a designated Lead Organisation to coordinate activities for spill prevention and combat. This is also in accordance with the tenets of the National Spill Response Plan.

Table 9: Designated Lead Organisation in Spill Prevention/Combat

QUESTION	ORGANISATION					
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)	RMU (%)
What is the designated lead agency to coordinate the prevention and combat of a spill?	17	17	66	0	0	0

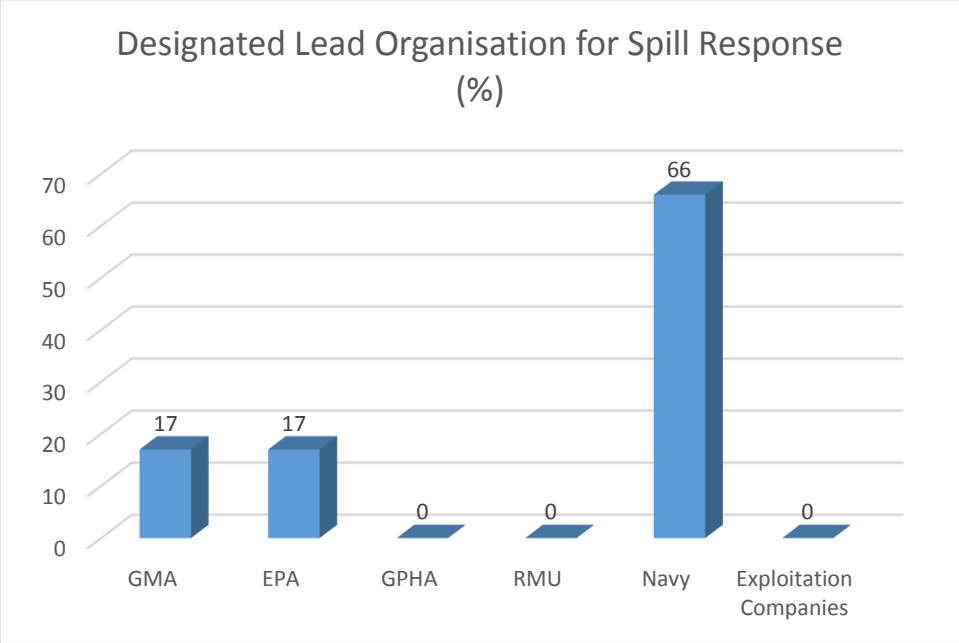


Figure 14: Designated Lead Organisation for Spill Prevention and Combat

17% of respondents indicated that the GMA was the Designated Lead Organisation for spill response, and 17% indicated it was the EPA, whilst 66% indicated it was the Ghana Navy. However, in actual practice at various drills held, the Navy has been the lead organisation and on-scene commander. This clearly indicates a conflict in organisational responsibility, and would not bode well for the country in an actual situation of an oil spill, as the lines of communication and authority are not clear cut, and may thus cause confusion and delays, to the detriment of the environment.

Table 10: Availability of Spill Prevention/Combat Equipment

QUESTION	ORGANISATION				
	GMA (%)	EPA (%)	NAVY (%)	GPHA (%)	Exploitation Companies (%)
Do you have the equipment to prevent or combat a spill?	0	0	0	100	100

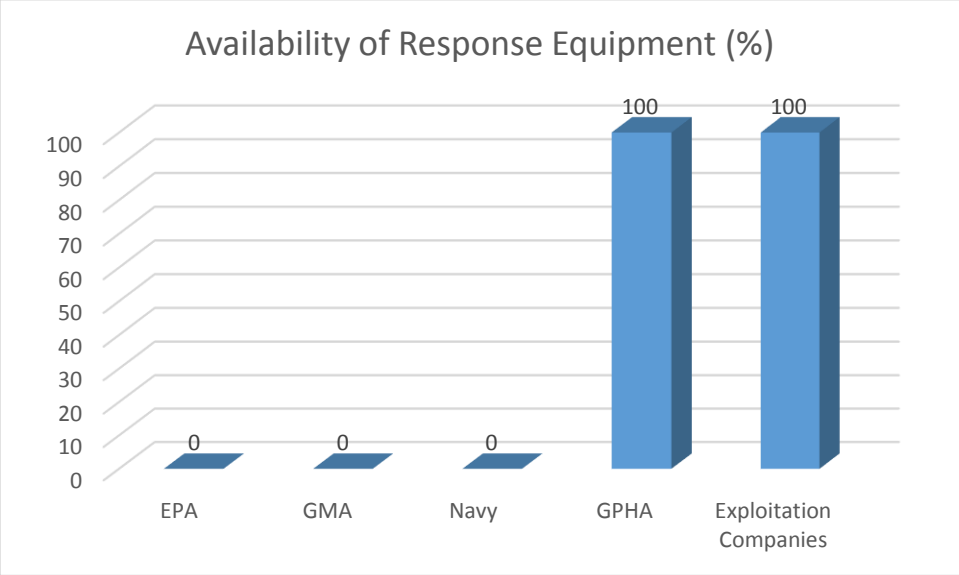


Figure 15: Availability of Spill Prevention/Combat Equipment

The responses indicate that none of the regulatory agencies have any equipment for prevention or combating of a spill. Only the exploitation companies, and the GPHA as a service organisation for the oil industry, have the equipment to prevent and combat a spill should one occur. However, responses from both organisations indicate that they have standard equipment with regards to the industry, including booms, skimmers, isolation chambers and chemical dispersants. The exploitation companies also indicated that they perform monthly checks on their Blow Out Preventers (BOPs) and semi-annual full maintenance checks on them.

Table 11: Organisation of Periodic Drills on Prevention/Combat of a Spill

QUESTION	ORGANISATION				
	GMA	EPA	NAVY	GPHA	Exploitation Companies
Are there periodic drills on prevention and combat of a spill?	Yes	Yes	Yes	Yes	Yes

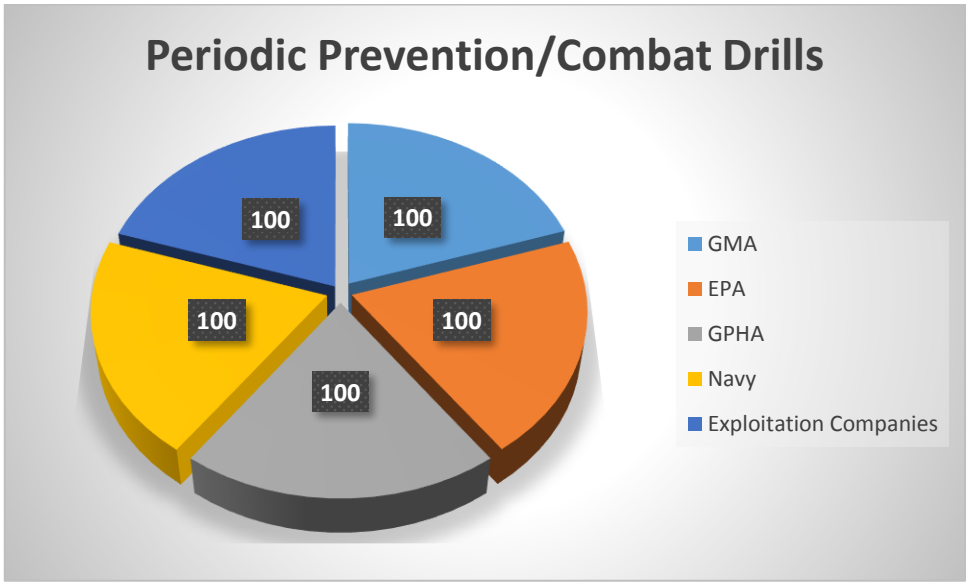


Figure 16: Organisation of Periodic Drills on Prevention/Combat of a Spill

All the organisations polled stated that there was an annual drill on Spill Prevention and Combat, which was coordinated by the Navy, as the on-scene commander. In addition, the exploitation companies stated that they held semi-annual joint drills on their own, as the exploitation companies, in order to be able to prevent, detect and combat a spill to prevent environmental damage.

3.4 Existence of National Provision to Engage International Aid in Spill Combat

To ascertain the veracity or otherwise of this statement, questions were asked of 4 organisations – the GMA, the EPA, the Navy and the Exploitation Companies. To answer this question, it was further sub-divided into the following criteria in the questionnaire:

- ✓ Whether there was national regulation to engage foreign aid in spill combat
- ✓ Whether there was any protocol to engage such foreign aid in spill combat
- ✓ Whether there was any existing contract/protocol with any particular entity for aid in spill combat
- ✓ How long it would take for such foreign aid to be activated

Responses received to these questions are summarised in the tables and graphs below:

Table 12: Existence of national regulation to call in foreign aid in spill combat

QUESTION	ORGANISATION			
Is there national regulation to call for foreign assistance in preventing and/or combating a spill	GMA	EPA	NAVY	Exploitation Companies
	Yes	Yes	Yes	Yes

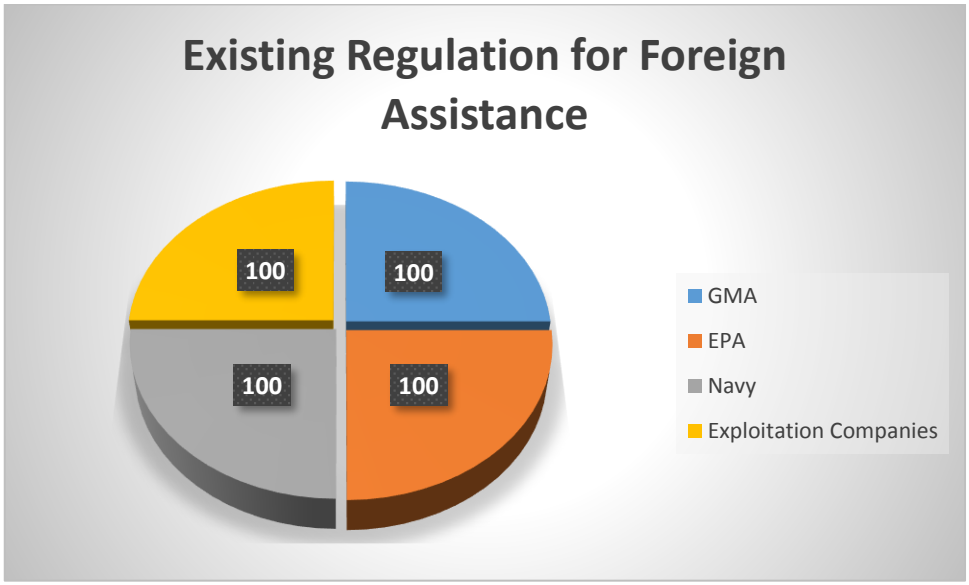


Figure 17: Existence of national regulation to solicit foreign aid in spill combat

All responding organisations indicated that there indeed existed national regulation to solicit foreign assistance in preventing and/or combating a spill.

Table 13: Existence of Protocol to solicit foreign aid in spill combat

QUESTION	ORGANISATION			
Is there any protocol for soliciting foreign assistance in preventing and/or combating a spill	GMA	EPA	NAVY	Exploitation Companies
	Yes	Yes	Yes	Yes

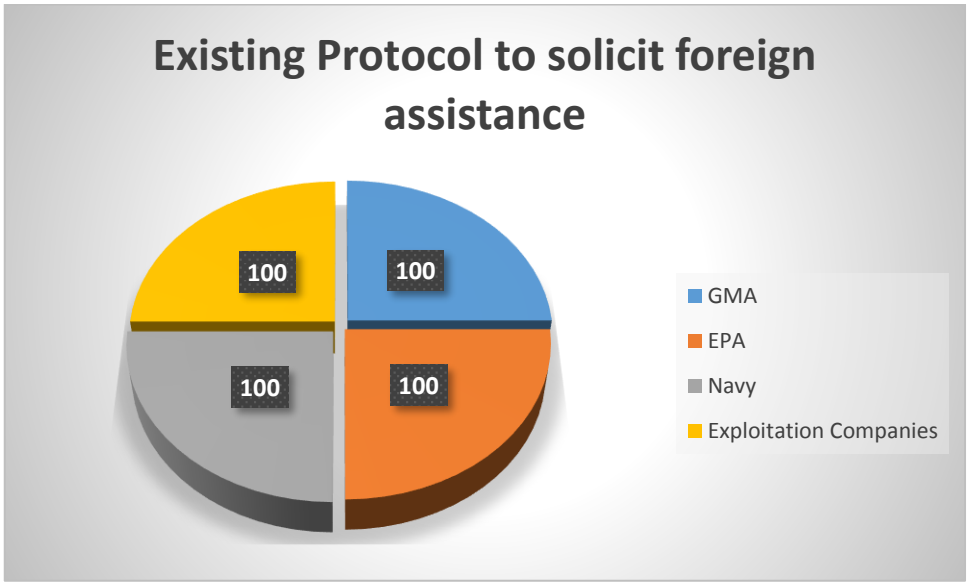


Figure 18: Existence of protocol to solicit foreign aid in spill combat

All responding organisations indicated that there were national protocols to solicit foreign assistance in preventing and/or combating a spill. They explained that Ghana was a signatory to the Abidjan Convention, and also the United Nations Environment Programme, which both sought to protect the marine environment against pollution, and thus the country could call in foreign assistance when needed.

Table 14: Existence of Contract for assistance in spill combat

QUESTION	ORGANISATION			
Is there any existing contract in preventing and/or combating a spill	GMA	EPA	NAVY	Exploitation Companies
	Yes	Yes	Yes	Yes

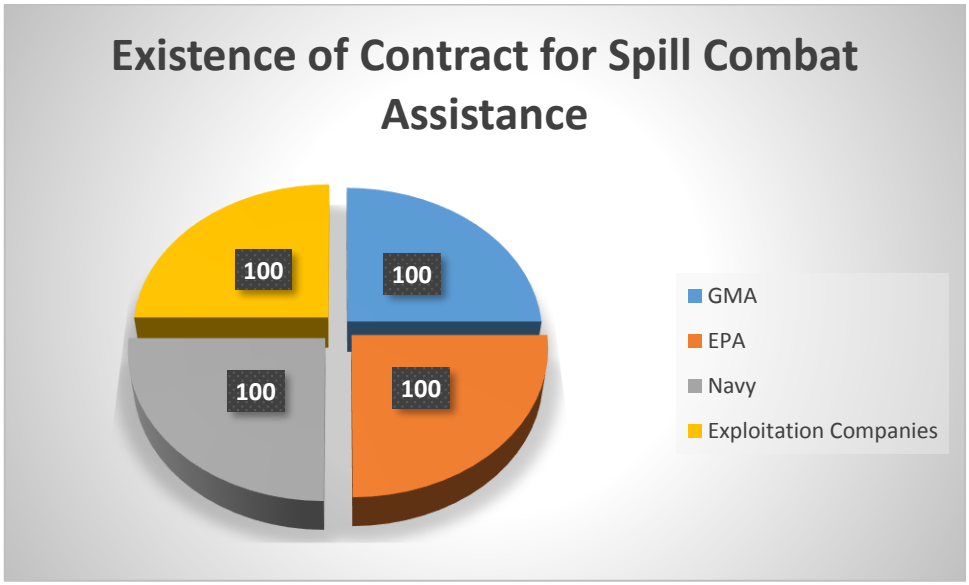


Figure 19: Existence of contract foreign assistance in spill combat

All the respondents polled indicated that there was an existing contract/agreement with Oil Services Response Ltd for the combat of a spillage, should it occur. In addition, the exploitation companies indicated that they variously had agreements with West African Oil Spill Network, and the International Oil Spill Organisation in the UK, for assistance in the event of a spill which was above their capacity to handle.

Table 15: How long would it take for such foreign aid to be activated?

QUESTION	ORGANISATION			
How much time would it take for such foreign aid in combating a spill to be activated?	GMA (Hrs)	EPA (Hrs)	NAVY (Hrs)	Exploitation Companies (Hrs)
	24	24	24	12

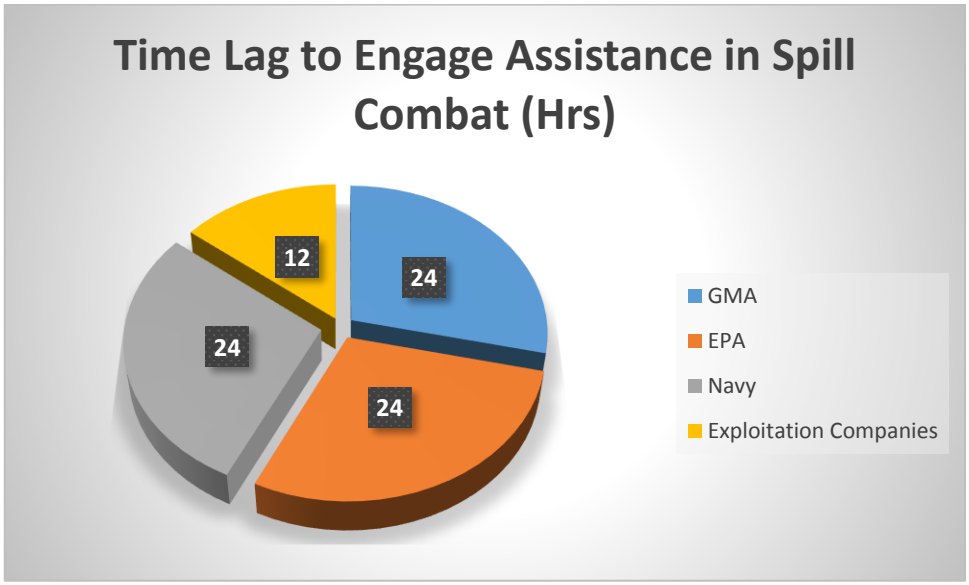


Figure 20: How long it would take to activate foreign assistance in spill combat

Responses from the regulatory agencies showed that it would take 24 hours to engage foreign assistance in combating a spill, whilst the exploitation companies indicated that they would take 12 hours to call in assistance when needed.

3.5 Existence of Compensatory Regime for a Spillage, and Existence of Specific Responsibility/Sanctions for such Regime

Questions on this statement sought to find out whether there was a regulatory regime for compensation in case of an oil spill, and if so, which organisation would see to the implementation of this regime. They also sought to find out whether the law placed specific responsibility on any organisation to effect the compensation, and/or prescribed any sanctions for such organisation should they fail to effect compensation. Respondents were drawn from the GMA and the EPA, as regulatory agencies. The questions were categorised into:

- ✓ Whether there was a regulation to exact compensation for oil pollution damage;
- ✓ Whether there was a designated institution to implement such a regulation;
- ✓ Whether the regulation identified any specific organisation responsible for paying such compensation;
- ✓ Whether any sanctions were prescribed for defaulting organisations.

Responses to these questions were all in the affirmative. The responses indicated that the law designated the GMA as the agency to implement the compensatory regime set out by law, and the regulations spelt out clearly a “polluter pays” policy, i.e., that the company identified as being responsible for the pollution would be held responsible for paying any compensation determined by the law. Again, the GMA could exact administrative sanctions on any organisation identified which failed to effect the compensation, which sanctions included preventing such companies from operating until all compensation issues had been resolved, or even revoking their operating licence.

3.6 Incorporation of Local Conditions and Population in Spill Prevention, Combat and Compensation Regime

This question sought to find out whether local conditions, including currents, tides and flow patterns had been factored into any prevention and combat preparations established in the oil fields. Responses from the regulatory agencies, the Navy and the exploitation companies indicated that indeed, this was standard practice, and the RMU also indicated that they included this in their training of local content, as it was standard procedure to factor in local conditions in the prevention and combat of a spillage.

However, all the respondents indicated that the local population had not been involved in any preventive or combat measures, and indeed they were prevented from engaging in any activities in or near the oil fields, as their activities might be potential hazards and cause pollution incidents.

CHAPTER 4

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

SDG 14 of the United Nations Sustainable Development Goals (SDG's) adopted in September 2015 is on "Life Below Water" and aims at laying the foundation for the integrated and sustainable management of the oceans (Cornier & Elliot, 2017), in order to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (Kates, Parris and Leiserowitz, 2016). Crude oil is a big pollutant, especially of the marine environment, and it is not surprising therefore that the IMO has placed emphasis on protection of the marine environment from pollution by crude oil. However, this emphasis has mainly been on the transportation of the crude, and there is little or no international regulation regarding the exploitation of the crude, and the pollution it can cause.

Ghana, as a relatively new entrant on the crude oil exploitation scene, is thus constrained in implementing laws which would protect its marine environment with specific regard to exploitation activities, as this has over the years in other jurisdictions, mainly been left to local legislation to regulate, and more often than not, has been regulated through learning from rather avoidable experiences. It is in this light that Ghana in 2016 passed the Maritime Pollution Act, 2016, which seeks to regulate somewhat exploitation of Ghana's marine resources with specific regard to pollution of the marine environment. In an attempt to reduce marine pollution to the barest minimum, the Marine Pollution Act, 2016 establishes the National Coordinator and a National Contingency Plan to combat a spill at the earliest possible time, but implementation of this Plan has come with its own problems.

Though Ghana had the Oil in Navigable Waters Act, 1964, this was obviously not adequate in the wake of oil discovery, and some review/amendments of this Act is found in the Marine Pollution Act, 2016. Ghana, however, has to pass an act

specifically regulating the exploitation of its marine resources, such as has been done in Nigeria with the NESREA Act, which effectively consolidated all the laws relating to the protection of the environment, especially with regards to exploitation of oil. This thus puts forward a compelling argument for a review of the EPA Act, 1994, which can consolidate the environmental laws without having to go through the process of passing a whole new law on the environment.

With the promulgation of the Maritime Pollution Act, 2016, implementation should be vested in the ambit of one institution, as the Act itself establishes the office of the National Coordinator. In the absence of clear and concise lines of authority and responsibility, it has fallen to the Ghana Navy to coordinate activities with regards to spill combating. This has the tendency of creating a lethargic attitude amongst the other regulatory agencies, as they may feel that their authority is being usurped. Again, these institutions are not resourced in spill combating, and the Navy is also under-resourced, such that they have to fall on the oil exploitation companies to provide said resources to combat a spill. This is not in the best interest of the country, as the companies are profit oriented, and would only provide the barest equipment required to comply with the law which granted them the licence to exploit the marine resources.

Ghana has some bilateral agreements on spill combat, including agreement with the Oil Spill Response Ltd (OSRL) and the United Nations Environment Programme (UNEP), and is also signatory to the Abidjan Convention, so can safely rely on international aid to combat a spill, but again, the time lapse before such aid can be called in is wide enough for any accidental spill to get out of control. Another issue of concern is the “polluter pays” principle on issues of compensation for oil pollution damage, as it might take some time for such polluter to mobilise resources to effect the compensation, which might not be good for the country, especially where international assistance in combating a spill is involved.

Finally, it is important to point out that though an attempt has been made to regulate the oil extraction industry with regards to pollution of the marine environment, Ghana is not well placed to combat a spill of enormous proportions such as one caused by a

blowout, and such a spill can cause grave environmental damage before it can be brought under control, if the current regime is left as it is.

4.2 Recommendations

In order to place Ghana on good footing with regards to prevention and combat of a spillage due to exploitation activities, the following recommendations are proffered:

- ✓ Review/Amend the EPA Act, 1994 to consolidate all environmental protection laws, taking into particular consideration the advent of commercial production of oil.
- ✓ Review the compensation regime currently in place to have a permanent fund to cater for compensation in cases of oil pollution damage.
- ✓ Clearly define lines of authority and responsibility for the organisation responsible for coordinating and leading any spill response, as enshrined in the National Contingency Plan, and circulate same to all stakeholder institutions, in order to have unity of command and responsibility in the event of a spill.
- ✓ Train, resource and equip the EPA to have permanent representatives at the exploitation sites, to also conduct independent monitoring of activities, and to have a first-hand report of any spills or potential hazards to the marine environment.
- ✓ Sensitise the local communities around the exploitation sites on the dangers of their fishing activities at the drill sites, in order to get their cooperation on the restriction of those areas, so as to free the Navy from the daily responsibility of keeping the fishermen away.

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APPENDICES

APPENDIX 1

QUESTIONNAIRE/STRUCTURED INTERVIEW FOR THE GHANA MARITIME AUTHORITY

1. Ghana's Parliament has passed the Maritime Pollution Bill in 2016, but it has not yet received Presidential Assent. Does the Ghana Maritime Authority (GMA) have the mandate of executing the tenets of this Bill once it receives Presidential Assent? Yes/No
2. If YES to (1) above, does the mandate include prevention and combating of oil pollution in Ghana's oil fields? Yes/No
3. Apart from the GMA, which other organisations have the mandate of ensuring prevention and combat of oil spills at the oil fields?
4. Does the GMA have any collaboration with these organisations with regards to preventing and combating an oil spill at the oil fields? Yes/No
5. Which organisation would play the lead role in the prevention of an oil spill at the oil fields?
6. Which organization would play the lead role in the combat of an oil spill at the oil fields, should one occur?
7. Does the GMA play any regulatory role regarding the operators at the oil fields? Yes/No
8. If YES to (7) above, what role?
9. Can the GMA enforce preventive measures towards an oil spill with regards to the operators at the oil fields? Yes/No
10. If YES to (9) above, in what way?
11. Can the GMA enforce combative measures in the event of an oil spill at the oil fields? Yes/No
12. If YES to (11) above, in what way?
13. Is the GMA required to have on-site inspectors at the oil fields towards the prevention of an oil spill? Yes/No
14. If YES to (13) above, does the GMA have these inspectors on site? Yes/No
15. Does the GMA have any standby equipment to prevent/combat an oil spill at the oil fields? Yes/No
16. If YES to (15) above, to what level are these equipment adequate (as described by the Maritime Pollution Bill)?
    Level 1 ☐ Level 2 ☐ Level 3 ☐
17. Does the GMA have the mandate to prescribe which preventive/combative measures need to be put in place by the operators in the oil fields? Yes/No
18. Can the GMA call in foreign aid to help combat an oil spill should it occur at the oil fields? Yes/No
19. If YES to (18) above, who will be responsible for compensating such foreign aid called in to help combat a spillage should one occur?
20. Can the GMA sanction operating companies in the oil fields in the event of an oil spillage? Yes/No
21. Is the GMA involved in educating the local population near the oil fields on oil pollution prevention? Yes/No

22. If YES to (21) above, has any education taken place on pollution prevention since the commencement of commercial exploitation at the oil fields? Yes/No
23. Is the GMA involved in educating the local population near the oil fields on oil pollution combating? Yes/No
24. If YES to (23) above, has any education taken place on combating of oil pollution amongst the local population since the commencement of commercial drilling? Yes/No
25. Would the GMA be involved in the calculation of any compensation to be paid in the event of a spillage at the oil fields? Yes/No
26. If YES to (25) above, does the GMA have the mandate to enforce any such awards according to law? Yes/No
27. The Maritime Pollution Bill stipulates the establishment of a National Coordinator to "Prepare a National Contingency Plan for preparedness and response" in case of an oil spill. Has this National Coordinator been established? Yes/No
28. If YES to (27) above, has a National Contingency Plan been prepared, as stipulated by the Bill? Yes/No
29. If NO to (27) above, how soon is the National Coordinator expected to be set up?
30. If NO to (28) above, how soon is the National Contingency Plan expected to be set up?
31. Is there any other information you can give regarding the GMA's involvement in the prevention and combat of an oil spill at Ghana's oil fields?

APPENDIX 2

QUESTIONNAIRE/STRUCTURED INTERVIEW FOR THE ENVIRONMENTAL PROTECTION AGENCY

1. The Environmental Protection Agency (EPA) Act, Act 490, was passed in 1994. Has the EPA considered any revisions/amendments to the Act? Yes/No
2. If YES to (1) above, have any revisions/amendments been presented to Parliament, especially in the wake of commencement of commercial exploitation of oil and gas in Ghana? Yes/No
3. Has the EPA proposed any revisions/amendments to the Oil in Navigable Waters Act, Act 235 of 1964, especially in the wake of commercial exploitation of oil and gas in Ghana? Yes/No
4. If YES to (3) above, have these revisions/amendments been presented to Parliament? Yes/No
5. If NO to (3) above, is the EPA considering proposing any revisions/amendments to the Oil in Navigable Waters Act, Act 235 of 1964? Yes/No
6. Has the EPA set any standards to be complied with by the exploitation companies in the wake of oil and gas discovery in Ghanaian waters? Yes/No
7. If YES to (6) above, are these standards spelt out in the Environmental Impact Assessment of the operators in Ghana's oil fields? Yes/No
8. If YES to (6) above, does the EPA have the logistics to monitor adherence to these set standards? Yes/No
9. If YES to (6) above, does the EPA have the personnel to monitor adherence to these set standards? Yes/No
10. If YES to (6) above, are there any prescribed measures to be undertaken in the event of non-compliance with these set standards? Yes/No
11. If YES to (6) above, does the EPA have the mandate to prevent the exploitation companies from operating, in case they do not comply with these set standards? Yes/No
12. Does the EPA have any prescribed pollution prevention measures in place to be complied with by the exploitation companies in Ghana's oil fields? Yes/No
13. If YES to (12) above, does the EPA have the mandate to halt the exploitation activities of these companies in the event of non-compliance with these measures? Yes/No
14. Can the EPA demand immediate curtailing of exploitation activities on the discovery of an environmental threat due to pollution from the exploitation activities? Yes/No
15. Does the EPA have the mandate to request combating of a spillage at the oil fields from the exploitation companies in case of such a spill? Yes/No
16. Does the EPA have the mandate to prescribe specific pollution combat measures/equipment for the exploitation companies? Yes/No
17. Is the EPA directly involved in environmental pollution prevention at the oil fields, e.g., in operational procedures? Yes/No
18. Is the EPA directly involved in combating a spill to prevent environmental pollution should it occur at the oil fields? Yes/No
19. Does the EPA have the requisite equipment and technical know-how in combating an oil spill at the oil fields, should one occur? Yes/No

20. Is the EPA involved in securing foreign aid to help combat an environmental disaster, should a spillage occur at the oil fields? Yes/No
21. If YES to (20) above, in what way?
22. Is the EPA directly involved in any compensatory regime in the event of an oil spill at the oil fields, should one occur? Yes/No
23. If YES to (22) above, in what way?
24. Is the EPA directly involved in any other way with regards to prevention and combating of a spillage at the oil fields? Yes/No
25. If YES to (24) above, in what way?

APPENDIX 3

QUESTIONNAIRE FOR THE GHANA NAVY

1. Is the Ghana Navy directly involved in the provision of security at the oil fields offshore Ghana? Yes/No
2. Is the Ghana Navy well equipped in the provision of security at the oil fields offshore Ghana? Yes/No
3. Is the Ghana Navy directly involved in the provision of preventive measures in case of an oil spill at the oil fields? Yes/No
4. If YES to question (3) above, in what way?
5. If YES to question (3) above, is the Ghana Navy well equipped for the prevention of an oil spill at the oil fields? Yes/No
6. If YES to question (5) above, are the equipment specific to local conditions with regards to preventing an oil spill? Yes/No
7. Is the Ghana Navy technically prepared in the prevention of an oil spill at the oil fields? Yes/No
8. Are personnel of the Ghana Navy permanently stationed at the oil fields in the provision of security? Yes/No
9. If YES to question (8) above, are the personnel of the Ghana Navy trained in the prevention of oil spills? Yes/No
10. Does the Ghana Navy have any laid down procedure incorporated into standard operations at the oil fields with respect to prevention of an oil spill? Yes/No
11. Does the Ghana Navy have the legal mandate to stop production activities in case of a spillage at the oil fields? Yes/No
12. Is the Ghana Navy directly involved in the combat of an oil spill at the oil fields, should it occur? Yes/No
13. If YES to question (12) above, in what way?
14. Is the Ghana Navy well trained in combating oil spills? Yes/No
15. Does the Ghana Navy have the resources to help combat an oil spill should it occur at the oil fields? Yes/No
16. Can the Ghana Navy call on other security services to help combat an oil spill should it occur at the oil fields? Yes/No
17. Can the Ghana Navy call on other nations in the sub-region to help combat a spillage, should it occur in the oil fields? Yes/No
18. If YES to question (17) above, are there any protocols to this effect? Yes/No
19. If YES to question (17) above, how much time may elapse before a response is received? 12 hrs. ☐ 24 hrs. ☐ 48 hrs ☐ 72 hrs ☐
20. Is there any other information you may give regarding the Ghana Navy's involvement in prevention and combat of an oil spill at the oil fields?

APPENDIX 4

QUESTIONNAIRE FOR THE GHANA PORTS & HARBOURS AUTHORITY

1. Is the Ghana Ports & Harbours Authority (GPHA) a premier provider of services to companies directly involved in exploitation activities in Ghana's oil fields? Yes/No
2. Has the GPHA factored into its operations the real possibility of an oil spill in Ghana's oil fields? Yes/No
3. Is the GPHA directly involved in prevention of an oil spill in Ghana's waters? Yes/No
4. If YES to (3) above, in what capacity?
5. Does the GPHA have the technical and logistic capacity to help combat an oil spill should one occur in Ghana's oil fields? Yes/No
6. Is the GPHA involved in drills towards the combat of an oil spill in Ghana's oil fields? Yes/No
7. Does the GPHA have an Oil Spill Contingency Plan as spelt out in the Contingency Planning Manual on Oil Pollution adopted by the International Maritime Organisation? Yes/No
8. Are there any specific materials prescribed for mitigating or containing an oil spill during drilling operations? Yes/No
9. If YES to (8) above, is the GPHA involved in the procurement and provision of these materials? Yes/No
10. Does the GPHA have the technical capacity to prevent and/or combat an oil spill should one occur in Ghana's oil fields? Yes/No
11. In which other way is the GPHA involved in the prevention and combat of an oil spill in Ghana's oil fields?

APPENDIX 5

QUESTIONNAIRE FOR THE REGIONAL MARITIME UNIVERSITY

1. The Regional Maritime University (RMU) is the premier training institution for training local content for Ghana's offshore industry. Is Basic Offshore Safety Induction and Emergency Training (BOSIET) / Tropical Basic Offshore Safety Induction and Emergency Training (TBOSIET) part of the standard training offered to students? Yes/No
2. If YES to (1) above, is BOSIET/TBOSIET training offered to all students for the offshore industry or to only those specifically involved in drilling activities?
3. If YES to (1) above, is the BOSIET/TBOSIET training available for personnel already working in the offshore industry? Yes/No
4. If YES to (1) above, does the BOSIET/TBOSIET training standards conform to those set by the Offshore Petroleum Industry Training Organisation (OPITO)? Yes/No
5. If NO to (4) above, to which international standards does the RMU's BOSIET/TBOSIET training conform?
6. Does the RMU offer re-validation courses for BOSIET/TBOSIET Certificates? Yes/No
7. If YES to (6) above, after how many years from the issuance of the last BOSIET/TBOSIET are trainees required to re-validate their Certificates?
8. Does the RMU offer Further Offshore Emergency Training (FOET) / Tropical Further Offshore Emergency Training (TFOET) training for personnel working in Ghana's offshore industry? Yes/No
9. If YES to (8) above, does the FOET/TFOET standards offered by the RMU conform to OPITO set standards? Yes/No
10. If NO to (9) above, to which international standards do the RMU's FOET/TFOET training conform?
11. Does the offshore emergency training courses offered by the RMU include prevention of spillages of oil at the oil fields? Yes/No
12. Does the offshore emergency training courses offered by the RMU include combat of spillages of oil at the oil fields? Yes/No
13. Does the RMU's training require trainees to have a Minimum Industry Standard Training (MIST) Certificate? Yes/No
14. Does the RMU offer MIST courses for trainees? Yes/No
15. If YES to (14) above, does the RMU's MIST course conform to OPITO set standards? Yes/No
16. If NO to (15) above, to which standards does the RMU's MIST courses conform?
17. If YES to (14) above, does the RMU's MIST course conform to local conditions? Yes/No
18. Does the RMU offer any other internationally recognized courses for offshore training geared towards prevention and combat of an oil spill? Yes/No
19. If YES to (18) above, which courses are these?
20. Is there any further information you can give us regarding training of personnel for the offshore industry towards prevention and combat of oil spills in Ghana's offshore industry?

APPENDIX 6

QUESTIONNAIRE/STRUCTURED INTERVIEW FOR THE OIL FIELD OPERATORS

Name of Company: ……

1. International Conventions prescribe the protection of the marine environment by all users of the maritime domain. As a potential contributor to degradation of the marine environment in Ghana's oil fields, is your company well placed with regards to protection of the marine environment due to pollution emanating from your activities? Yes/No
2. Has your company considered the possibility of a spillage during your operations, e.g., a blowout? Yes/No
3. Do you have active measures in place to prevent pollution of the marine environment due to your activities? Yes/No
4. If YES to (3) above, which measures do you have in place?
5. If YES to (3) above, were these measures prescribed by law or they are your normal operating procedures?
6. Do you have Blow Out Preventers (BOPs) on **all** your well heads to prevent potential damage to the marine environment? Yes/No
7. If YES to (6) above, how often are the BOPs checked for possible malfunction?
8. Do you have active measures in place to combat a spillage should one occur due to your operations? Yes/No
9. If YES to (8) above, which measures do you have in place?
10. Do you have booms on site to contain a spillage should one occur due to your operations? Yes/No
11. If YES to (10) above, how wide an area can your booms cover?
12. Do you have a containment chamber(s) on site to help contain an oil spillage should one occur due to your operations? Yes/No
13. If YES to (12) above, how much oil/pollutant can the chamber(s) contain?
14. Do you have dispersants on site to help mitigate the effects of an oil spill should one occur due to your operations? Yes/No
15. If YES to (14) above, how often are they checked/changed?
16. Do you have any other oil spill combating materials on site to mitigate the effects of a spill during your operations, should one occur? Yes/No
17. If YES to (16) above, what are they?
18. Does your company regularly perform oil spill emergency drills? Yes/No
19. If YES to (18) above, how often?
20. Does your company have an Oil Spill Contingency Plan/Procedure as set out by the Manual on Oil Spill Contingency Planning of the International Maritime Organisation (IMO)? Yes/No
21. If YES to (20) above, are your staff well versed in the Plan?
22. Does your company have any relationship with international organisations to be able to call for help in combating a spillage should one occur due to your operations? Yes/No
23. If YES to (22) above, which organisations are these?
24. If YES to (22) above, how soon can your company expect a response from these organisations:
    12 hours ☐ 24 hours ☐ 36 hours ☐ 48 hours ☐ 72 hours ☐

25. Does your company collaborate with other operators in the oil fields towards oil spill preparedness and combat? Yes/No
26. Does your company have joint oil spill emergency drills with other operators in the oil fields? Yes/No
27. If YES to (26) above, how often?
28. Has your company identified any natural collection sites to use in case of a spillage due to your operations? Yes/No
29. Does your company have a log of currents and flow patterns in the oil fields where you operate? Yes/No
30. Does your company have a log of estimated currents and deflection angles in the oil fields where you operate? Yes/No
31. Has your company identified any tidal considerations to be factored into your operations in the event of an oil spill due to your operations? Yes/No
32. Is your company well placed to use double barrier technique in the event of an oil spill due to your operations? Yes/No
33. Is your company well placed to use deflection booming in the event of an oil spill due to your operations? Yes/No
34. Does your company have stand-by boats for debris collection, boom deployment? Yes/No
35. Does your company have shore sealing booms, in case of an oil spill due to your operations? Yes/No
36. Does your company have a pre-spill Plan as part of your Standard Operating Procedures? Yes/No
37. If YES to (36) above, is this pre-spill Plan integrated into your Oil Spill Contingency Plan? Yes/No
38. Does your company have any funding mechanism set aside to respond to an oil spill, should one happen due to your operations? Yes/No
39. Does your company engage your staff in periodic pre-spill training and simulation, e.g., BOSIET? Yes/No
40. Has your company identified any high risk areas in your field of operations? Yes/No
41. Does your company have the ability to assess any environmental damage that may happen due to your operations? Yes/No
42. Does your company have the ability for restoration after decommission of your wells? Yes/No
43. Is your company able to effect compensation for any environmental damage due to an oil spill as a result of your operations?
44. What other preparations has your company made towards the prevention/combat of an oil spill should one occur due to your operations?

APPENDIX 7

STRUCTURED INTERVIEW FOR THE LOCAL POPULATION

1. Are you aware of the on-going drilling activities in the waters off your coast? Yes/No
2. If YES to (1) above, how did you get to know?
   - I heard it on the news
   - I saw them when I went fishing
   - I was told by the drilling companies
   - I was told by a Government representative (Assembly member, DCE)
   - Other (Please specify)
3. Has the drilling activities off your coast in any way affected your daily life? Yes/No
4. If YES to (3) above, in what way?
   - It has limited our fishing grounds
   - It makes us go further to get any catch
   - We are not allowed to fish in the area
   - We are not allowed to use outboard motors in the area
   - Other (Please specify)
5. Has any compensation been paid to your community for the disruption of your livelihood? Yes/No
6. If YES to (5) above, by whom?
   - By the drilling companies
   - By a local Government representative (Assembly member, DCE)
   - By Government employees from Accra
   - By the Ghana Ports & Harbours Authority (GPHA)
   - Other (Please specify)
7. Has any sensitization been conducted in your community on what to do to prevent accidents at the oil fields? Yes/No
8. If YES to (7) above, by whom?
   - By the drilling companies
   - By a local Government representative (Assembly member, DCE)
   - By Government employees from Accra
   - By the Ghana Ports & Harbours Authority (GPHA)
   - Other (Please specify)
9. Does regular sensitization on how to prevent an accident at the oil fields take place in your community? Yes/No
10. If YES to (9) above, how regularly?
    - Once a year
    - Twice in a year
    - Three times in a year
    - Once every quarter
    - Other (Please specify)
11. If YES to (9) above, by whom?
    - By the drilling companies
    - By a local Government representative (Assembly member, DCE)
    - By Government employees from Accra
    - By the Ghana Ports & Harbours Authority (GPHA)
    - Other (Please specify)

12. Has any sensitization been conducted in your community on how to combat a spillage should one occur? Yes/No
13. If YES to (12) above, by whom?
    - By the drilling companies
    - By a local Government representative (Assembly member, DCE)
    - By Government employees from Accra
    - By the Ghana Ports & Harbours Authority (GPHA)
    - Other (Please specify)
14. If NO to (12) above, are you aware of how to combat a spillage of oil should one occur at the oil fields? Yes/No
15. If YES to (14) above, how did you know?
    - Folklore passed down from generation to generation
    - Past experience
    - Cultural practices of our area
    - Other (Please specify)
16. Does regular sensitization on how to combat a spillage should one occur in the oil fields take place in your community? Yes/No
17. If YES to (16) above, by whom?
    - By the drilling companies
    - By a local Government representative (Assembly member, DCE)
    - By Government employees from Accra
    - By the Ghana Ports & Harbours Authority (GPHA)
    - Other (Please specify)
18. Has any spillage occurred in your community since the commencement of drilling activities? Yes/No
19. If YES to (18) above, was it combated? Yes/No
20. If YES to (19) above, by whom?
    - By the drilling companies
    - By Government employees from Accra
    - By the Ghana Ports & Harbours Authority (GPHA)
    - By ourselves (local community)
    - Other (Please specify)
21. If YES to 18 above, was any compensation paid to your community for the spillage? Yes/No
22. Do you feel capable enough to help combat a spillage should one occur at the oil fields? Yes/No
23. Is there any other information you can give us with regards to combating an oil spill at the oil fields?