2014

From exploration drilling to decommissioning : where does responsibility lie for regulating and monitoring offshore oil platforms in Liberian waters?

Daniel Tarr
World Maritime University

World Maritime University

Malmö, Sweden

From Exploration Drilling to Decommissioning: Where Does Responsibility Lie For Regulating and Monitoring Offshore Oil Platforms in Liberian Waters?

By:

DANIEL TARR

Liberia

A dissertation submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

Master of Science in Maritime Affairs

(Marine Environmental and Ocean Management)

2014

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: 7/22/2014

Supervised by: Professor Olof Linden
World Maritime University

Assessor: Prof. Yoshinobu Takei
World Maritime University

Co-assessor: Prof Graham Shimmield
Bigelow Laboratory for Ocean Sciences

Acknowledgement

Gauging the lapses of a particular offshore regulatory regime is founded in international legal framework, innovative technology and conceptual framework. These in turn are given force through domestication. Hence we stand not so much on the shoulders of a few giants as on a multitude of capable individuals who have managed to view policy assessment from a new dimension. The basic concepts have not changed; the way we view and add meaning to them in terms of present-day reality has.

This dissertation could not have come to fruition without the numerous texts and articles that preceded it. Thus I would like to register my indebtedness to various authors of the books, manuals and journals from which materials have been gathered. I would also like to thank the personnel of the Liberia Maritime Authority, National Oil Company of Liberia and the Environmental Protection Agency who helped me with key data and issues. Most especially I would like to register my appreciation to Messrs Emmanuel Mezoh Dolakeh and Morris Gontor respective of the LiMA and EPA.

I am utmost grateful to the Federal Ministry of Economic Cooperation and Development (BIZ) of the Federal Republic of Germany and the German Development Cooperation (GIZ) for funding my studies. My thanks go to the Commissioner/CEO of the Liberia Maritime Authority Mr. Binyah C. Kesselly for nominating me for the award. Many thanks go to the Liberia Maritime Authority for its continuous assistance during the course of my studies.

To all my professors and lecturers especially Prof. Larry Hildebrand and Lisa Froholdt that provided me with materials and guidance, I remain grateful. The active support and patience of my supervisor, Prof. Olof Linden was an extremely positive influence for which I express my gratitude.

I am as well deeply grateful for effort of the staff of WMU library most especially Mr. Chris Hoebeke, Miss Anna Volkova.

To my beloved parents and family members I extend my thanks for their prayers, support and encouragement throughout my sojourn at WMU.

To my wife Deborah and children, Saydah, Wodokueh, Pinkahn and Blessing, many thanks for their love, support, and patience during my absence from home.

ABSTRACT

Title of Dissertation:

From Exploration Drilling to Decommissioning: Where Does Responsibility Lie For Regulating and Monitoring Offshore Oil Platforms in Liberian Waters?

Degree: MSc.

Invariably, environmental consciousness is now at the fore front of most concession agreements. Within the offshore oil sector low-frequency oil spills, let alone catastrophic voluminous spills such as the Deepwater Horizon are no longer tolerated. Even with offshore platforms decommissioning, the trend is now towards sustainable decommissioning(Doyle, Pappworth, & Caudle, 2008) and not simply stripping the installation and then dismantling leftover structures down to a navigational safe depth (Doyle et al., 2008). Regrettably, there have been instances of conflicting interests in Liberia's nascent offshore oil exploration and production sector that do not augur well for safe environmental inspection and monitoring of the country's offshore oil sector.

This paper investigates the offshore oil activities of Liberia, its past, current state and future potential. Accordingly, it examines the regulatory framework that governs environmental compliance from international and national perspectives. In furtherance it dissects the respective Acts establishing the entities overseeing Liberia's upstream and downstream sectors as well as the environmental aspects; scouts for areas of conflicts and lapses. More so related petroleum policies and legislations are scrutinized. An assessment pattern of the hypothesized environmental effect is given using the DPSIR model.

In order to address these lapses the dissertation examines some of the contemporary issues associated with the regulatory and enforcement paradigm of international offshore oil industry and thus "challenges the concept of principal actors" (Barchue, Lawrence D., 2005) in the Liberian offshore oil industry, their roles and the issue of accountability. It discusses some of the benefits of a watertight regulatory and inspection regime and encourages relevant entities to pursue an alternative course in line with best practices in Norway, UK and Canada thereby minimizing some of the supra regulatory challenges and hence thwarting the regulatory collapse that lied behind the Deep Horizon blowout and its lingering environmental nuisance.

Keywords: Examines, Conflicts, Inspection, Investigate, Lapses, Regulatory

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AGO…Automotive Gas Oil

AIS…Automatic Identification System

APCL…African Petroleum Corporation Limited

BOP…Blowout Preventer

CBD…Convention on Biodiversity

CEAA…Canadian Environmental Assessment Act

COGDP…Canada Oil and Gas Drilling and Production

COGI… Canada Oil and Gas Installations

COGOA… Canadian Arctic offshore is the Canada Oil and Gas Operations Act

COLREGS… Convention on the International Regulations for Preventing Collisions at Sea

Comm'n…Commission

CSA… Canada Shipping Act

CSR…Corporate Social Responsibility

DECC…Department for Climate Change

DPSIR…Drivers, Pressures, State, Impact, Response

DTI…Department of Trade and Industry

EA…Environmental Assessment

EC…European Commission

EEM… Environmental Effects Monitoring

EEZ…Exclusive Economic Zone

EIA…Environmental Impact Assessment

EPML..Environmental Protection and Management Law

EPA…Environmental Protection Agency

E&P…Exploration & Production

ERB…Energy Regulatory Board

ESIA..Environmental Social Impact Assessment

ESMP…Environmental Social Management Plan

EU…European Union

GC…Geneva Convention on the Continental Shelf

GIWACAF… Global Initiative for West and Central Africa

GOL…Government of Liberia

HTC…Hydrocarbon Technical Commission

IAIA…International Association for Impact Assessment

IMO…International Maritime Organisation

INS… Information Service

IPIECA… International Petroleum Industry Environmental Conservation Association

ITOPF… The International Tanker Owners Pollution Federation

LiMA…Liberia Maritime Authority

LNOC… Liberia National Oil Corporation

LPRC…Liberia Petroleum Refining Corporation

LRIT…Long Range Identification and Tracking

MARPOL… International Convention for the Prevention of Pollution from Ships

MLME…Ministry of Lands, Mines and Energy

MOTC… Monrovia Oil Trading Corporation

MSC…Maritime Safety Commission

NAS… Navigation Assistance Service

Nat'l…National

NCA…Norwegian Coastguard Administration

NBSAP… National Biodiversity Strategies and Action Plan

NEA…..Norwegian Environment Agency

NEB…National Energy Board

NEP… National Energy Policy

NEPA… National Environmental Policy Act

NOCAL…National Oil Company of Liberia

NNPP…National New Petroleum Policy

NPD…National Petroleum Directorate

MICAT…Ministry of Information Culture and Tourism

MMSI…Maritime Mobile Service Identity

MOA…Ministry of Agriculture

MOH…Ministry of Health

MOPW…Ministry of Public Work

MOT…Ministry of Transport

MoU…Memorandum of Understanding

OGP…International Association of Oil and Gas Producers

OPRC… International Convention on Oil Pollution Preparedness, Response and Co-operation

OSPAR…(Oslo Paris)… Convention for the Protection of the Marine Environment of the North-East Atlantic

PMS… Premium Motor Spirit

PPCA…Public Procurement Concession Act

PSA…Petroleum Safety Authority

Reg…Regulation

S-AIS…Satellite Automatic Identification System

SOLAS…Safety of Life at Sea

TOS… Traffic Organisation Service

TSS…Traffic Separation Scheme

UK…United Kingdom

UKCS…United Kingdom Continental Shelf

UKOOA… United Kingdom Offshore Operators Association

UNCLOS…United Nations Convention of the Law of the Sea

UNEP…United Nations Environment Programme

USA…United States of America

VTS…Vessels Traffic Services

1.0 CHAPTER ONE

1.1.0 Introduction

Early March 6, 2014 (Sieh, 2014; Sieh, 2014a), it was alleged that the National Oil Company of Liberia (NOCAL) and its Partner, TGS-NOPEC Geophysical Company, attempted riding the company into a bid round contrary to the agenda of the National Petroleum Policy of Liberia (Sieh, 2014a).

Then again in March 10, 2014 (FPA Editorial, 2014) it was reported that the Chief Executive Officer of NOCAL, Dr. Randolph McClain conducted a power-point presentation in Johannesburg, South Africa where he supposedly promised launching a licensing round of blocks in the deep and ultra deep water basin of Liberia (FPA Editorial, 2014). Though Dr. McClain denied the allegation however the media made the public believe that his power-point presentation in Johannesburg proved otherwise (FPA Editorial, 2014).

In another interesting scenario, onshore oil exploration permit oil was issued to a company named Simba Energy with no clear direction of how it was done. It is being debated as to whether it should be the Ministry of Lands, Mines and Energy or NOCAL (Global Witness et al., 2011). While Simba Energy has been conducting exploratory activities in Liberia with very close proximity to the coastal margins of the country (Simba Energy, 2012), it is however very unclear the environmental impacts its operations might have (Global Witness et al., 2011) on the marine ecosystem.

The conflicting regulatory impasse in the Liberian offshore industry bears some resemblance to the precursor of the Deepwater Horizon blowout. After the spill, critics attacked regulators for an inadequate environmental review process under the National Environmental Policy Act (NEPA) (Bush, 2012; Osofsky, 2013). Policymakers also attacked the Minerals Management Service's (MMS) numerous conflicts of interest with the oil industry (Bratspies et al., 2010).

There were a number lessons learnt from the Deepwater Horizon oil spill. First, deep sea oil drilling operations are susceptible to accidents of immense environmental proportions. Second, the negligence of rig employees or failure of rig safety equipment is likely to cause oil platforms blowout. Third, the failure of a government to maintain proper regulatory oversight over deepwater oil exploration ultimately compromises the sanity of the marine environment and the survival of the coastal settlements within proximity to such spill (Cleveland, 2010).

Accidents of varying proportions have also occurred elsewhere in the world. For example the blow-out at Ekofisk Bravo in Norway in 1977 and the 1988 Piper Alpha incident have respectively been largest spill in the Norwegian Continental Shelf (Petroleum Safety Authority, 2014) and the most disastrous of offshore accidents in UK North Sea area (Vinnem, 2014a). The graph below depicts disastrous offshore accidents:

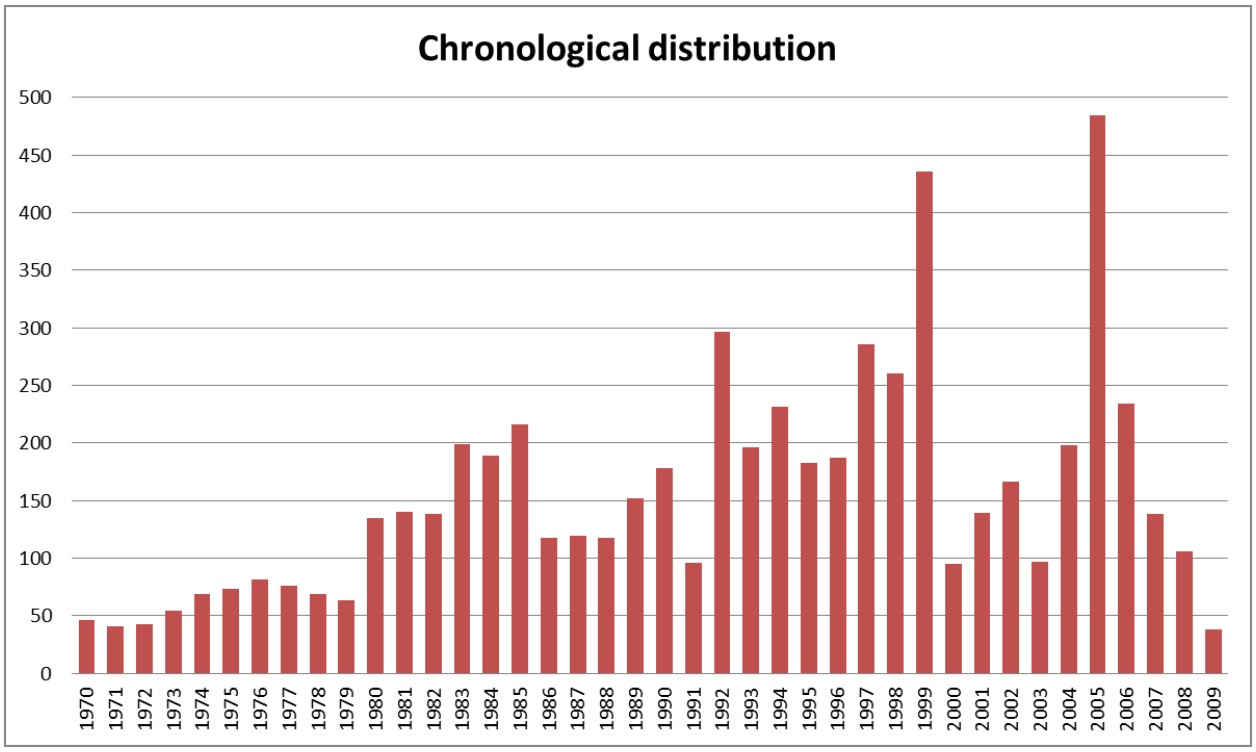

Figure 1: Chronological Distribution of Accidents in the WOAD (World Offshore Accident Dataset) Database.

The graph shows that there have been several offshore accidents since 1970 with 1999 and 2005 showing the highest. Notwithstanding the Deepwater Horizon incident in 2010 shows that more has to be done in terms of regulations and monitoring.

While the Deepwater Horizon occurred during the production stage, consideration should also be paid to the stage when the taps have been turned off. After the wells have become redundant comes the stage at which the offshore structure will have to be decommissioned. The decommissioning of offshore structures also poses significant health and safety challenges (ConocoPhillips, 1999; Ekins, Vanner, & Firebrace, 2005). The key environmental factors involved in disassembling the structures include effective relocation of drill cuttings (the soil and rock particles removed during the drilling process) and waste management and optimization (ConocoPhillips, 2014).

Moreover, supply and support boats servicing rigs and platforms result in increase ship traffic in laydown yard harbors (New York Outer Continental Shelf Office, 1982; Office Of Naval Intelligence & U.S. Coast Guard Intelligence Coordination Center, 1999; CSCAP, 2011, p. 1; GMA, 2012). Navigational or operational errors in the vicinity of these facilities could therefore result in collisions. Impacts which could result from any such collisions include injury, loss of life, spillage of oil and release of debris, including all or part of a rig, platform or ship. The release of a ship's cargo could present a serious threat to the environment if the cargo were a toxic chemical, crude oil, or refined petroleum product (New York Outer Continental Shelf Office, 1982; Abdulla & Linden, 2008, p. 22).

Thus offshore oil rig activities entail varying degrees of hazards which include, inter alia:

- fire, after ignition of released hydrocarbons;
- explosion, after gas release, formation and ignition of an explosive cloud;
- oil release on sea surface or subsea (European Union, 2012);
- collision (New York Outer Continental Shelf Office, 1982).

Hence this research tackles four key areas. The first is to analyse the international and national regimes covering offshore oil exploration and production. The second task is to investigate if regulatory policies that take their point of departure in international and national environmental law have been applied to protect the environment. The third task is to examine the principles of sustainable decommissioning through the necessary regulatory framework.

In spite of the regulatory mechanisms, accidents do occur. Therefore monitoring mechanisms to continuously assess policy feedback will have to be in place to take corrective actions to mitigating environmental degradation. Accordingly, the final task is to make a trend analysis of offshore oil exploration and production sector using the DPSIR model to give a portrait of the Drivers, Pressure State, Impact and Response variables within a localized framework.

1.2.0 Motive

The last decades have been marked by a considerable development of offshore oil and gas activities. Because of an increasing energy demand and technological innovations, drilling activities extended and moved into deep and ultra-deep water areas. As of today, almost a third of the oil and a quarter of the natural gas consumed in the world come from underwater areas and this rush to offshore oil and gas exploration and exploitation is not about to end: forecasts show a continuing growth of production in traditional offshore regions and significant development in new areas (Rochette, Wemaëre, Chabason, & Callet, 2014). One of such new areas is Liberia. Major oil companies have trooped to the country (Ecobank, 2014). However, deepwater drilling itself pushes the limits of our technical capabilities, and containing a spill at that depth has proved extremely difficult (Osofsky, 2013). Thus as offshore oil exploration and production in Liberia is at its threshold, putting the right mechanisms in place now is a matter of urgency.

1.3.0 Purpose of the study

This research addresses hypothesized lapses in Liberia's offshore regulatory regime.

1. The respective Acts establishing the Liberia Maritime Authority (LiMA), the National Oil Company of Liberia (NOCAL) and the Environmental Protection Agency (EPA) are scrutinized against current international standards.
2. Current data stipulating the frequency and methods of inspections are compared with current international standards.
3. Regulations and methods of inspections by three maritime administrations, namely: Canada, Norway and UK will be presented for comparison with those of Liberia.
4. Data from Maritime Rescue Coordination Center pertaining to vessels monitoring (marine incidents) are extracted and analyzed for synchronization of offshore platform monitoring scheme.

It is hope that by this Liberia shall

1. Comply with all relevant and international conventions;
2. That players in the country's oil sector would have a standardized working document for environmental compliance;
3. That mechanisms would be set up for environmental monitoring and assessment;

4. That safety of navigation would be maintained at all times in the country offshore oil activity areas;
5. The interests of other users of the sea, for example, fishermen would be well served.
6. That the country's marine environment is protected.

1.4.0 Scope and Methodology

This dissertation addresses lapses in Liberia's offshore regulatory regime. Thus, this research mainly delves into regulatory and monitoring aspects as it is the neglect of these that inevitably lead to tragic environmental disasters.

Statutory laws that approbate responsibility of inspections to particular entities in Canada, Norway, the UK and Liberia are discussed, parallels drawn and discrepancies highlighted.

For comparative analyses, Canada, Norway and United Kingdom are brought in the picture because West Africa shares similar geological straits to that of UK North Sea where Canada Overseas Petroleum Limited, also with a block concession in Liberia, has experienced exploration success (Canadian Overseas Petroleum Limited, 2013). Furthermore Norway has been involved with the financing of Liberia's maritime boundary delimitation with Sierra Leone on one hand and La Côte d'Ivoire on the other hand. The Government of Liberia has also committed itself to restructuring the State owned oil company in line with the agency design promoted by the Norwegian government's oil for development program (NOCAL, 2013).

Endeavoring therefore to derive a model that will enhance Liberia's offshore oil inspection and compliance, the two notable methods of offshore inspections, prescriptive-based and performance-based are thoroughly investigated. Additionally, current resources of Liberia's vessels monitoring system are analyzed in an attempt to effectuate an offshore monitoring scheme within Liberia's waters.

In order to meet the objective of the paper, domestic Liberian regulations that support UNCLOS provisions giving effect to States having sovereignty over their marine waters are divulged. In addition other source materials such as books, articles and journals on the issues related to the research are used to set the theoretical bases.

For the purpose of gathering primary data, questionnaires were circulated amongst the Liberia Maritime Authority, the National Oil Company of Liberia, and the Environmental Protection Agency.

1.5.0 General Approach

The journey to unveil the shortcomings of Liberia's offshore regulatory framework commences with general facts about Liberia and its offshore oil activities. A history of its offshore oil program is presented within the context of upstream and downstream. The current and future potential of the upstream activities are also espoused upon.

The dissertation delves into the institutional and legal framework of Liberia's offshore oil activities. More essentially, analyses of Statutes of Liberian Government Agencies involved with Offshore E & P including the outcomes of a questionnaire about the research are analyzed. The questionnaire gives a portrait of key features of the inspection program, environmental monitoring and decommissioning policies.

In order to address these lapses the dissertation looks at some of the contemporary issues associated with the regulatory and enforcement paradigm (Barchue, Lawrence D., 2005) of the countries of interest and challenges the concept of principal actors in the Liberian offshore oil industry: in view of the regulatory frameworks with regards to inspection, decommissioning, environmental and maritime traffic monitoring; which should precipitate the need for the development of a steadfast inspection and monitoring regime. Endeavoring therefore to derive a model that will enhance Liberia's offshore oil inspection and compliance, the two notable methods of offshore inspections, prescriptive-based and performance-based are thoroughly investigated. Some of the characteristics of a watertight regulatory and inspection regime of Norway, UK and Canada are investigated. Additionally, current resources of Liberia's vessels monitoring system are analyzed in an attempt to effectuate and recommend an offshore monitoring scheme within Liberia's waters. Moreover the hypothesized lapses of Liberia's offshore regulatory and inspection regime are investigated. An application of the DPSIR model towards the offshore oil exploration and production process is thus algorithmically presented.

2.0 CHAPTER TWO

2.1.0 Overview of Liberia and its Offshore Oil Activities

An efficacious way of investigating the shortcomings in Liberia's offshore sector is to decipher its jurisdictional maritime claims, geology of the country itself, history and organization of its petroleum industry. In furtherance, oil companies involved in the sector are as well treated.

2.2.0 Maritime Claims

Liberia made a territorial sea claim of 200nm miles in 1977 (Smith, 2000; Roach & Smith, 2012). But as the declaration was protested by the United States in the same year, Liberia rolled back the decision to 12nm in 2008 (Smith, 2000; Roach & Smith, 2012). However in 2012, the country declared an Exclusive Economic Zone of 200nm and a contiguous zone of 24nm (Executive Mansion-Liberia, 2013a). It also intends to extend the Outer Limits of its Continental Shelf from 200 to the 350 nautical miles (NOCAL, 2013) as under United Nations Convention of the Laws of the Sea (UNCLOS).

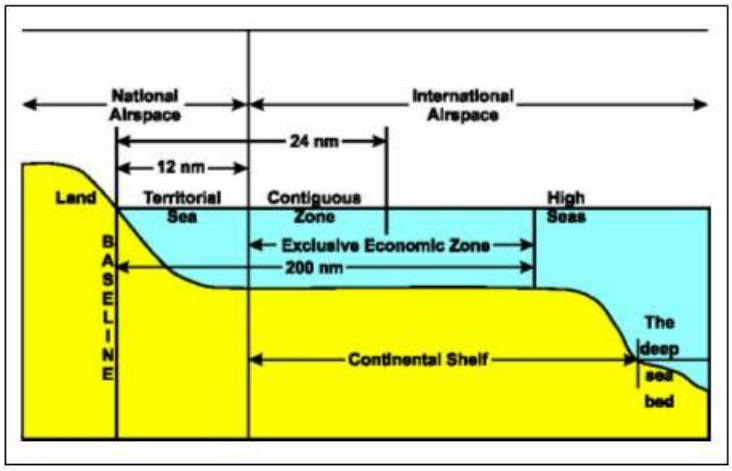

Figure 2: Maritime Zones (Source: Schofield, 2003)

2.3.0 Geology

Liberia is perched on the West African Shield, a rock formation from 2.7 to 3.4 billion years old. Its shore is broken by river estuaries, tidal creeks, swamps, and a few rocky capes and promontories that appear as landmarks from the sea. Except for those promontories and capes

and an occasional small hill, the altitude of the coastal region usually rises no higher than 30 to 60 feet (Hadden, 2006).

2.4.0 History of Oil and Gas Activities in Liberia

2.4.1 Liberia Basin

The Liberia Basin is a long-standing depo-center, with faulting and basement highs to the northwest and southeast. From west to east, the Liberia Basin is defined by three distinct fault zones – Monrovia fault one, Buchanan and Greenville fault zones (Bennett & Rusk, 2002). However, the origin of the basin is vague because of the limited number of studies in the area (Bennett & Rusk, 2002; Cooper, 2010). Nevertheless, it is believed that it was formed millions of years ago when the earth's plate shifted. The basin then developed into (Bennett & Rusk, 2002) a syn-rift phase followed by a phase of usual passive margin. The basin is an outlay of the greater Liberia-Sierra Leone Basin (LSLB). The LSLB forms part of the West African Transform Margin that extends from Sierra Leone to Benin (Conn & Rodriguez, 2011). A map showing the location of the Liberian basin is presented.

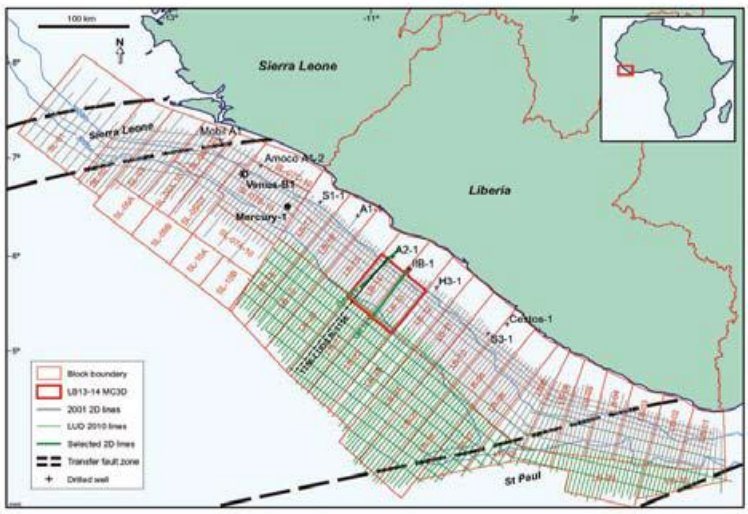

Fig. 3: Location map of Liberia-Sierra Leone Basin. (Source: Conn & Rodriguez, 2011)

It is debatable when oil and gas operations started in Liberia because some authors maintained that it started in the 1960's (Shannon, 2006;Mbendi Energy News, 2014) while some maintained that it started in the 1970's (Bennett & Rusk, 2002; NOCAL, 2014). For the purpose of this research it is maintained that hydrocarbon exploration has been active in Liberia since the

1970s surveys were carried out and several offshore wells were drilled. Reportedly, seven exploratory wells were drilled and abandoned on the shelf considerably shoreward of the potential deepwater basins in offshore Liberia (Bennett & Rusk, 2002). There was a break in activity from 1985 through to 2000 due to various factors including lack of technology to image or develop deepwater plays, political instability (Bennett & Rusk, 2002) along with the low price of oil (Akinsanya, 2012). Notwithstanding the seven wells provided an abundance of key data, which contributed to the identification of several hydrocarbon systems(Bennett & Rusk, 2002).

In 2000, with the price of oil at one of its highest peaks, the government decided to reignite its ambition for exploration. Consequently, between 2000 and 2010, TGS Nopec Geophysical Company from Houston, Texas conducted 24, 773 km of 2D Seismic Data; 24,408km of 2D Gravity and Magnetic Data and 18,345 km^2 of 3D Seismic Data as outlined by Conn and Rodriquez (2011). The TGS surveys established the presence of essential petroleum factors: multiple mature oil prone source beds throughout most of the study area.

In 2009, the government passed the landmark Liberian Extractive Industry Initiative (LEITI) act encompassing natural resource revenue and transparency (Ernst & Young, 2013).

2.5.0 Petroleum Sector Organisation

The Government's institutional framework for the petroleum sector comprises an office responsible for hydrocarbons in the MLME and two state-owned enterprises dedicated to upstream operations (NOCAL) and downstream operations (LPRC) (Ministry of Lands, 2009, p. 27).

2.5.1 Upstream Development

In its capacity of overseeing upstream activity, the Ministry of Lands, Mines and Energy (MLME) supervises petroleum exploration and development activities through the state-owned National Oil Company of Liberia (NOCAL). The NOCAL has been charged with managing the nation's petroleum resources since 2000 (Africa Energy Unit & The World Bank, 2011; Akinsanya, 2012). It initially had unhindered regulator and commercial operator rights that enable it to sequentially manage these resources while hiring others to perform the actual exploration activities (Africa Energy Unit & The World Bank, 2011; Boakye et al., 2012).

2.5.2 Concessionary Blocks

Thirty concessionary blocks: 17deepwater blocks from the continental shelf to water depths of 2500 meters to 4000 meters and 13 'ultra-deepwater' blocks to water depths of 4500 meters, comprise Liberia's offshore acreage (NOCAL, 2014a).

Of the 17 deep-water blocks:

- Ten (10) blocks awarded: LB17, LB16, LB15, LB14, LB13, LB12, LB11, LB10, LB9, LB8
- Two (2) blocks are currently under negotiations: LB7 and LB6)
- Five (5) blocks have not been awarded: LB 1-5.

Of the 13 ultra deep blocks, none have been awarded (NOCAL, 2014a).

2.5.3 Current Drilling Activities and Future Potential

1. African Petroleum Corporation Limited (APCL), acquired Blocks LB-08 and LB-09 in 2007 and holds 100% working interest in both blocks (African Petroleum Corp, 2014). The company completed drilling of two wells in Block LB-09 during the 3rd quarter of 2011 and 1st quarter of 2012. The geological and geophysical data acquired confirmed the presence of a working hydrocarbon system in the basin. On February 21, 2012, APCL announced that it has made a significant oil discovery in one of the wells, offshore Block LB-09 (NOCAL, 2012; African Petroleum Corp, 2014).

2. Anadarko currently holds the right as operator for four blocks with participating interest for Mitsubishi, Repsol, and Tullow. Production Sharing Contracts (PSCs) for Blocks LB-15, LB-16, and LB-17 were signed in 2005 and amended and ratified by the Legislature in 2008 with Anadarko holding 47.5% operating interest, Repsol 27.5%, and Tullow 25% in each of the blocks. In 2009, Block LB-10 was signed and ratified by the National Legislature with Anadarko holding 80% operating interest, Mitsubishi 10%, and Repsol 10% (Anadarko, 2011; NOCAL, 2014a).

3. Chevron acquired three offshore Liberian blocks namely LB-11, 12, and 14 (Chevron Corporation, 2014; CbI - Cross-border Information - African Energy, 2013).

The potential for significant oil and gas discoveries in Liberia is indeed significant, given some recent exploratory success in the region including Ghana, with production at Jubilee; production from shallow water reservoirs offshore Côte d'Ivoire; and recent discoveries offshore Sierra Leone (Derrick Petroleum Services, 2011; Williams, 2012).

Chevron, ExxonMobil, Anadarko Petroleum Corporation and potentially African Petroleum Corporation are reportedly about to commence production operations (CbI - Cross-border Information - African Energy, 2013).

Also of interest is an area onshore but very close to the coast (see figure 4). Simba Energy has a 100% interest in the onshore licence which covers an area of 1,366 square kilometers within the Roberts and Bassa Basins of south coastal Liberia. (Simba Energy, 2012).

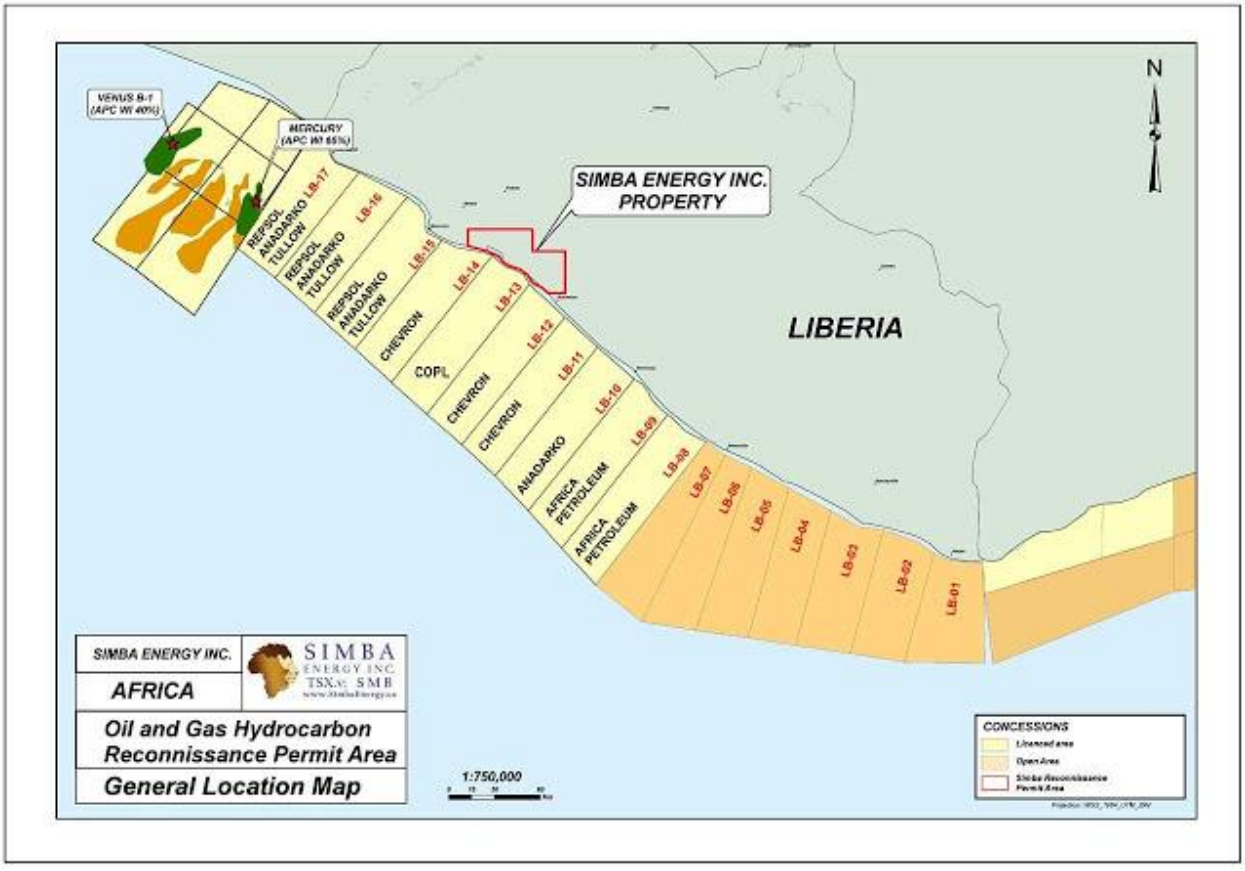

Figure 4: Map showing location of Liberian Blocks along with their operators (Source: Modified from Simba Energy)

2.5.4 Development of Oil and Gas Facilities (Downstream)

2.5.4.1 Downstream Sector Organization

This is where the activities of the Liberia Petroleum Refining Company (LPRC) come in; The entity is responsible for storing and handling petroleum and petroleum products. This segment comprises of three (3) main areas;

- Importation
- Distribution and
- Retailing

The sector has the responsibility to discharge tankers and ensure that products are safely stored and appropriately handled (LPRC, 2012). However setting the domestic market price for oil is the responsibility of the Ministry of Commerce and Industry (Africa Energy Unit & The World Bank, 2011).

The Ministry registers companies and issues commercial operating licenses. The LPRC has monopoly to import oil products into Liberia and distribute them. However, it does not import any products directly at the moment, nor distribute. In early 2010, LPRC encouraged Liberian and foreign investors to invest in the importation of petroleum products – Premium Motor Spirit (PMS) and Automotive Gas Oil (AGO). Presently, there are nine registered importers which ensure that adequate petroleum products are on the Liberian market (Africa Energy Unit & The World Bank, 2011; LPRC, 2012).

Marine storage facilities of the company are located in Monrovia, the Port City of Buchanan, the border town of Ganta and two aviation storage sites at the Robert International Airport and the James Spriggs Payne Airport (Africa Energy Unit & The World Bank, 2011).

3.0 CHAPTER THREE

3.1.0 International Framework Necessary for Marine Environmental Protection as a Result of Offshore Exploration and Production

The ecological impacts of offshore wastes or discharges and potential threat to biodiversity as a result of increased maritime traffic including habitat destruction and fragmentation (Abdulla & Linden, 2008, p. 161-163; Islam & Khan, 2013) are now being recognized as major concerns associated with petroleum and natural gas developments. Consequently, reducing these environmental impacts are the most pressing issue today. Pollutants at sea are seldom stagnant. For example, oil as a floating pollutant knows no boundaries and crosses over maritime zones and national and international jurisdictional demarcation lines in directions dictated by nature (Mukherjee, 2007, p.3). To therefore mitigate the environmental consequences of the industry, various international conventions and regional agreements are in place with the relevant national legislations and policies giving force to these conventions and agreements. In most areas the performance of a Strategic Environmental Assessment (SEA) must be performed before the commencement of most projects (IAIA, 1998; Therivel, 2010; Ungemach-bensaid et al., 2014) involving hydrocarbon exploration as it can result in large - scale environmental impacts (Therivel, 2010) and is thus necessary among other things for the identification of possible risks and fatal flaws (Tarr, 2013).

As the national framework is of dominance (UNCLOS, 1982, Art. 2(1), 24, 192 & 208; UNEP, 1997 ; Gao, 1998a; Lyons, 2012, p. 10), herein, offshore drilling and various environmentally-related international conventions to which Liberia has bound itself is brought into sharp focus. Accordingly, environmental frameworks as regards to offshore oil and gas operations, decommissioning of platforms and vessels monitoring/routeing is examined. In this vein, a focus is placed on the country's regulatory mechanism of the lead government entities.

3.2.0 International Framework**s**

3.2.1 United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS was adopted as a package deal, precisely to encourage that the greatest number of States ratified the convention based on the perceived advantage of having a majority of States bound to all provisions (Buzan, 1981; González, 2012). UNCLOS provides a general rule and framework for Liberia`s rights and obligations (Wahuemo, 2013). As a signatory to UNCLOS

Liberia is under obligations to implement UNCLOS` provisions as provided under Article 192 of UNCLOS to protect and preserve the marine environment as a result of Liberia`s hydrocarbon exploration and exploitation or production activities (UNCLOS, 1982, Art. 192). Further, Article 193 provides that Liberia has sovereign rights to exploit her hydrocarbon resources. Article 197 is the legal basis for Liberia and other coastal States cooperation as a way of establishing, regional and international agreed norms for marine environmental protection. The Convention provides a legal basis for marine space protection under Article 207, which emphasizes Parties' obligations to take into account the marine environment protection measures agreed upon under different instruments (González, 2012).

The provisions therefore have very strong emphases on the prevention, reduction and control of pollution in the marine environment. UNCLOS exerts a considerable efforts on all further law-making regimes and processes concerning the protection of environmental resources of the oceans and seas (Wahuemo, 2013). Additionally, Parts V and VII of UNCLOS also deals with States` rights and duties concerning the conservation and management of marine living resources, including marine mammals, in the EEZ as provided under Article 56, 61, and 65 (UNCLOS, Art.209(1) & 214; Birnie et al., 2009; Wahuemo, 2013).

3.2.2 Rights and Obligations to Protect the Marine Environment

UNCLOS can therefore be perceived has an "umbrella agreement that brings other international rules, regulations and implementing bodies under its canopy (Guruswamy, 1998; González, 2012)." Consequently, diplomatic conferences and international organizations can supplement this "framework for marine pollution control through specific regulatory instruments (Guruswamy, 1998; González, 2012)." These principles are regimes in nature. They are also considered to be part of the defined International Environmental Law (IEL). Therefore regimes like the Abidjan Convention and MARPOL, are binding on State parties (UNCLOS, Art. 215).

Though, Liberia is not a party to and therefore not bound by 1972/96 London Dumping Convention (UNCLOS, Art. 237 (1-2)) but her obligations to protect the marine environment as a coastal State (Beyerlin & Marauhn, 2011) is evidenced by Articles 192-5 of UNCLOS, by regional treaties and by other multilateral regimes such as the Abidjan Convention for West and Central African States, UNCLOS, MARPOL, OPRC and the Convention on Biological Diversity (CBD), among others negotiated agreements since 1954 (UNCLOS, Art. 192, 193, 194(1), 195; Birnie et al., 2009).

These frameworks therefore provide the legal provisions that Liberia has to comply with for the prevention, reduction and control of marine pollution as a consequence of Liberia`s hydrocarbon exploration and exploitation or production activities (UNCLOS, Art. 214).

Articles 208(1)(5), and 214 obligate Liberia to adopt laws and regulations and enforce them to prevent, reduce and control pollution arising from the hydrocarbon exploration and exploitation activities on Liberia`s continental shelf or sea-bed (Wahuemo, 2013).

3.3.0 International Convention for the Prevention of Pollution from Ships and its Protocol (MARPOL 73/78)

The stated objective is "to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharges of such substances". Requirements under MARPOL shall be considered as supplementary of UNCLOS or widening the scope of UNCLOS (MARPOL73/78 Article 2 and 3 (a)) .

3.3.1 MARPOL 73/78 Scope of Survey

Kiss & Shelton (2000) posit that once an operation is licensed, the coastal State authority has the power to prohibit, limit, or regulate any chemical or discharge from offshore installations that may cause injury or harm to the marine environment. Hence regulations concerning discharges in special areas and marine pollution from offshore rigs as well as technical standards of rigs are stipulated in regulation 34 of MARPOL. Platforms are subject to the survey and certification requirements of Annex VI of MARPOL (MARPOL73/78, Annex 1., Chapter 7, regulation 39 Article 2(3)(a),(4); Kiss & Shelton, 2000; Evans, 2014; Marsden & Varner, 2013). The scope of the survey and certification is limited to the extent that emissions directly arising from the exploration, exploitation and associated offshore processing of sea-bed mineral resources are, consistent with Article 3 Paragraph (b)(ii) of the MARPOL Convention, exempt from the provisions of Annex VI of MARPOL (MARPOL73/78, Article 3 (b)(ii)). Such emissions include the following: (a) from any platform resulting from the incineration of substances that are solely and directly the result of exploration, exploitation and associated offshore processing of sea-bed mineral resources, including but not limited to: (i) the flaring of hydrocarbons and the burning of cuttings, muds and stimulation fluids during well completion and testing operations, (ii) flaring arising from upset conditions, and (iii) the release of gases and volatile compounds entrained in drilling fluids and cuttings, (b) associated solely and directly with the treatment, handling or storage of a sea-bed mineral (c) from a diesel engine that is solely dedicated to the exploration,

exploitation and associated off-shore processing of sea-bed mineral resources (MARPOL73/78, Annex 1 ; Gavouneli, 1995; Wahuemo, 2013, p. 24).

3.4.0 International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)

A conference of leading industrial nations in Paris called upon IMO In July 1989 to develop further measures to prevent pollution from ships. This call was endorsed by the IMO and a convention was subsequently drafted to combat major incidents or threats of marine pollution. Under the convention, among other things, operators of offshore units under the jurisdiction of Parties are required to have oil pollution emergency plans or similar arrangements which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents (IMO, 2014b).

Parties to the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), as Liberia (IMO, 2014e), are required to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries (IMO, 1991; IMO, 2014).

3.4.1 Prevention of Pollution by Oil of the Marine Environment

Article 3 paragraph 2 of OPRC on oil pollution emergency plan provides that Liberia as a State party to this Convention has obligations to require oil companies of the offshore units under Liberia jurisdiction to comply with oil pollution emergency plans (OPRC, Articles (2),(3) and (4); Birnie et al., 2009).

3.5.0 London Dumping Convention

The London Convention and Protocol serve to promote the effective control of all sources of marine pollution and prevent pollution of the sea through regulation of dumping into the sea of waste materials. Contracting Parties shall therefore take effective measures to prevent pollution of the marine environment caused by dumping at sea (see articles I and II of the Convention and article 2 of the Protocol) (IMO, 1972b; IMO, 2006). Liberia, however, is not a signatory to this convention.

3.6.0 Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) is an international legally-binding treaty with three main goals: conservation of biodiversity; sustainable use of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources.

3.6.1 Measures for the Management of Environmental Impact of the Marine Environment

National Biodiversity Strategies and Action Plans (NBSAPs) are the principal instruments for implementing the Convention at the national level Article 6. The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity. To date, a total of 93% of the signatories including Liberia (NBSAP-Liberia, 2004) have developed NBSAPs in line with Article 6 (CBD, 2014a).

Article 6 of the Convention on General Measures for Conservation and Sustainable Use states that each Contracting Party shall, in accordance with its particular conditions and capabilities:

- Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned
- Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies (CBD, 2014a).

In the tenth meeting of the Conference of the Parties on the CBD, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, Parties adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period (CBD, 2014b). Some examples of the Aichi Biodiversity Targets are:

- At least halve and, where feasible, bring close to zero the rate of loss of natural habitats;
- Establish a conservation target of 17% of terrestrial and inland water areas and 10% of marine and coastal areas;
- Make special efforts to reduce the pressures faced by coral reefs (CBD, 2014b).

3.7.0 Abidjan Convention

The United Nations Environment Program (UNEP) introduced a Regional Seas Programme in 1974, basically to promote regional collaborative action towards the protection of the marine and coastal environment, and the conservation of their resources. One of such programmes is the Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention) (Abidjan Convention, Articles 3 & 4). The convention scope include: Overfishing, dumping at sea, exploration and exploitation of the sea-bed and other activities that pollute the marine environment and coastal ecosystems, Articles 2(1), 3(1)(3) of the Abidjan Convention (Kiss & Shelton, 2000).

3.7.1 Obligations to Protect the Marine Environment

Article 3(1)of the Abidjan Convention provides that States parties to the Abidjan Convention can enter into bilateral, sub-regional, regional and multilateral agreements, once those agreements` objectives are for the protection of the marine and coastal environment of the convention`s area as well conform to international law.

3.7.2 Pollution from Hydrocarbon Activities on the Sea-bed

The Convention provides contracting parties to this convention shall cooperate to deal with marine pollution emergencies in the Convention area in order to mitigate marine environment pollution arising from hydrocarbon activities (Gavouneli, 1995; Kiss & Shelton, 2000; Wahuemo, 2013).

3.8.0 Decommissioning

The offshore oil and gas industry had its beginnings in the Gulf of Mexico in 1947 (Day, 2008). The initial design of multi-piled steel jacket to support the topside production facilities has since been used extensively. Now there are more than 7000 drilling and production platforms located on the Continental Shelves of 53 countries (JPT, 1995; Parente et al., 2006; Day, 2008). As the oil and gas fields begin to deplete their reserves the concern then turns to the removal and disposal of these structures (Day, 2008).

Fig 5: Global Distribution of Platforms. Updated from Ferreira (2003) with numbers compiled from various sources, including government reports, industry reports and academic literature

Decommissioning is an expression that is now frequently used in the oil and gas industry. It entails complete or partial removal, or re-using the offshore installation as artificial reefs. Occasionally the disused installation may be sunk (Climate and Pollution Agency, 2011). Other technical activities include plugging and abandonment of wells, pipelines, risers and related facilities (Zawawi et al., 2014). Thus as it covers a variety of activities, the expression decommissioning is widely accepted within the oil and gas industry rather than using the terms "abandonment", "removal" or "disposal" (Higginson, 2012). Infrastructures that necessitate decommissioning encompass varying types of facilities. For example infrastructure in the North Sea consists of a variety of different structures, consisting mainly of production platforms supported by large gravity-based concrete foundations or steel frames (or 'jackets'). In addition to this, there are some smaller structures either floating on the surface or positioned on the seabed as well as interconnecting pipe-work and wells (Royal Academy of Engineering, 2013). It has become increasingly important that the decommissioning be done in a sustainable manner to protect the marine environment.

3.8.1 Sustainable Decommissioning

Sustainable decommissioning constitutes a decommissioning plan that take the environment into consideration. Thus sustainability is achieved when platforms are removed and disposed

onshore in an environmentally responsible manner. The landed structures are normally dismantled, sorted and processed in a facility fully equipped and licensed to handle such hazardous materials (Thornton & Twomey, 2011).

One element in the decommissioning process is effective relocation of drill cuttings (the soil and rock particles removed during the drilling process) and waste management and optimization. The decommissioning plan should employ the best available techniques to relocate such drill cuttings. Essentially, hazardous waste near the structures should thoroughly be mapped in order to plan for careful removal and disposal, while optimizing reuse and recycling. As such minimal impact on the environment should be the goal.

Reuse is as well an option. Reuse takes place when end-of-life steel is reclaimed and reused, mostly retaining its original state of material. Thus the embodied energy of steel is saved and the environmental impacts of creating new steel would be reduced. Reusing offshore platforms potentially removes thousands of tonnes of steel from the waste stream and reduces the input energy required for reprocessing or recycling. Taking salvaged steel as an example, in 2007 the emissions cost of recycling over reuse cost the UK the energy equivalent of the output of two power stations (Kay et al., 2012). As can be seen, reuse is an important aspect of sustainability as the energy used for remanufacture or refurbishment is relatively small compared to the energy of the recycling process.

Figure 6 The new European 5-Step Waste Hierarchy which classifies waste management strategies according to their desirability (Altit & Igiehon, 2007)

As illustrated in Figure 6, reuse is the second most viable option in the new European Waste Framework Directive (2008/98/EC) aimed at promoting recycling among EU member states(SEPA, 2014). From an environmental and often economic point of view it is desirable that as many components of an offshore structure as possible are extracted from the waste stream for reuse at the end of their useful life. Although reuse has primarily been used in the Gulf of Mexico, as artificial reefs, the trend is picking up in other locations, such as the North Sea and Southeast Asia where dis-use oil platforms are being converted to offshore wind farms (Altit & Igiehon, 2007; Thornton & Twomey, 2011; Royal Academy of Engineering, 2013).

However, in all of these conceptual frameworks, the type of regulatory regime employed by the government is a key to the successful outcome of the framework.

3.8.2 Decommissioning of Offshore Installations- Applicable International Framework

In most of the western and central coasts of Africa the environment is more moderate and the majority of structures in these areas are in water depths from 3 to 300 m with maximum storm wave heights of 12 m. Therefore, with a few exceptions, platforms in these areas will probably be totally removed at the end of their producing lives (Day, 2008). But the thirty concessionary blocks in offshore Liberia are in areas of phenomenal depths (see p. 10) which permit other removal options besides total removal. The implication with any chosen option is that the ideal decommissioning assessment report, for instance, must take into consideration the effects of the chosen options. It should therefore include energy use, biological and technological impact of discharges, secondary air emissions, physical and habitat matters, fisheries, waste management, littering, drill cutting deposits, free passage, personnel safety, national contents, employment, cost feasibility, and impacts on local communities, including visual interference, noise, odour and traffic (Parente et al., 2006). To achieve these decommissioning is therefore governed by international legal framework.

The international framework provide for ‘removal’ or abandonment as opposed to decommissioning. However, the 1995 Brent Spar (Hamzah, 2003a) controversy is the causation of the new concept of decommissioning sensu stricto; before that incident the concept of removing an abandoned offshore platform was simply referred to as ‘abandonment’ (Hamzah, 2003a).

As guidelines for decommissioning of upstream Installations are very much based on key international conventions (Hamzah, 2003; Zawawi et al., 2014) herein various international conventions and regional agreements are digested.

3.8.2.1 United Nations Convention on the Continental Shelf 1958 "Geneva Convention" (GC)

The GC gives countries exclusive rights for the purpose of exploring the continental shelf and the rights to exploit its natural resources (Geneva Convention, Art. 2(1)). It therefore sanctions States to construct and maintain or operate offshore installations(Geneva Convention, Art. 5(2)). However, the convention stipulates that the exploration of the continental shelf and the exploitation of its natural resources must not result in unjustifiable interference with navigation, fishing or the conservation of the living resources of the sea (Geneva Convention, Art. 5(1)).

In furtherance, it explicitly provides that apart from giving notice of the existence of any such installations by providing and maintaining a permanent means of warning, any installations which are abandoned or disused must be entirely removed (Geneva Convention, Art. 5(5)). Thus, by this Article any redundant offshore installation or structure must be totally removed. The 1958 United Nations Geneva Convention on the Continental Shelf (GC) can therefore be considered as the keystone document on offshore decommissioning (Geneva Convention, 1958; Azaino, 2012).

3.8.2.2. The 1982 United Nations Convention on the Law of the Sea

The precursor to the UNCLOS, the GC's total or complete requirement criteria without any exceptions, paved the way for UNCLOS. The UNCLOS preamble explicitly states that developments since 1958 have increased the need for a new and generally acceptable Convention and as expected the convention gives a less draconian requirement:

"Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organisation. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other states. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed (UNCLOS, Art.60(3)).

It can be deduced from Art. 60(3) above, that while the acceptable standard is complete removal, it nevertheless unlike the GC, made provision for those exceptional occasions where total removal is not possible.

3.8.2.3 International Maritime Organisation Guidelines 1989

The wording of Article 60(3) UNCLOS which requires States to take abide by international standards established by 'the competent international organisation', gives the International Maritime Organisation (IMO) and in particular its Maritime Safety Committee, the momentum to assert its competence in this regard (Cameron, 1998; Azaino, 2012). Using the provisions of Article 60(3) UNCLOS as a reliance, the body produced Standards and Guidelines on the removal of disused or abandoned offshore installations (IMO, 1989a). These Standards and Guidelines are recommendations to be taken into account by member governments when making regulations regarding the removal of abandoned or disused installations or structures and therefore not legally binding (IMO, A. 672 (16)).

The Guidelines provide that where it is deemed necessary to allow the whole or part of an installation to remain in place, account must be taken of such factors as: potential effect on the environment; effects on navigation; the costs, technical feasibility and risks to personnel involved in the removal; and any new use or other justification for allowing all or part of the installation to remain (IMO, A. 672 (16), para 2.1). Though the Guidelines allow for the possibility of partial removal, the standards provide that where an installation stands in less than 75m of water and weighs less than 4000 tonnes it should be entirely removed (IMO, A. 672 (16), para. 3.1). The Guidelines further provide for the entire removal of installations located in certain defined areas important for navigation, and that they should not be subject to any exceptions (IMO, A. 672 (16), para 3.7). The Guidelines are meant to be minimum standards, thus member states can adopt stringent decommissioning requirements. Interestingly, though not a legally binding document, the Guidelines have been widely received and adopted (Azaino, 2012).

3.8.2.4 London Dumping Convention

Echoing several regional arrangements, the Contracting Parties to the London Convention decided in 1993 to prohibit dumping of all types of radioactive waste and sea-based incineration of sewage sludge and industrial waste; moreover, dumping of the latter would be phased out within three years. They also resolved to take an active part in the implementation of Agenda 21 of the United Nations Conference on Environment and Development (UNCED) regarding waste

management world-wide. Hence a programme of technical assistance would be elaborated in tandem with sustained efforts to increase participation in the Convention. Those two themes, bringing global-level commitments on par with the most advanced regional agreements and strengthening programmatic activities with a view to improving waste management in developing countries, form the core of a long-term strategy hammered out by the Contracting Parties and incorporated into a 1996 Protocol which thoroughly rewrites the Convention (IMO, 1972b; IMO, 2006; Stokke, 2002).

3.8.2.5 Abidjan Convention

Although all of the above are basic guidelines to removal and disposal, they do not account for all of the issues involved with the abandonment or disposal of offshore structures (Day, 2008). As the word "decommissioning" is not found in GC, UNCLOS and 1989 IMO Guidelines and Standards (IMO, 1989; Hamzah, 2003a) nor is it defined in other regional treaties that deal with marine pollution (ILM, 1993; Hamzah, 2003a), States are therefore left to decipher the issues, and to generate legislation to offset the pitfalls in international law in line with their priorities. Hence by 1992, 15 United Nations Environment Programme (UNEP) regional conventions had been held, one of which is the Abidjan Convention. Here, States have adopted varying degrees of guidelines for potential legal concerns such as determination of the party responsible for removal, responsibility and methods of payment, responsibility of owners in default situations, owner designation upon non-use, maintenance responsibility and liability for items left in place and such site-specific issues as bottom debris removal and moratoriums for marine migrations. While the complexity of issues has stymied most countries from adopting specific guidelines and standards for platform removal, most however do require abandonment procedures to be submitted to designated regulatory agencies for approval on a case-by-case basis (Day, 2008).

The Abidjan Convention which was treated previously (see page 10) also applied to decommissioning since it is basically geared towards the promotion of regional collaborative action towards the protection of the marine and coastal environment, and the conservation of their resources (Azaino, 2012). It has a comprehensive coverage of varying degrees of guidelines for potential legal matters (Abidjan Convention, 1981; Day, 2008).

3.8.2.6 Influence of non-State Actors on International Legal Framework

Decommissioning has become an all-inclusive, politicised and costly issue (Ferreira, 2003; Parente et al., 2006). Pressure groups like the Friends of the Earth International and the World Conservation Union (IUCN) are very active at IMO diplomatic conferences and their lobbying power for marine environmental protection has had far-reaching effects (Mason, 2003). Thus their stands on environmental issues are never to be overlooked.

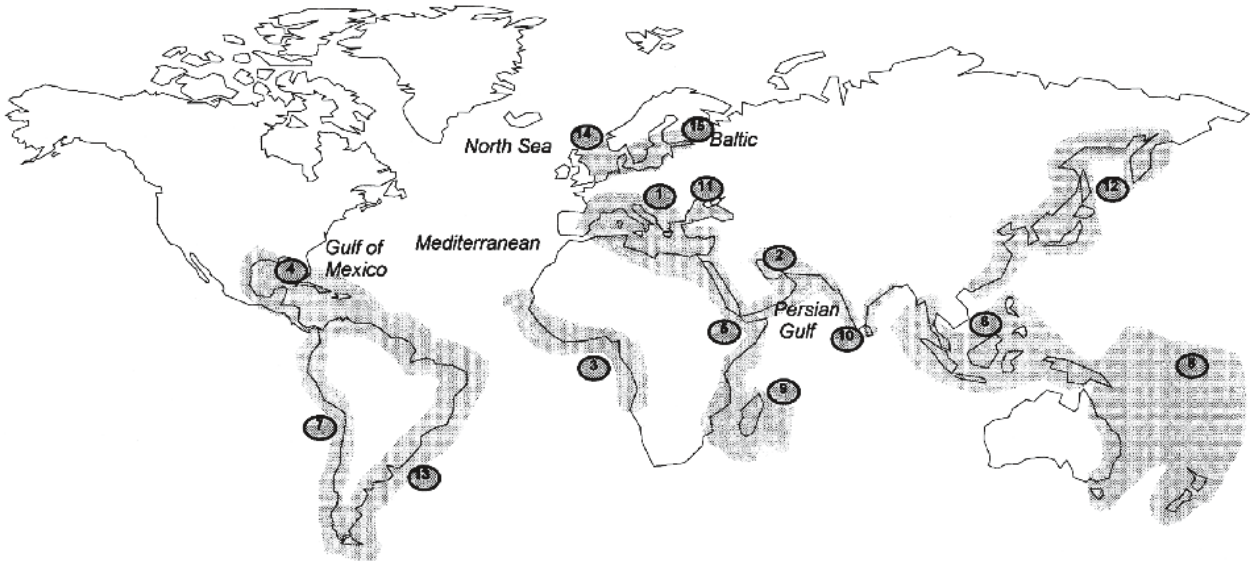

Figure 7: UNEP Regional Seas Programmes and other conventions (Source: Day, 2008)

Despite all difficulties involved in the decommissioning process, it is an inevitable development. In Europe over the next two decades, an average of 15–25 installations are expected to be decommissioned annually, representing 150,000–200,000 tonnes of steel per year among other materials (Osmundsen & Tvetera˚ s, 2003). Non-decommissioned oil facilities have also been a menace to the environment and human health in the Niger Delta (IUCN Niger – Delta Panel, 2013; Ite, Ibok, Ite, & Petters, 2013).

3.8.2.7 Corporate Social Responsibility-Voluntary International Framework

Prior to decommissioning, a SEA should be undertaken by the regulatory agency and an EIA/ESIA conducted by the company, to include the effects of all decommissioning options and nowadays feedback from the local communities (Parente et al., 2006; UNEP, 2011). But often times the ‘‘public relation environment’’ may come in the limelight before the ‘‘physical and legal environment’’(Parente et al., 2006). Thus a company may strictly follow all regulations and still be far from satisfying public expectations (Ferreira, 2003). Osmundsen and Tvetera˚ s (2003)

cite the population's growing willingness to pay for keeping the oceans as close as possible to their ''natural'' state and also to the companies' growing concerns on the effect on their reputations as a consequence of their decommissioning choices. In the case of Liberia, it is the latter that is applicable. Oil, an extremely visible pollutant, often raises environmental concerns because of its aesthetic impact and damage. Its medium of marine environmental damage is spelled out in the United Nations Law of the Sea Convention (UNCLOS Art (1) para 4 & 5). Multinational oil companies are more vulnerable to civil society pressures than companies in some other sectors of the economy. The companies' international brand reputations are therefore vulnerable (Austin & Sauer, 2002; Frynas, 2009). Another important explanation is that oil companies are willing to accept higher levels of sociopolitical risks as they are forced to operate in more challenging environments for geological reasons, with oil and gas deposits often being located near ecologically vulnerable areas and in countries with poor governance (Pegg, 2006; Chen, 2007). Thus environmental performance is considered an important factor impacting corporate image. The petroleum industry is particularly vulnerable to public criticism because, on one hand it must seek public approval for accessing geographical areas and developing natural reserves, while – on the other hand – its image can be easily damaged by highly visible accidents of oil spills or well blowouts (Wojtanowicz, 2008).

The growth of CSR is demonstrated, among others, by the remarkable growth of corporate codes of conduct and social and environmental reporting. A total of 95% of the world's 250 largest companies formally report on their CSR activities, with oil companies being at the forefront of this reporting movement (KPMG International, 2011). CSR has become more sophisticated and complex from the mid 1990s. Oil companies have joined various international voluntary initiatives aimed at addressing different aspects of sustainability, including the 1997 Global Reporting Initiative, 1999 UN Global Compact, 2000 Voluntary Principles on Security and Human Rights, 2003 Extractive Industries Transparency Initiative (EITI) and 2007 Combat Climate Change 3C Initiative (Frynas, 2010; Frynas, 2012).

Over time, the petroleum industry involved in the Petrobras's P-36 platform blowout, the Macondo blowout, and other visible accidents learned that public perception might often play a larger role in influencing a course of action than facts. They learned that compliance with existing laws and regulations is not sufficient to convince the public but there must be evidence of improvement of technology to receive approval for continuing operation. Moreover, a company's environmental performance is becoming an important factor in corporate

assessments by the investment community, not just as a factor considered as part of the 'watchdog' function of environmental organizations. In fact, a company's environmental performance is increasingly becoming a factor in investor evaluations of future potential (Duncan & Sauer, 2002). Thus the petroleum industry is expected to perform concomitantly in three areas, productivity, environmental and social. This 'triple bottom line' concept operates on the principle that better performance of one of the three pillars – representing economic, environmental and social considerations – cannot be considered substitutable for underperformance in another (Whitaker, 1999; Wojtanowicz, 2008). Therefore, voluntary initiatives often pursued under the banner of Corporate Social Responsibility (CSR), though not mandatory and legal in the sense of the word but these initiatives are becoming a form of framework for compliance that are dictating the course of operations of oil companies and government parastatals alike. In this new domain of 'legal' framework, the Liberian scenario is no exception.

3.9.0 Framework for Maritime Traffic Monitoring for Marine Environmental Protection

Ships' routeing measures that are important for safety of navigation and marine protection include: traffic separation schemes (TSS) (IMO, 1972a), traffic lanes, separation zones, roundabouts, inshore traffic zones, recommended routes, deep-water routes, precautionary areas and areas to be avoided. Besides improving the safety of navigation 'areas to be avoided' are interesting from an environmental perspective. Up to December 2002, thirty four 'areas to be avoided' were approved by the IMO, of which a majority aims to protect a certain habitat or a sensitive area (e.g., breeding grounds for sea-bird populations, a marine sanctuary, coral reefs) against the risks of pollution or to protect oil and gas pipelines against the risk of damage (IMO, 2003). Routeing measures can also be implemented to avert or reduce collisions between ships and whales (ship strikes) (Maes, 2008).

The implications of the establishment of structures and installations in connection with routeing systems and TSS is considered in Resolution A.572(14) on general provisions on ships' routeing. The Resolution recommends that governments should ensure, as far as practicable, that oil rigs, platforms and other similar structures are not established within routeing systems adopted by IMO or near their terminations. If the establishment of these installations cannot be avoided, the TSS should be amended temporarily in accordance with guidelines given in the same resolution. In the case of the establishment of permanent installations within a TSS, permanent amendments to the scheme should, if deemed necessary, be submitted to IMO for adoption. IMO Resolution A.671(16) on safety zones and safety of navigation around offshore

installations and structures recommends governments to study the pattern of shipping traffic at an early stage in order to assess potential interference with marine traffic passing close to or through resource exploration areas. The Resolution also calls on coastal states to take action against those responsible for infringement of the regulations on safety zones or, at least, to notify flag states, giving detailed evidence of the infringement by their vessels (Maes, 2008)..

Clearly, the principle, and attendant problems, of multiple or shared use of a physical environment is nowhere better exemplified than in the world ocean. As the respective technologies of the fishing, offshore mineral, shipping, and other industries and user groups have rapidly progressed during the last two decades, conflicts between virtually all of these interests have arisen (Knight, 1969, p.1; Manning, 1971, p. 11; White, Halpern, & Kappel, 2012). As offshore oil exploration invariably leads to increased maritime traffic thus causing harm to the marine ecosystem in terms of noise, pollution and loss of biodiversity (Abdulla & Linden, 2008) and the ever potential threat of collisions, an avenue have to be sought to reduce such problems in addition to TSS. Long Range Identification and Tracking (LRIT) technology sits amongst the promising new class of satellite-enabled tracking options that can be used to reduce and prevent marine pollution by tracking information from ships within 1,000 nautical miles (IMO, 2012, p. 64) of the coast (IMO, 2012).

Importantly, In 2006, the IMO adopted a resolution to promote the establishment of the Long Range Identification and Tracking (LRIT) to provide global vessel identification and tracking for the enhancement of maritime safety and security (International Maritime Organization MSC. 211(81), 2008). LRIT is a satellite-based system that detects information transmitted from mandatory shipboard equipment, Global Maritime Distress Safety System. Commercial vessels subject to the Safety of Life at Sea (SOLAS) Convention (i.e., mobile offshore drilling rigs, passengers, and cargo ships of over 300 gross tonnage on international voyages) are required to transmit their location along with IMO and Maritime Mobile Service Identity (MMSI) numbers every 6 hours. Further, LRIT provides support for maritime search and rescue as well as environmental protection and response. A major use of LRIT is the determination of overall traffic patterns, dominant offshore corridors and monthly variations thus limiting the possibility of collisions which could lead to environmental consequences (Maritime Security Partnerships, 2008).

3.10.0 Framework for Marine Environmental Monitoring

3.10.1 (OGP) Guidelines - Offshore Environmental Monitoring for the Oil and Gas Industry

The purpose of the OGP guidelines is to provide a consistent approach to monitoring of the marine environment. Environmental monitoring can offer essential support to obtaining access to resource areas and for continued access during the project duration. More essentially in order to establish baseline conditions, develop an understanding of potential impacts, to test hypothesis developed as part of the EIA and identify possible mitigation measures needed to achieve operational, environmental or regulatory goals and company specific requirements, environmental monitoring is necessary (OGP, 2012).

While these guidelines are voluntary, monitoring data are useful for the purpose of environmental management of normal industry operations such as drilling, facility planning, and production and decommissioning (OGP, 2012).

However regions do differ as regards oceanographic features, trophic structure in terms of variability and unpredictability of the marine environment. Therefore the environmental monitoring regulations do differ from country to country but having the mechanism in place to conduct environmental monitoring is of essence.

4.0 CHAPTER FOUR

4.1.0 National Framework for Marine Environmental Protection and Monitoring

As a general rule, the international frameworks for protecting and conserving the marine environment are as a result of offshore E & P activities are prescriptive jurisdiction by flag and coastal states. These frameworks are driven by means of rules of reference to 'generally accepted international rules and standards' (GAIRAS) (UNCLOS Art 211(2)). Thus countries generate legislations to cover loopholes in these international frameworks (Day, 2008). They create state parastatals that will come up with relevant policies that will complement the legal frameworks. However such policies must be purposeful and focus so as not to leave ambiguity of expectations. Therefore the yardstick should be clarity, consistency, predictability and equity (Chircop & Hildebrand, 2001).

Thus ocean governance and regulatory issues, in addressing the concerns of countries, are vested in centralized government agencies such as the Energy Ministry, Maritime Authority, Environmental Protection Agency, etc. These differing central government agencies respond to differing concerns, some of which may conflict with one another (Forrest, 2006). These agencies play a central role in implementing the staggering quantity of regulations that applies to deepwater oil exploration and drilling as well as any likely oil spills, even if one focuses only on the core regime and not on other related important issues, such as waste disposal and worker safety (Osofsky, 2013). Thus clear and definitive policies and regulatory framework are necessary for monitoring such environmentally susceptible industry.

4.2.0 The Environmental Protection Agency (EPA)

As a commitment to the environment, the Government of Liberia established the EPA in 2003 under the EPA Act. However, the agency became a fully functioning entity in 2006 with a board of directors and policy council. As the lead government environment protection agency, the EPA has been charged with the executive authority over all environmental activities and programmes relating to environmental management in Liberia (EPA, 2011b).

The entity is mandated to protect the environment and serves as a regulatory agency for the implementation of environmental laws and policies. The EPA Act and the Environmental Protection and Management Law (EPML) provide the legal framework for the EPA and thereby give the agency its enforcement powers (EPA, 2011a).

4.3.0 The Liberia Maritime Authority (LiMA)

In discharging its flag state, port state and coastal state functions, LiMA has some defined objectives. According to the new maritime act of 2010, the Liberia Maritime Authority objectives are:

- ✓ Administer, secure, promote, regulate, enforce, design and execute policies, strategies, laws and regulations, plans and programs relating, directly and indirectly to the functioning, growth and development of the maritime sector and national awareness;
- ✓ Collaborate, coordinate, and consult with the Ministry of National Defense (especially the Coast Guard), the Ministry of Justice (Police, Immigration, and other relevant law enforcement agencies), the Ministry of Finance (Customs), the National Port Authority (NPA), the Ministry of Agriculture (the Bureau of Fisheries), the National Oil Company of Liberia (NOCAL), the Ministry of Transport (MOT), and other government institutions engaged in activities related to the maritime sector which exist or may be established in the future, with a view to working together to promote the country's social and economic development associated with or growing out of the national maritime, marine and related programs and activities;
- ✓ Introduce and promote the enactment of national legislations in the exercise of the rights and discharge of the responsibilities of the Republic of Liberia under the United Nations Convention on the Law of the Sea of 1982 and any other maritime related international conventions, agreements and instruments (National Legislature, 2010).

4.3.1 Marine Pollution Prevention

As a flag state and member of the IMO, Liberia, through LiMA, is signatory to the following conventions:

1. The IMO International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

2. 1982 United Nations Convention on the Law of the Sea (UNCLOS), (Part XII: Articles 192 & 237) which addresses Protection and Preservation of the Marine Environment and gives basic obligations to prevent, reduce and control pollution from land-based sources; pollution from sea-bed activities subject to national jurisdiction; pollution from activities in the Area; pollution by dumping; pollution from vessels; and pollution from or through the atmosphere (Liberia Maritime Authority, 2014).

In 2013 (Executive Mansion-Liberia, 2013b), however a National Maritime Security Committee was established which could be a catapult for cooperation and collaboration amongst the lead entities implementing maritime functions.

4.4.0 The Ministry of Lands, Mines and Energy (MLME)

The Ministry of Lands, Mines & Energy was established by an act of Legislature to administer all activities related to land, mineral, water and energy resources exploration, coordination and development in the Republic of Liberia. In adherence to its statutory mandate, the Ministry formulates and implements policies and regulations in collaboration with other sector related agencies for the delivery of efficient services to the public from the land, mineral, water and energy sectors (MLME, 2013). But the task of offshore activities has since been delegated to NOCAL (Goanue, 2010) notwithstanding MLME still provides technical direction to the petroleum exploration program (Shannon, 2006).

4.5.0 The National Oil Company of Liberia (NOCAL)

The National Oil Company of Liberia was established in April 2000, by Liberia's National Legislature for the purpose "….of holding all of the rights, titles and interests of the Republic of Liberia in the deposits and reserves of liquid and gaseous hydrocarbons within the territorial limits of the Republic of Liberia, whether potential, proven, or actual, with the aim of facilitating the development of the oil and gas industry in the Republic of Liberia" (NOCAL, 2014c).

4.5.1 Environmental Obligation

NOCAL's documents commit it to managing operations in an environmentally sensitive and responsible manner. Accordingly, NOCAL has established a Safety, Health and Environment (SHE) department to uphold this responsibility. NOCAL has also stated that it will ensure compliance with applicable laws, regulations and international standards (NOCAL, 2014c).

4.6.0 The Liberia Petroleum Refining Corporation (LPRC)

In 1989 the Liberia Legislature passed a law granting exclusive rights to the LPRC for the importation and distribution of all petroleum products (National Legislature, 1989). The Liberia Petroleum Refining Company is a public entity, wholly owned by the Government of Liberia (GOL), with the mandate to procure and supply quality petroleum and petroleum products to the Liberian market (Goanue, 2010; Dukuly, 2012).

The Company has established a Health and Safety Environment Section and the personnel in that section also are member of the EPA's Environmental Protection Team that is constantly updated of environmental activities around the country (LPRC, 2012).

4.7.0 Environmental Protection and Petroleum Policy

This 2003 Act establishes the legal framework for the sustainable development, management and protection of the environment by the Environment Protection Agency in partnership with regulated Ministries and organizations and in a close and responsive relationship with the people of Liberia; and to provide high quality information and advice on the state of the environment and for matters connected therewith. Part VI, section 82 and Part VII, section 83 address protection of the coastal and marine environment and conservation of biodiversity respectively (National Legislature, 2003a). The Law requires EPA, in consultation with relevant Line Ministries, to establish a national environmental quality monitoring system(DAI, 2008) .

4.7.1 The National Environmental Policy

The National Environmental Protection Policy (2003) aims at promoting sustainable development and the general welfare of the state through conservation and judicious use of the national biological resources. The policy seeks to adequately protect human, flora, fauna, and their biological communities and habitats against harmful impacts, as well as to preserve the biological diversity. It further calls for the enactment or promulgation of environmental legislation and regulations for sound environmental management. Such regulatory regime may include issues on oil spill and marine waste management (National Legislature, 2003b).

The policy also stresses conducting and mainstreaming of environmental impact assessment in all necessary environmental activities in order to mitigate any adverse impact on the environment. It captures Environmental Impact Assessment (EIA) as a useful tool to facilitate the integration of environmental concerns in decision-making process. Additionally, the policy calls for public hearing programs of all developmental initiatives that may impact on the environment prior to execution of such undertaking (National Legislature, 2003b).

4.7.2 Diversity Conservation Policy

The overall goal of the National Biodiversity Strategy and Action Plan (2004) is to sustainably use biodiversity on a long-term basis to meet the needs of both the present and future generations. Pursuance to this, with regards to marine environment, the biodiversity conservation policy endeavors to regulate management and control the risks associated with the use and release of wastes, discharges that will impact the marine environment (NBSAP-Liberia, 2004).

4.7.3 National Energy Policy

The principal objective of the National Energy Policy (NEP) is to ensure universal access to modern energy services in an affordable, sustainable and environmentally-friendly manner in order to engender the economic, political, and social development of Liberia. The NEP addresses access, quality, cost, and institutional framework. These issues refer to the need for the various technologies and delivery options for energy products and services to be available, acceptable, affordable, and adequate (MLME, 2009).

4.7.4 National Petroleum Policy

The Petroleum Policy covers Liberia's governance of the upstream petroleum sector, including activities related to reconnaissance, exploration, development, production, transportation of non-refined petroleum and decommissioning, as well as provisions for the management of revenues generated by upstream petroleum. It, among other things, seeks to separate the commercial, policy, and regulatory functions of the National Oil Company of Liberia (HTC, 2012; Martor & Sellers, 2012).

Under the proposed reforms, the MLME shall assume responsibility for policy formulation, setting the terms and conditions of companies desiring licenses for exploratory drilling, exploration, and commercial development (MLME, 2009).

The assumption of the above functions by the MLME will require the amendment of the existing legislation establishing NOCAL and LPRC which are currently vested with these policy setting functions. The GOL shall create a new state-owned enterprise, the Liberia National Oil Corporation that shall take over the technical and commercial operational functions of NOCAL and LPRC that do not relate to the GOL's policy setting and monitoring roles. NOCAL's residual functions shall be undertaken by LNOC's department of upstream operations, and those of

LPRC shall be undertaken by LNOC's department of downstream operations. LNOC shall provide technical advice to the Government in determining licensing criteria and during the processing of applications for licenses and concessions (MLME, 2009).

The Policy established a Energy Regulatory Board (ERB) which shall inter alia be responsible for all environmental aspects in the upstream and downstream petroleum sector. Based on standards established by the Government, the ERB shall establish a monitoring system to ensure accuracy of gauges, quality of products, and compliance with safety and environmental regulations in the downstream sector and to minimize adverse impacts on health, safety and environment in the upstream sector (MLME, 2009).

4.8.0 Petroleum Legislation

The hydrocarbons law is the New Petroleum Law of Liberia enacted in 2002.

Liberia's legislature has enacted two pieces of legislation that could have a major impact on management of the country's nascent oil sector.

One is the Petroleum (Exploration and Production) Act 2013, which shall govern upstream petroleum activities, including the government's institutional framework, transparency rules and procedures for licensing. The other is the National Oil Company of Liberia (NOCAL) Act 2013, which shall define the role of the national oil company.

5.0 CHAPTER FIVE

5.1.0 Monitoring of Offshore Activities

In this chapter, options are explored to guard against any likelihood of spills. Hence consideration is given to the regulatory approaches. Mechanisms for monitoring the installations and vessels servicing or supplying the installations as well as transporting crude oil from the installations are examined. Means of securing the marine environment after the oil has dried up are as well investigated. The regulatory approach to effectively minimize injuries, fatalities, accidents, fires, explosions, collisions, pollution incidents, or damage to the marine environment with respect to all oil and gas operations on the continental shelf forms the base of the analyses. The regulatory approach needs to ensure that the respective agencies can promptly and thoroughly respond when innovative approaches are developed or when there are technological and environmental changes (NPC, 2011p. 21). Accordingly, pitching prescriptive approach against performance-based approach is thus a good place to begin.

5.2.0 Approach to Regulations: Prescriptive versus Performance-based

Approaches to regulation can be characterized as either prescriptive or as performance-based or goal-based (Dagg et al., 2011). Traditional prescriptive regime is founded on command, control, and compliance (Cooke et al., 2011 p.3). Prescriptive regulation sets specific technical or procedural requirements with which regulated entities must comply. The regulatory function focuses on ensuring conformity with specified requirements. On the other hand, performance-based or goal-based regulation identifies functions or outcomes for regulated entities but allows them considerable flexibility to determine how they will undertake the functions and achieve the outcomes. With this approach, the regulatory role involves defining the standards that companies must meet and using audits and inspections to ensure that they have the management systems in place to achieve the specified performance standards or goals (Dagg et al., 2011). Goals or targets to be met in such regulations are often qualified by “reasonable practicability,” and thus demand, from both the regulator and the duty holder, a correlation between action to risk and of cost to benefit (Maher et al., 2011, p.4). While many regulatory regimes for offshore drilling include elements of both approaches; interestingly, there is evidence of a general increase in the use of performance-based or goal-based regulation (Det Norske Veritas, 2010; Maher et al., 2011, p. 4).

Each of these approaches however has strengths and limitations (Dagg et al., 2011). For example, the main weaknesses of prescriptive regulation are that its inflexibility can impede the introduction of innovative practices and technology and reduce responsiveness to unique or changing circumstances (Dagg et al., 2011). On the other side, the weaknesses of performance-based approach include higher enforcement costs and the potential lack of transparency to the public. Furthermore, it may be difficult to interpret the desired performance levels defined in the regulations. Guidelines or interpretation documents may therefore be useful here though (Dagg et al., 2011). However, the advantages of performance-based regulations include:

- Performance-Based Regulations can better adapt to best practices and innovative technology.
- Performance-Based Regulations can be more cost-effective – the company can utilize the tools, resources, and management systems that are already in place rather than "reinvent the wheel."
- Prescriptive Regulations can be reduced to a "tick in the box" approach and are often unable to reflect the most up-to-date practices.
- With Prescriptive Regulations, implementers focus on achieving compliance, rather than focusing on effectiveness.
- With a Performance-Based approach, the duty holder must demonstrate that they have managed all the risks through a coherent and compelling safety argument (Dagg et al., 2011).

In any case the two approaches are not mutually exclusive concepts but rather can be used together in a balanced way to achieve the desired outcomes related to safety and environmental protection (NPC, 2011, p. 21) as prescriptive requirements are often needed to define the metrics for performance-based safety, so both control mechanisms can be important (Maher et al., 2011, p. 4).

5.3.0 Maritime Traffic Monitoring (AIS versus LRIT)

Regulation 19 of SOLAS Chapter V - Carriage requirements for shipborne navigational systems and equipment - sets out navigational equipment to be carried on board ships, according to ship type (IMO, 2014a). The Automatic Identification System (AIS) is a collision avoidance system. It broadcasts encoded messages in the VHF spectrum with ship-specific information. The transmission is automatic and can be collected by any receiver tuned to that VHF frequency.

The Long Range Identification and Tracking (LRIT) system adopted in May 2006 by the Maritime Safety Committee (MSC) of the IMO has become mandatory equipment for all internationally operating commercial ships over 300 GRT and mobile offshore drilling units (IMO, 2014d). Only ships which operate exclusively within range of shore-based VHF coast stations (20 to 30 nautical miles), Sea Area A1, are exempted from the LRIT obligation. The regulation is anchored in Chapter V of SOLAS on the Safety of Navigation and is mandatory for passenger ships, cargo ships, high-speed craft and mobile offshore drilling units (IMO, 2014d). The SOLAS regulation on LRIT is designed to improve maritime safety with the long range identification and tracking of ships (SPAWAR Systems Center Pacific USCG, 2014). Transmission of ship-specific information is not automatic but requires an active role by the participating vessels. Host nations can request LRIT information for all vessels destined for their ports (SPAWAR Systems Center Pacific USCG, 2014; IMO, 2014d).

Interestingly, Geographical Information System techniques can be used for the development of preliminary LRIT data analysis that can be useful tool for integrated management of offshore ocean areas. The traffic patterns emerging from this analysis will be most useful for decision-making (Koropatnick et al., 2012). For example, LRIT data-derived predominant traffic routes could be considered as part of an assessment of options for designating spatially defined “places of refuge” (IMO, 2014b; Chircop et al., 2006) such as conveniently located ports or other sheltered coastal locations (Koropatnick et al., 2012) for the purpose of avoiding serious oil pollution from such distress ships. Hence this system demonstrates how technology can be used to enhance performance-based regulations.

Primarily, all of these are outpost of the more familiar Safety of Life at Sea Convention and Convention on the International Regulations for Preventing Collisions at Sea.

5.4.0 Environmental Monitoring of Offshore Oil and Gas Activities

The three types of monitoring are compliance, surveillance, and effects monitoring (Curran et al., 2006; USEPA, 2014). Compliance monitoring is an 'end-of-pipe' approach to environmental monitoring and so it quantifies the impacts of industry on the environment to ensure that it abides by the applicable laws, regulations, permit conditions, orders, and settlement agreements. Surveillance monitoring enforces the compliance of industry and typically is performed by the regulator. Lastly, Environmental Effects Monitoring (EEM), is used to test that predictions made in environmental assessment of development projects remain within predicted and acceptable limits (Curran et al., 2006).

Some of the international frameworks for environment monitoring are:

- Kyoto Protocol on Climate Change
- Stockholm Convention on Persistent Organic Pollutants
- United Nations Framework Convention on Climate Change (UNFCCC)
- Vienna Convention (for the Protection of the Ozone Layer)

Seemingly, the first two forms of environmental monitoring are just some form of inspections to determine whether stipulated regulations are being observed by the industries.

However, while regulations often promote the development of technology to meet minimum acceptable limits, they are rather insufficient to improve industrial practice. Therefore, as minimum requirements environmental regulations alone may not at all prevent the impairment of the environment by industrial activities (Curran et al., 2006; IFC, 2007). In order to develop effective regulations and the technology required to ensure that the discharges meet the limits, it is necessary to understand both the nature and volumes of the discharges and the sensitivities of the receiving environment thus providing the knowledge for responsive decision making by operators and government (Doyle et al., 2008; CNSOPB, 2011). Hence, EEM is the essential component in controlling the impacts of industry on the environment and has been used in various countries since the 1960s. EEM helps to identify, quantify, and compare predicted environmental impacts of a proposed project to those observed after the project has been developed (Curran et al., 2006; IFC, 2007). The aim of EEM is to determine if impacts exist within predicted and acceptable limits and to trigger mitigation measures if they do not (Curran et al., 2006; IFC, 2007; OGP, 2012).

The wastes from oil and gas exploration and production operations can be generated from the oil and gas operations themselves and from the support activities. The major wastes, by volume, from drilling and production operations include:

- Produced water
- Excess water based drilling muds
- Drill cuttings
- Wastes that require handling during site abandonment (Gao, 1998; Doyle et al., 2008).

Minor wastes include:

- Deck drainage
- Tank bottoms
- Produced sand
- Excess chemicals and chemical containers
- Household wastes (Doyle et al., 2008)

Baring accidental events, the primary discharges of potential concern during exploratory drilling are drilling muds and cuttings. Modern muds are now essentially non-toxic although some pathological effects of barite (barium sulfate, a major constituent of drilling mud) have been reported during laboratory tests with scallops, shrimp, and flounder. The main environmental effects of the discharge of mud and cutting are probably some very localized smothering an/or alteration of benthic communities near the well (CNSOPB, 2011).

Conversely, accidental releases can result from a number of situations, including tank or pipeline ruptures, ship or boat accidents, and well blowouts. The material spilled can include crude oil, fuel oil, diesel, or bulk chemicals. At the end of the development of an offshore oil or gas field, the platform and associated equipment (e.g. wellheads) must be removed. In some areas any accumulated piles of drilling cuttings must also be taken away and disposed of when the field is abandoned (Doyle et al., 2008). Thus EEM provides:

- Early warning of aggravation of the environmental situation
- Preparation of forecasts for expected environmental conditions
- Verification of models for calculating environmental risk as a function of the existing and expected discharges from the offshore industry

- Verification of the laboratory-based research to increase the knowledge of possible environmental impacts of discharges from petroleum activity
- Assessment of the risk of damage to the environment and ecological effects
- Documentation of environmental status in the area of interest (Statoil, 2014)
- Mapping of vulnerable species / habitats

It thus helps to establish baseline data that are essential in marine biodiversity conservation and the enactment of regulations for the protection and conservation of the marine environment.

Explicitly, the three forms of EEM encompasses industry-led monitoring that is guided by government regulations, government-led monitoring, and cooperative monitoring between industry and government (Curran et al., 2006). In practice, in the oil and gas sector EEM is often a cooperative effort between industry and government. The scope of the cooperation of course varies according to the petroleum development regions (Curran et al., 2006; IFC, 2007) as the characteristics of the water bodies receiving discharged wastes vary widely (Doyle et al., 2008). Some of the important factors in determining sensitivity to the impact of discharges are:

- The chemical and physical characteristics of the waste
- Water depth
- Distance from shore
- Typical wind and wave forces in the area
- The presence of sensitive marine communities (Doyle et al., 2008).

Thus different jurisdictions regulate exploratory drilling differently and few jurisdictions have specific EEM regulations aimed at the single exploratory well.

6.0 CHAPTER SIX

6.1.0 Overview of Regulatory and Inspection Regimes of Norway, Canada and the UK

The offshore oil inspection regimes of Canada, Norway, and the UK are examined herein. Thus the mechanisms for better environmental monitoring in terms of decommissioning and maritime traffic are scrutinised.

Besides the comparison mentioned (see section 1.4.0), these countries are of keen interest equally because, in the 1970s and 80s, major accidents involving offshore rigs and platforms in the North Sea led the regulatory agencies in UK and Norway to replace their prescriptive regulations with performance-based rules (Lindøe, Baram, & Paterson, 2012), a regulatory framework that is an object of discussion within this research. For her part Canada uses a hybrid of the two approaches in her Arctic operations (Dagg et all. 2011; The Pembina Institute, 2011) and intense effort is being made to implement risk-based performance approach in her Atlantic operations (Office of the Auditor General of Canada, 2012).

Endeavoring therefore to derive a model that would enhance Liberia's offshore oil inspection and compliance, the methods of offshore monitoring and inspection in terms of exploration and production, decommissioning and maritime traffic monitoring are thus be investigated.

6.2.0 Norway

Norway's regulatory regime is mainly performance-based, supplemented with prescriptive elements (Dagg et al., 2011). The Petroleum Safety Authority Norway (PSA) was established as an independent government regulator in 2004 (Petroleum Safety Authority, 2010). It has five regulations which control safety of design and operation of offshore installations (Vinnem, 2007) which covers health, safety, conduct of petroleum activities, design and outfitting.

Under the Norwegian regime the industry is required by law to report incidents that could lead to severe accidents and to report occupational accidents. The PSA approach has been to develop a monitoring program covering all risk aspects within the PSA´s jurisdiction (Vinnem, 2010). The same requirements also apply to major onshore petroleum facilities, but the guidelines are somewhat different (Vinnem, 2014b). The offshore safety regime in Norway is therefore based on detailed risk assessments by the operators, with the regulator reviewing and accepting - rather than approving - these before implementation (Det Norske Veritas, 2014).

In cooperation with the industry, unions and with support from researchers the PSA prepares annual reports of incident levels. The report uses statistical, engineering and social science methods to provide a broad illustration of risk levels, including risks due to major hazards or to incidents that may represent challenges for emergency preparedness, and risk perception and cultural factors (Lindøe et al., 2012).

6.2.1 Decommissioning

Norway holds around 7% of total world offshore installations (Ferreira et al., 2004). However these installations are of high weight and structurally complex due to the severe weather conditions common to that region (Ferreira et al., 2004) and the high environmental standards imposed by the Norwegian authorities (Osmundsen & Tvetera˚s, 2003). Thus several Norwegian acts and regulations apply to decommissioning of offshore installations, and authorities in several sectors are therefore involved in the decommissioning process. Dismantling of installations offshore is considered to be part of "petroleum activities" and is regulated by the petroleum legislation. Once modules have been loaded on to a barge, they come under the rules for maritime transport. Demolition and recycling are regulated by other legislation (Climate and Pollution Agency, 2011).

Under the Norwegian Petroleum Act, a decommissioning plan, including an impact assessment and plans for public consultation, must be submitted between two and five years before an installation is finally taken out of use. The decommissioning plan must contain proposals for continued production or shutdown of production and the disposal of installations. Disposal may mean further use in petroleum activities, other use, complete or partial removal or abandonment of installations (Climate and Pollution Agency, 2011). Norway's international obligations are in line with those recommended by the OSPAR Convention (OSPAR, 2014).

In Norway, the government covers the largest part of platform removal costs and companies cannot deduct removal expenses in their corporate income tax as stated by Parente et al., (2006). But rather the State's percent share is equal to the average tax rate for each lessee over the lifetime of an installation considering that state contributions cannot exceed accumulated paid taxes but allowing for a correction factor if near the time of decommissioning of a specific platform the tax rate were to increase or decrease (Parente et al., 2006).

Hence, decommissioning obligations are not subject to ordinary tax treatment: they are maintained outside the tax system (Parente et al., 2006).

6.2.2 Maritime Traffic Monitoring

The Norwegian Vessel Traffic Service (VTS) is an international service that is managed by the Norwegian Coastal Administration to improve safety at sea and protect the environment. The maritime traffic control centres prevent incidents and accidents by monitoring and regulating ship traffic in defined areas along the Norwegian coast (NCA, 2014). The Norwegian Vessel Traffic Service (VTS) offers three types of services based on national regulations outlined in a REG-2009 which spans regulations relating to maritime traffic in specific waters, compulsory pilotage, and provisions pertaining to the marking of permanently located offshore units in the petroleum industry.

These services include:

1. Information Service (INS) which covers, inter alia, providing important information at the right time to support the nautical decision-making processes on board such as traffic situation, meteorological and hydrographic information.

2. Navigation Assistance Service (NAS) for vessels at risk of running aground, collision or uncertain of its position.

3. Traffic Organisation Service (TOS): this service is in place to prevent hazardous situations from developing and to ensure safe and efficient navigation through the VTS area. Furthermore, the Norwegian Coastal Administration utilises LRIT system to enhance maritime traffic mechanism in Norwegian waters (NCA, 2014).

6.2.3 Environmental Monitoring

Norway has the most innovative and effective Environmental Effects Monitoring (EEM) approach compared to other offshore petroleum development regions, an approach which is consistent, coordinated, and internationally recognized by OSPAR (UNEP, 2013; OSPAR, 2001; OSPAR, 2004). See a picture of Coccoliths formation in the North Sea, the destruction that unregulated drilling can do to the algae responsible for their formation (figure 8) and the EEM system (figure 9) in place to mitigate some of those types of problems.

The Norwegian system combines a 'flexible' and 'command-and-control' approach with economic incentives to encourage industry to adopt sound environmental practice. Under national legislation, offshore petroleum operators must provide environmental information, including annual reports, which are made available to the public. Reports produced by the industry include detailed environmental performance information, and typically contain more data than is required (UNEP, 2013; Curran et al., 2006).

Figure 8: Coccoliths which build up to form chalk. Layers of this rock are found in the the Ekofisk area's Tor formation in the North Sea. (Illustration: Robert W. Williams, NPD)

Also, through the health, environment and safety regulations for the petroleum sector, and through their permits, the Norwegian Environment Agency (NEA) sets limits on releases from oil and gas activities (Norwegian Environment Agency, 2014).

Emissions and discharges from the Norwegian petroleum activities are regulated through several acts, including the Petroleum Act, the CO2 Tax Act, the Sales Tax Act, the Greenhouse Gas Emission Trading Act and the Pollution Control Act. The processes related to impact assessments and approval of new development plans are cornerstones of the petroleum legislation (MPE & NPD, 2013).

Figure 9: Real time monitoring system located in the Norwegian Sea to monitor the effect of solid particles on corals (source: Statoil research project)

The NEA (formed as a merger of Norwegian Climate and Pollution Agency and the Norwegian Directorate for Nature Management) (NEA, 2014), the Norwegian Petroleum Directorate and Norwegian Oil and Gas (formerly the Norwegian Oil Industry Association), has established a joint database for reporting emissions to air and discharges to sea from the petroleum activities. All operators on the Norwegian continental shelf report emission and discharge data directly into the database (MPE & NPD, 2013).

6.3.0 Canada

The main legislation for the offshore oil and gas in Canadian Arctic offshore is the Canada Oil and Gas Operations Act (COGOA) (Government of Canada, 1985; Dagg et al., 2011). This Act regulates exploration for resources and operations of offshore activities. COGOA describes the responsibility of the operator to ensure worker safety and protection of the environment and outlines requirements to obtain a well approval. In Eastern Canada, through Memorandums of Understanding with Fisheries and Oceans Canada and Environment Canada, the Canada–Nova Scotia Offshore Petroleum Board (CNSOPB) and the Canada–Newfoundland and Labrador Offshore Petroleum Board (C-LNOPB) regulate drilling and productions off the coasts

of Nova Scotia and Newfoundland and Labrador, respectively (Fraser & Ellis, 2009; Dagg et al., 2011).

Assessment from regional environmental review bodies such as Environmental Impact Screening Committee, the Environmental Impact Review Board, the Nunavut Impact Review Board is required for any project that may have significant negative impact on present or future wildlife harvesting under the Inuvialuit Final Agreement (Inuvialuit Regional Corporation, 2014). The Review Boards recommend terms and conditions for mitigating any negative impact on wildlife harvesting to the National Energy Board (Inuvialuit Regional Corporation, 2014).

However, Environment Canada reviews any projects that fall under the Canadian Environmental Assessment Act (Government of Canada, 2012).

The National Energy Board (NEB) is responsible for regulating northern and offshore oil and gas exploration and development under COGOA. Thus the NEB assesses applications, issues authorization for well constructions, and is the primary response and coordination body in the event of an oil spill (Dagg et al., 2011).

The NEB approach is a blend of traditional prescriptive regulations with performance-based regulations. The Canada Oil and Gas Drilling and Production Regulations, updated in 2009, contain mostly performance-based regulations, while other regulations (in particular, the Canada Oil and Gas Installations Regulations, Canada Oil and Gas Geophysical Operations Regulations and the Canada Oil and Gas Diving Regulations) are mainly prescriptive (Dagg et al., 2011).

6.3.1 Decommissioning

One of the world's largest gravity base structures (GBS) was installed off the coast of Canada. It was designed to withstand impacts by icebergs and weighs approximately 1.5 million tones including ballast (Day, 2008). Now, as oil and gas fields begin to deplete their reserves, the concern has turned to the removal and disposal of these structures at the end of their producing lives (Day, 2008). The Canada Oil and Gas Drilling and Production (COGDP) Regulations (Government of Canada, 2009), which came into effect in 2009, are one of several sets of regulations implementing COGOA. The COGDP Regulations impose obligations in three

general areas on operators seeking to suspend or abandon a well, beyond being able to locate it readily. Operators must also (a) ensure isolation of all hydrocarbon bearing zones from the rest of the environment and prevent formation fluid from escaping, (b) subsequently monitor well integrity to prevent pollution and (c) clear the seafloor so that other commercial uses of the sea are not impaired (Government of Canada, 2009; IEE, 2010).

The COGDP Regulations specify an execution plan and schedule, safety plans, environmental plans and contingency plans (Government of Canada, 2009).

Abandonment of fixed offshore production installations is subject COGOA regulatory regime and Canadian Environmental Assessment Act (CEAA). These provide that, in addition to thorough environmental assessment, where removal is a condition of a development plan approval, “the operator shall incorporate in the design of the installation such measures as are necessary to facilitate its removal from the site without causing a significant effect on navigation or the marine environment” (Government of Canada, 2009). The Operator shall also ensure “that, on the abandonment of a well, the seafloor is cleared of any material or equipment that might interfere with other commercial uses of the sea” (Government of Canada, 2009; IEE, 2010). Costs for decommissioning are covered by escrow accounts which allocate upfront capital and are conferred with deductions from companies’ tax payment for ex-post expenses (Parente et al., 2006).

6.3.2 Maritime Traffic Monitoring

Canada has the world's longest coastline with 243,000 kilometers on the Pacific, Arctic and Atlantic oceans, as well as the Great Lakes. Transport Canada (TC) keeps a watchful eye over ships transiting waters under Canadian jurisdiction through its National Aerial Surveillance Program (NASP). It is the lead federal department responsible for preventing pollution from ships and the NASP is one method by which this is achieved (Transport Canada, 2014). All of these functions are derived from a regulatory framework based primarily on the Canada Shipping Act (CSA) and the Safety of Life at Sea Convention (SOLAS) (Canadian Coast Guard, 2008).

The Coast Guard also has successfully implemented the national AIS project, building AIS shore infrastructure so that vessel data is now collected for virtually the entire east and west coasts and the Great Lakes – St. Lawrence Seaway (Canadian Coast Guard, 2011).

In addition, the Maritime Region's and Coastal Management Division (OCMD) of Fisheries and Oceans Canada (DFO) has developed spatial assessment and decision support tools, including human use maps (Horsman & Breeze, 2006), to facilitate marine conservation, sustainable development, and to identify and manage conflicting and compatible uses of ocean resources in support of integrated coastal and ocean management. The entities have introduced LRIT with GIS to enhance access to remote monitoring systems to track offshore vessel traffic and as well to improve spatial and temporal patterns of commercial shipping beyond the coastal zone (Koropatnick et al., 2012). In line with its marine conservation impetus, the IMO approved a proposal from Canada in 2002 to change the shipping lanes in the Bay of Fundy to protect the North Atlantic right whale from ship strikes (Maes, 2008).

6.3.3 Environmental Monitoring

In the main Canadian offshore oil and gas activities areas of Nova Scotia and Newfoundland and Labrador, there are EEM's in place for ensuring Operators implement programmes that provide for protection of the environment during all phases of offshore petroleum activities, ensuring that environmental hazards are properly identified and that the associated risks are assessed, mitigated and managed (Curran et al., 2006; CNSOPB, 2011). EEM therefore involves scientific monitoring of the effects of production activities, and occasionally exploration activities, on specific components of the surrounding environment (Curran et al., 2006; CNSOPB, 2011).

All environmental assessments (EAs) for petroleum activities are undertaken in accordance with the Canadian Environmental Assessment Act (CEAA). EAs are a tool used by the regulatory bodies to assess the impact of proposed activities through specific predictions of environmental effects. Some of these predictions are later verified using EEM programs designed to collect data on the known relationship between activities and the receiving environment (CNSOPB, 2011).

The EEM process framework was developed by the regulatory boards, in conjunction with the Canadian Environmental Assessment Agency, Fisheries and Oceans Canada (DFO), and Environment Canada, in order to strengthen cooperation and coordination between government, regulators and industry when conducting EEM programs for the offshore oil and gas sector (Curran et al., 2006; CNSOPB, 2011).

6.4.0 United Kingdom

6.4.1 Inspection Regime

As a means of avoiding a repeat of the Alpha piper incident (Office of The Inspector of Transport, 2012) the U.K. uses a performance-based approach to inspect offshore E & P activities (Dagg et al., 2011, p. 20). Within the U.K. regulatory regime the onus is on the duty holder to demonstrate that whatever provision (procedure, standard, system or hardware) is in place meets the goal defined within the regulations. Hence, if an international standard is used in the design of a safety critical element, the Duty Holder must be able to demonstrate that the resulting design meets the required performance standard (Dagg et al., 2011, p. 33).

The UK's goal-setting safety regulations allow a flexible approach in the choice of technology and systems to meet safety standards. The safety regime therefore requires a systematic approach to the identification of hazards and through the application of quality engineered solutions and systems hence ensuring that risks are reduced to a reasonably practicable level (Paterson, 2007; Paterson, 2011; Lindøe et al., 2012). However other industry analysts still argue that a fundamentally prescriptive environmental framework applies to the offshore industry in the UK (Ifesi, 2003).

The Department of Trade and Industry (DTI) is the lead regulator. Other agencies (e.g. the Environment Agency, the Scottish Environmental Protection Agency) regulate offshore activities within a three-mile coastal limit. DTI requires companies operating in offshore areas to obtain licenses at the exploration and production stages. These licenses include conditions relating to environmental protection (Ifesi, 2003). The DTI works with industry to obtain information for measuring the environmental performance of offshore petroleum operations. The 'flexible' regulatory approach adopted in the United Kingdom allows individual operators to maintain monitoring programs and are subject to visits from regulators to ensure compliance of operations within government regulations (Curran et al., 2006). Thus DTI carries out regular monitoring and surveillance flights (Ifesi, 2003).

The UK regulatory picture therefore features an active relationship with the industry association, the United Kingdom Offshore Operators Association (UKOOA) (Ifesi, 2003).

6.4.2 Decommissioning

The UK Continental Shelf (UKCS) has been a scene of large amounts of oil and gas production since the 1970s with production reaching its peak in 2000 though it has since decline (Royal Academy of Engineering, 2013). Over 2,300 kilometres of pipeline and 130 installations are scheduled for decommissioning over the next decade. This includes floating, production, storage and offloading vessels (FPSOs), small normally unmanned platforms in the southern North Sea, and large integrated facilities in the central and northern North Sea (Oil & Gas UK, 2013).

The Department of Energy and Climate Change (DECC) is responsible for most of the regulations related to decommissioning of UK offshore oil and gas installations and pipelines using legislation under the Petroleum Act 1998, amended in the Energy Act 2008. Other agencies including the Health and Safety Executive and the Scottish Environment Protection Agency are also responsible for certain aspects of decommissioning. The UK's regime is based on the Convention for the Protection of the Marine Environment of the North- East Atlantic ("the OSPAR Convention") (OSPAR, 1998). Decommissioning provisions cover concrete-based structures, vertical structures, dimensions of partially removed structures and safety zones (Royal Academy of Engineering, 2013).

As oil companies are taxed on their earnings from oil and gas production in the UK, decommissioning expenditures are therefore made against taxable earnings, thus giving oil companies the ability to obtain deductions for ex-post removal expenses in their corporate income tax (Parente et al., 2006).

6.4.3 Maritime Traffic Monitoring

The Maritime and Coastguard Agency (MCA) is responsible for UK maritime policy and the coastguard system. The MCA provides a 24/7 maritime search and rescue service around the UK coast and in the UK International search and rescue region, and also has a range of other responsibilities which include real-time tracking and monitoring of shipping movements along the UK coastline and EEZ waters from the shore using an AIS network around the UK coast (MCA, 2014). The MCA as well responds to pollution from shipping and offshore installations

(Office of The Inspector of Transport, 2012; MCA, 2014). The MCA also broadcast navigational warnings and issues marine guidance notices (Office of The Inspector of Transport, 2012).

One of such marine guidance notices is the Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004 (Statutory Instrument No.2004/2110), as amended, which give legal effect in the UK to Directive 2002/59/EC, as amended, establishing a Community vessel traffic monitoring and information system.

With this Directive the UK targets enhancing the safety and efficiency of maritime traffic and improve the response of authorities to incidents, accidents or potentially dangerous situations at sea (MCA, 2004).

UK port authorities are responsible for forwarding relevant information to MCA for capture in the CERS (MCA, 2004).

6.4.4 Environmental Monitoring

The UK Oil and Gas Directorate, under the auspices of the DTI which is the regulatory agency in the UK liaise with industry to obtain information for measuring the environmental performance of offshore petroleum operations. It also carries out regular monitoring and surveillance flights. Environmental monitoring is not conducted by a third party and environmental performance reporting by offshore operators is voluntary. However external factors (e.g. stakeholder perception) are the incentive for voluntary reporting (Ifesi, 2003; Curran et al., 2006).

It is not legislated that environmental effects monitoring information be a public document, although the United Kingdom Offshore Operators Association (UKOOA) have encouraged members to abide by voluntary codes regarding environmental performance reporting beyond legislated requirements (Curran et al., 2006). A Sustainability/UNEP initiative has also been developed in the United Kingdom to encourage higher reporting levels and more comprehensive environmental reports for inter-company comparison (Offshore Oil & Gas Environment Forum, 2012). Participation in the program is voluntary, while external factors (e.g. stakeholder perception) are the incentive for participation(Curran et al., 2006).

7.0 CHAPTER SEVEN

7.1.0 Analyses of Statutes of Liberian Government Agencies involved with Offshore E & P and Questionnaire

With a view of analyzing possible shortcomings in Liberia's offshore regulatory regimes, questionnaires (see appendix 2 & 3) were sent to the NOCAL, EPA and LiMA. Moreover the statutes of the respective entities were collected and analyzed for cases of conflicts and gaps.

7.2.0 Constraints

A basic constraint is the paucity of available data especially for the oil sector in Liberia. While there is an institution that is required by law to be the producer and repository for the statistics (qualitative and quantitative) of all core government activities, the focus has regrettably evaded the oil industry. However data on marine incidents/accidents within Liberia's EEZ was collected from MRCC-Monrovia.

7.3.0 Introduction to Questionnaire

For the purpose of this work, questionnaires about some specific mechanisms/policies (see appendix) were handed to Senior Personnel of the above mentioned entities, six persons arranging from Managers to Inspectors and the responses are thus tabulated.

7.4.0 Data from the Questionnaire (Table 1)

Entity	Domestic Reg. Environmental Inspection	Frequency of Inspection	Method of Inspection	Environmental Monitoring	Decommissioning Regulations	Decommissioning to a Navigational Depth	Any other applicable Regulations For redundant offshore installations
NOCAL	NOCAL Act, NEP, NNPP	Not definite	undefined	None	None	Somehow	Somehow
EPA	EPA Act, NEP, NNPP,NBSP , EPML	irregular	NA	Compliance monitoring	None	Somehow	Yes
LiMA	LiMA Act, NEP, EPML	Not definite	undefined	NA	None	None	None

Clarity to the responses is given in the below chart.

Table 2: Clarity to Responses

NATURE OF RESPONSE	CONTEXT
Compliance Monitoring	Persons agreed that it exists
Irregular	Persons asked from said entity were sure of the period for inspections but the inspections did not have a definite sequence
NA	Not applicable to the particular entity because of its mandate
None	There was agreement that such did not exist at the time of the interview
Not definite	There was agreement that there exists some form of inspection but at least one of interviewees from the entity was not sure of the sequence
Somehow	At least one of the interviewees from the entity answered that the entity has procedures for such
Undefined	interviewees could not state whether the inspection is prescriptive or performance-based.
Yes	interviewees answered in the affirmative

As can be seen from the answers (see Table 1) only the EPA and NOCAL have some regulations dealing with redundant oil installations. While there are domestic regulations giving effect to international conventions on marine environmental monitoring; only the EPA was definite in stating that it performs some sort of irregular inspection of the marine environmental activities. The other two entities were not definitive on the frequency of their inspections.

7.5.0 Observations from Policy and Statutory Documents

Overall vitality of continental shelf resource development process can be affected as much by inertia in the regulatory arena as by stagnation in the technology. Hence, prudent development of offshore oil and gas resources requires effective management and safe operation of systems

in conjunction with a coordinated regulatory process that can quickly adjust to changing technological capabilities, environmental conditions and offsetting conflicting regulations.

Even after the establishment of an independent regulator that will eventually absorbed the regulatory role of the NOCAL (which will be responsible for the State's commercial interests) leadership of the overall management is expected to remain within the Ministry of Lands Mines and Energy (MLME), which is the Cabinet-level agency ultimately responsible for overall policy formulation as stated in the New Petroleum Policy (2012).

7.6.0 Complexity of Overlapping Statutes and Regulatory Agencies

Table 3 summarizes the intricate confluence of national statutes and regulatory agencies that affect offshore oil and gas developments. The complex regulatory processes pervade several statutes and different national agencies. Prior to the establishment of NOCAL, MLME's Division of Hydrocarbons played the lead role in negotiating agreements with the handful of international oil companies that came to Liberia with the intent of securing upstream petroleum exploration and production contracts. While MLME still heads regulatory oversight, at times conflict arises over awarding of contracts and environmental responsibilities. The New Petroleum Policy does not make Table 3 any simpler and the complex and overlapping regulatory purviews can be expected to continue.

Table 3: Confluence of National Statutes and Regulatory Agencies

Regulatory Authority & Domestic Law		Offshore Oil and Gas Project Phase			
		Pre-Development Phase (Exploration)	Development Phase (Design, Construct)	Production Phase (operations)	Divestiture Phase (Decommissioning)
NOCAL	NOCAL Act, New Petroleum Law				
MLME	New Petroleum Law				
LiMA	LiMA Act 2010; Maritime Reg. Title 21				
EPA	EPA Act				
Ministry of National Defence (Coast Guard)	National Defence Act of 2008 (Sections 2.3(c) and (d)				

Symbol	Meaning
	Explicit
	Implicit

The conflicting goals of the EPA and other agencies appear to be a hurdle to effective environmental monitoring. Table 4 depicts these conflicting issues. Clarifications on division of responsibilities and authorities are needed for certain overlapping authorities and responsibilities among the NOCAL, EPA, LiMA and MLME. For example, responsibility over the regulation of discharges and emissions from offshore activities in all areas of the Liberian deepwater should be defined accordingly.

7.7.0 Examples of Conflicting Goals between NOCAL and other agencies

Table 4: Conflicting Goals between NOCAL and other Agencies

Examples of Conflicting goals	Purpose or issue	NOCAL regulatory authority
Exploration (MLME is in charge of hydrographic activities)	Overseeing seismic survey activities	NOCAL Act 2000, § 4 & § 5(a), New Petroleum Law of Liberia 2013, § 2.4.6
Inspections (LiMA and EPA also have statutory responsibilities). NNPP empowers the ERB	Inspections for compliance with relevant int'l conventions as regards to protecting the marine environment	New Petroleum Law of Liberia 2013, § 4.6; (New Petroleum Law of Liberia 2013, §2.2 also empowers EPA)
Transportation of Hydrocarbons/Construction of Pipelines (By law LiMA is the lead authority on marine transportation; MLME and MoPW are also authorities here. Also ERB	Movement of the Hydrocarbons from place of production to other facilities	New Petroleum Law of Liberia 2013, § 8.1
Oil spill response (the coast guard has statutory control over Liberian waters), ERB	Mobilizing resources for prompt intervention in the event of a spill	New Petroleum Law of Liberia 2013, §2.4.3
Decommissioning (EPA is the lead authority for any EIA's, ESIA's, ESMP's and LiMA stands as the lead authority in charge of all crafts on Liberian waters). But NNPP empowers ERB	Returning the marine environment to a sustainable state	New Petroleum Law of Liberia 2013, §7.7

7.8.0 Decommissioning

The National Petroleum Policy and New Petroleum law fall short of stating which entity has specified obligation as regards to decommissioning.

The Petroleum Law specifies that an environmental impact study should be part of every contract The EPA, however, was not included in the first and second bidding rounds, another example of partial implementation of the Petroleum Law (Kamau, 2011). If this trend continues, it could be parsed and debated that the EPA might not be part of any future decommissioning plans.

The LiMA oversees the areas of safety of navigation, protection of navigational aids, preservation of the environment and protection, reduction and control of pollution and sanitary laws but such functions seemingly cross the boundaries of other State entities Liberia National Coast Guard, EPA and the Ministry of Health and could also transverse the would-be Energy Regulatory Board (ERB). Any formal with State entities on the marine environment is virtually non-existent. It remains to be seen whether LiMA might cooperate with other entities in times of decommissioning.

7.9.0 Oil Spill Response Arrangements

The Ministry of Defence, Office of Coast Guard Affairs is charged with the protection of coastal waters and fish resources, and is the focal point for organising spill response (ITOPF, 2000) although it has no specific statutory responsibilities (National Legislature, 2008). The LiMA, LPRC, MLME, MOA, MOH and the MICAT may also play a response role. Interestingly, the Liberia National Ports Authority is responsible for clean-up within the ports.

No oil spill contingency plan exists in the country. However in 2010 EPA played host to an IMO, GIWACAF and IPIECA-led initiative (IMO/IPIECA, 2010) aimed at developing a contingency oil spill plan for Liberia.

The Liberia Maritime Regulation title 21 addresses ship-source pollution and the dumping of wastes in the marine environment and penalties for such violations (National Legislature, 2002).

7.10.0 Compliance Inspections and Monitoring

The EPA of Liberia mainly performs compliance monitoring. The EPA environmental inspectors conduct environmental inspections across the country. EPA employs voluntary compliance mechanisms including self-reporting and self-monitoring (EPA, 2011a).

Liberia is a signatory to both the United Nations Framework Convention on Climate Change (UNFCCC) (UN, 1992a) and the Vienna Convention (for the Protection of the Ozone Layer) (UNEP, 1985) , Stockholm Convention and to most emissions and chemicals-related Multilateral Environmental Agreements (MEAs) (EPA & UNDP, 2013), but has not signed the Kyoto Protocol (UN, 1992b). Therefore Liberia is not legally bound to any international targets. However, as a matter of CSR a consideration of the implications for direct contribution of the industrial activities to greenhouse gas emissions, taking account of the International Finance Corporation Performance Standard 3 (IFC, 2006; URS, 2013; EPA & UNDP, 2013).

More essentially, the management of hazardous and toxic wastes remains an issue of major concern, considering the necessary infrastructure (e.g. disposal sites/hazardous landfill sites) to accept such wastes are not available, and best practices and technologies for determining their impacts on the marine environment are not being employed (EPA & UNDP, 2013).

However, the promotion and implementation of all relevant international instruments pertaining to chemicals and hazardous waste should be encouraged to ensure that necessary procedures are put into place and national commitments can be met

The fact that there is almost no laboratory capacity in place to support monitoring activities jeopardizes the enforcement capacity of inspectorates (EPA & UNDP, 2013).

Besides the EPA, NOCAL says that it conducts environmental monitoring (NOCAL, 2014b) but from all indications what it does is that type of environmental monitoring that falls under inspection.

The capacity of certain private sector entities in the area of Safety, Health and Environmental (SHE) can be considered advanced, in particular related to practices in the area of chemicals and waste management. In such cases, the EPA can use third parties to be charged of EEM programs as is done in Norway.

7.11.0 Maritime Traffic Monitoring

Generally maritime surveillance is covered under the 2010 LiMA Act (National Legislature, 2010). The Government of Liberia, in compliance with the global SAR plan, created the national legal basis for hosting one of five regional MRCCs when it enacted 'the National Maritime Search and Rescue Centre' Act in 2008 (IMRF, 2014). As a consequence the Monrovia Regional Maritime Rescue Coordination Centre (MRMRCC) was established for mainly coordinating maritime search and rescue activities (IMRF, 2014). Some coastal surveillance and fishing vessels monitoring are respectively conducted by the Bureau of National Fisheries and the Liberia National Coastguard (BNF, 2014).

Liberia has the following systems for vessel monitoring and tracking:

- VHF DSC;
- FLEETMON AIS;
- EXACTEARTH AIS;
- Vessel Monitoring System (VMS);
- Long Range Identification and Tracking System provided by LISCR through the Liberia Data Center, Pole Star; but not currently used to monitor maritime traffic in Liberian waters
- as well as the INMARSAT mini-c which uses the Enhanced Group Calling for meteorological/Navigational warnings and forecasts (Liberia Maritime Authority, 2012).

As of 2014 the MRMRCC has conducted some SAR operations that otherwise would have negatively impacted the marine environment. This topic is further discussed below.

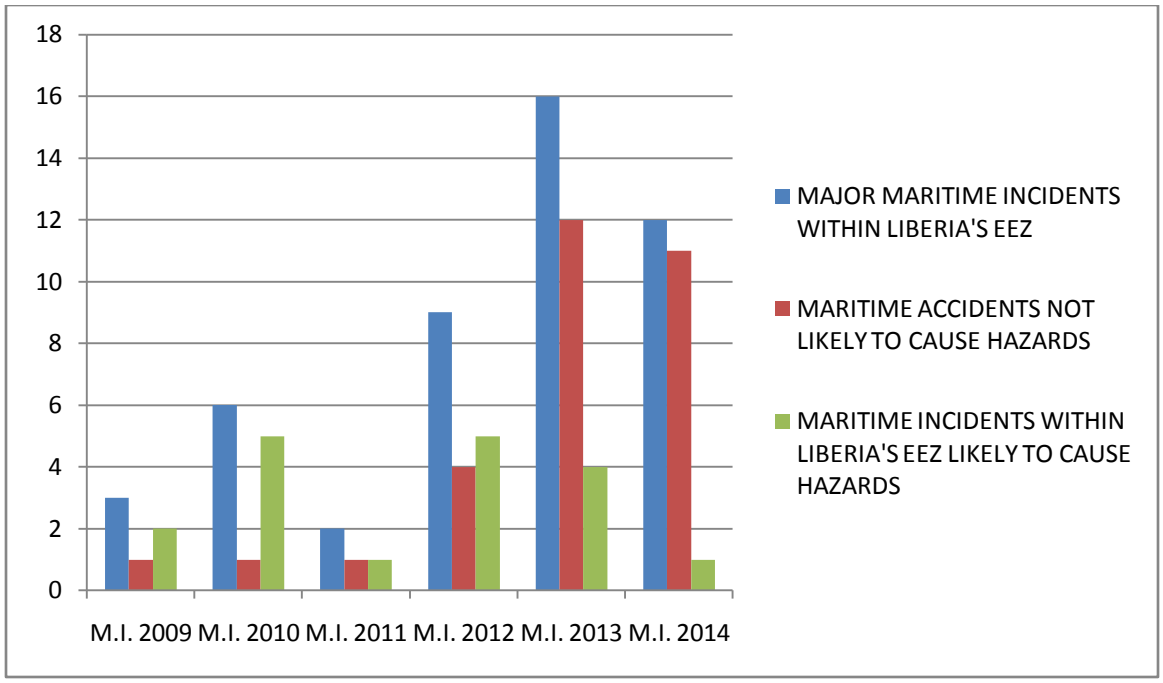

Figure 10: Graph of Maritime Incidents, Liberia (Data from MRCC-Monrovia)

It is clear from the graph that there have been marine incidents in Liberia's EEZ that has the potential of causing marine environmental disasters but these have been adequately contained by the MRMRCC. However as there will be an increase in maritime traffic (see figure 13) as a result of offshore oil activities, increase maritime surveillance would be required.

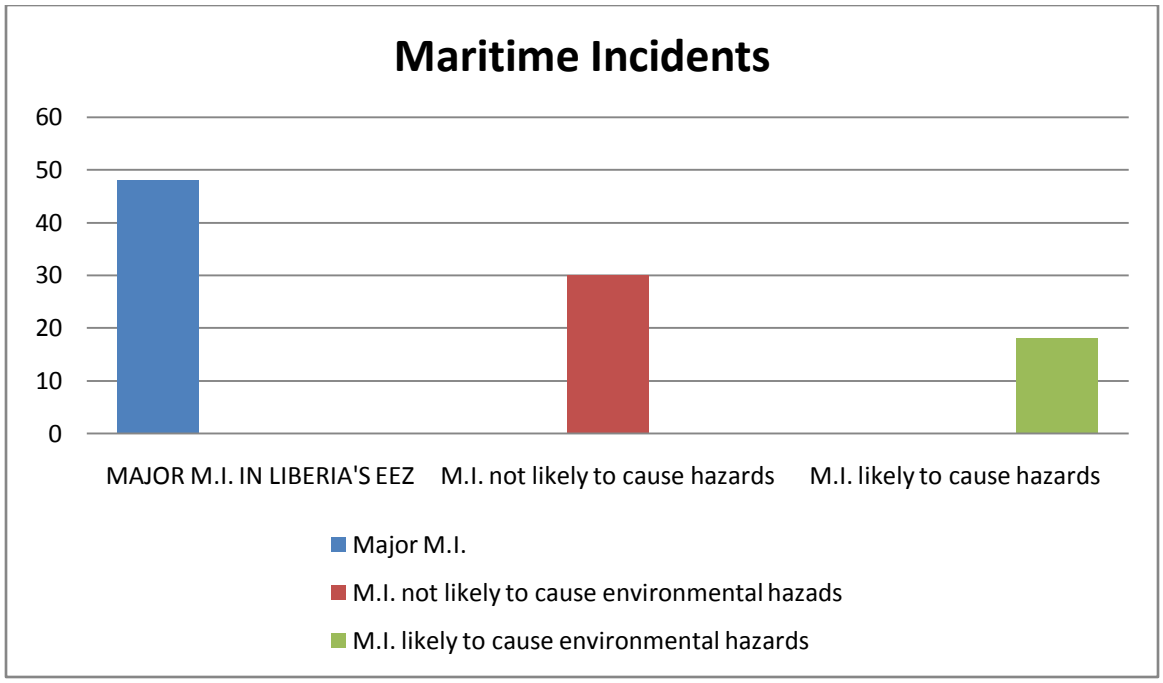

Figure 11: Types of Maritime Incidents, Liberia (Data from MRCC-Monrovia)

Of the total 48 maritime incidents that occurred within Liberia's EEZ from 2009 to 2014, a total of 18 which constitutes 37.5% were likely to cause environmental hazards. These included vessels that were for example drifting as a result of engine.

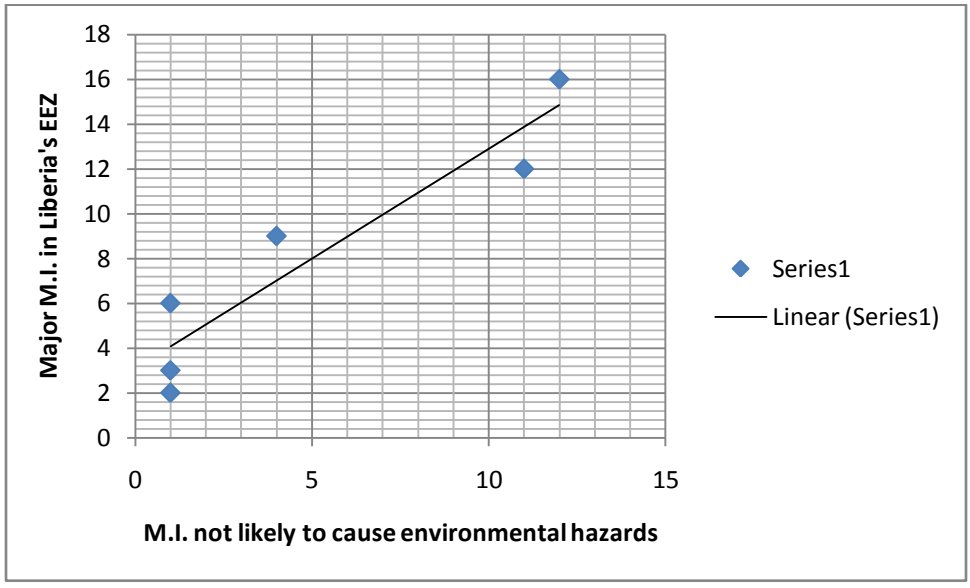

Figure 12: Probability Depiction

The data from the MRCC-Monrovia as scrutinized (see appendix 3) shows an 84.6% chance of maritime accidents that occurred in the country's EEZ not likely to cause marine environmental hazards. However with a potential increase in maritime traffic as a result of offshore activities there could be a decrease in such probability.

Figure 13: Maritime Traffic in Liberia's EEZ (Courtesy of MRCC-Monrovia)

Figure 13 shows the situation of maritime traffic in Liberia's EEZ. This is one of several patterns that show present reality.

8.0 CHAPTER EIGHT

8.1.0 Environmental Evaluation Framework

In order to determine the effects of a project on the environment, there are 'sustainability assessment tools' that can be used to assess such impacts. Some of such sustainability tools or frameworks are SEA, ESIA/EIA and DPSIR. These frameworks provide the basis for the "sustainable development" paradigm in various economies at various levels, and implicitly argue for the rights of future generations to raw materials (natural resources) and to vital ecosystem services. Strategic Environmental Assessment has often been used to evaluate the long-term effect of a project on the environment and is normally governments driven. Environmental Social Impact Assessment looks at the short term negative impact that a project might have on the environment and such assessments are required to be subjected to government authorities for a project to be implemented by the interested parties. One of the key current conceptual frameworks in widespread use, the Driver-Pressure-State-Impact-Response (DPSIR) framework, has developed over the last few decades and is used as the basis for the majority of conceptual approaches addressing pressure-state change links. The DPSIR framework provides some structure to the way that complex issues can be conceptualised in a standard way (C. Smith et al., 2014). By emphasizing the importance of causality, it veers into giving a clear picture of the initial state of the environment (Waheed et al., 2009). Exceedingly, it identifies gaps that occur in the effort to ensure that policy-making is evidenced based. Thus it is being used by EU countries to gauge the impact of legislation and policies on ameliorating the effects on the environment for which they were set. It has now being adopted by Canada in assessment its policy instruments on the Great Lakes (SOLEC, 2013). As this framework has gained wide acceptance, how it can therefore be applied to the offshore E&P sector is herein examined.

8.2.0 Application of the DPSIR Framework to Offshore Exploration and Production

The potential risks underlining the hypothesized lapses in the country's offshore regulatory framework can be assessed using the DPSIR model. The model, after being developed from an OECD approach which aimed to link pressures (created by human demands of the system) with the state changes and impacts, the systemic DPSIR framework encompasses Drivers, which are the key demands by society and creates Pressures, and recognizes that State Changes and Impacts then require a Response by society (Svarstad et al., 2008; Atkins et al., 2011). The

DPSIR framework therefore gives a structure to present these indicators needed to enable feedback to decision makers (Elliot, 2002).

Essential to the framework is the definition of the boundary of the system it describes, the demarcation of which depends on the particular issue of interest and its conceptualisation (Svarstad et al., 2008). The DPSIR approach can therefore be applied to any particular stressor in the marine environment, for example to offshore oil installations (Fehling, 2009).

In the case of offshore E&P, the overall drivers are the desire for fossils: economic growth, increased global trade and fossil fuel dependency, all leading to increased oil demand.

This section first identifies the overarching drivers to be considered when developing potential responses to offshore accidents. Second, a general classification of responses that are directed at Drivers, Pressures, and the State of the environment and Impacts are respectively identified.

8.2.1 Drivers

Hasselström and Cole posits that (2013) the threshold in identifying potential responses to offshore accidents is identifying the drivers behind the risk of such accidents. They also emphasized that policy measures should take into account the different factors leading to operational (including intentional) and accidental spills. Thus different drivers entail different policy responses. In order to account for various types of responses, the drivers are therefore divided into two categories: underlying drivers and direct drivers (Hasselström & Cole, 2013):

• U**nderlying drivers would include increased population,** economic growth, increased global trade and fossil fuel dependency, all leading to increased oil demand. Together with the global preference for relatively inexpensive seabased transport, this will lead to the **continued growth of the maritime transport sector**, and a subsequent increase in the risk of offshore accidents/incidents (Hasselström & Cole, 2013).

• By **direct drivers: drivers** that directly imply a risk for accidents are generated by the underlying drivers, for example:

■ **Tanker traffic and OSV's** transporting large amounts of oil and offshore installations supplies/refuse (e.g liquid mud, wastes, etc).

■ **Non-tanker traffic** including cargo and passenger transport vessels, fishing vessels and cruise ships all using the congested space. These vessels carry large amounts of oil in their fuel tanks, and given increased global trade;

■ **Bunkering activities** include the loading and unloading of cargo and oil products, which can lead to accidental spills (Elliot, 2002; Hasselström & Cole, 2013).

For Hasselström and Cole the universe of possible policy measures for mitigating offshore accidents may fall into three general categories according to Hasselström and Cole: Measures targeted at (1) drivers, (2) pressures, or (3) the state of the environment. However as accidents are inevitable policies aimed at impacts are included in this dissertation.

8.2.1.1 Measures targeted at Drivers

Measures directed at drivers aim to lessen the risk of accidents by limiting the direct or underlying drivers themselves. For example, these measures could be in terms of:

• **Transition to natural gas fuel for non-tankers and non-osv's transiting the operational area.** This reduces the risk for oil spills from sea-based transports. A policy instrument that could accomplish this might be creating economic incentives for this transition. As there are several international frameworks, for example within the Liberian context, the Abidjan Protocol which could support such measures, this type of measure should be implemented on an international level, due to the international character of the shipping market.

As it requires significant investment in port infrastructure and should be viewed as a long-term measure (Hasselström & Cole, 2013).

8.2.2 Pressures

The pressures resulting from the activity mainly include the construction of fixed and mobile structure, increase maritime traffic, bunkering activities, dredging and disturbance through noise and vibration of the structures once operating (Elliot, 2002). Large quantities of pollutants are released to air, sea and the seabed during E & P activities. This happens at all stages from oil and gas field operation to pipeline construction, transport of oil and gas, and onshore processing. Furthermore, when oil fields are exhausted, decommissioning of installations and equipment would result in further releases of pollutants and generate waste that must be properly disposed of (Norwegian Environment Agency, 2014).

8.2.2.1 Measures directed at Pressures

Measures directed at pressures focus directly on the goal of reducing accident probability or improving spill response, given existing traffic patterns. For example, these measures may include:

• **Limiting tanker traffic in sensitive areas e.g fishing zones and MPA's.** If sensitive ecological areas are protected through limiting tanker traffic, the risk of oil spills in these areas is reduced. For example, policies that regulate MPA's may be used as an instrument to achieve this measure. The implementation of these measures may be done on a national and regional level, but may require approval by the IMO (Hasselström & Cole, 2013).

• **Improved technical standards.** Requirements for double-hulled ships and separated ballast tanks would fall into this category. This reduces the risk for spills, or reduces the likely amount of oil that is spilled. Further, technical rules may require mandatory navigation equipment in certain areas.

Policy instruments that stimulate these improvements are usually international regulations (Hasselström & Cole, 2013).

• **Improved spill response capacity.** Drafting a National Oil Spill Contingency Plan as has been initiated (see p.) that will incorporate the concerns of coastal communities is crucial for limiting impacts. Also the training of staff responsible for cleanup or improving international collaboration may result in a more efficient response. An international governance umbrella that regulates response capacity is the IMO's International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC). However, the actual implementation needs to be done on a regional, national and local level (Hasselström & Cole, 2013),

• **Safer navigation procedures.** For example, traffic separation requirements, regulations concerning navigation equipment, routeing schemes and other operative procedures may result in a reduced risk for collision. The IMO Convention on the International Regulations for Preventing Collisions at Sea (COLREG) provides an example of international governance that addresses navigation procedures and in general, policy instruments in this field need to be internationally anchored. However, the monitoring and enforcement of existing regulations may be improved on a regional/national level (Hasselström & Cole, 2013).

• **Better trained crews.** Since a majority of the accidents at sea are caused by 'human factors', improved training, improved control of crew composition, and requirements for maximum duty

time could be important policy instruments to reduce the probability of accidents. IMO regulations such as

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and specified Liberian maritime regulations aimed at Offshore structures and vessels in Liberian territorial waters are the main governance umbrellas. (see also the ILO Merchant Shipping Convention).

• **Increased Inspections of Oil installations:** As this is a costly affair, it needs to be well planned (Hasselström & Cole, 2013)**.**

8.2.3 State

The State relates to the nature of the seabed where the structures are sited, its physical and biological features and the surrounding water column. The impacts will depend on local conditions and can emanate for example from the disturbance of hydrographic, sedimentological patterns and as well as frequency of operational/intentional or accidental discharges/dumping of oil, wastes, etc from oil installations as well as commuting OSV's and tankers(Elliot, 2002) .

8.2.3.1 Measures directed at the State of the Environment

From an oil spill perspective, measures directed at the state of the environment reduce the effect of an oil spill in the long-run, usually by improving the ecosystem's ability to recover from an oil spill.6 These measures can be thought of as buying insurance, that is, investing in measures that improve an ecosystem's resilience will reduce the social cost of future spills (Halpern et al., 2012):

• **Restoration of marine ecosystems** by private and public actors, repairing historic environmental damage (e.g., habitat restoration), thus improving ecological resilience. Such measures may be driven by policy instruments that require environmental compensation for damage resulting from infrastructure development or oil/chemical releases. The International Maritime Organisation (IMO) Oil Pollution Compensation Fund (IOPC Fund) provides governance mechanisms for these measures, which are implemented on the regional and international level, respectively (Hasselström & Cole, 2013).

• Domestic wastes discharge/dumping regulations

As Liberia is not a party to the London Dumping Convention, an enactment of a domestic regulation could also buttress UNCLOS and MARPOL.

• **Protection of biodiversity** helps to restore resilience in ecological systems and may be implemented through the establishment of environmental objectives that aim to maintain, or prevent the decline in, a certain level of biodiversity (policy instrument). The governance structure surrounding such initiatives may be, for example, the International Convention on Biological Diversity (CBD) or national initiatives (Hasselström & Cole, 2013).

8.2.4 Impacts

The effects of a changing seabed may influence the benthic populations and their predators. The effects on the water column may have affects to fish and sea mammals (Elliot, 2002). The so called reef effect, the addition of a hard substratum, is believed to cause the largest impact on the marine environment (Petersen & Malm, 2006). Additionally marine mammals are potentially endangered by offshore operations through collision with vessels, barrier effects and loss of biodiversity.

8.2.4.1 Measures Targeted at Impacts

The human response to such potential problems is to mitigate and minimise any disturbance through choice of location as well as construction- and operation techniques (Elliot, 2002). Effects during construction period may be minimized by using good practice and avoiding areas containing rare habitats or species (Petersen & Malm, 2006). Moreover administrative and legal controls such as Environmental Impact Assessments and planning regulations are of a significant importance. In addition indicators for acceptable change have to be defined once the potential impacts have been clarified (Elliot, 2002).

9.0 CHAPTER NINE

9.1 Liberia's Hypothesized Lapses considering the Norwegian, Canadian and UK regimes

Certainly all international environmental regimes are "social institutions consisting of agreed upon principles, norms, rules, procedures, and programs that govern the interactions of actors in specific issue areas" (Levy et al., 1995; Young et al., 1999; EE publishing, 2010). More commonly some individual regimes are more effective than others with regard to some criteria. As has been averred environmental monitoring is the baseline for the enactment of environmental regulations. Provably, the impacts of the regulations need to as well be assessed. Can it then be said that Liberia's offshore regulatory regimes fall within all necessary spheres of the larger international environmental regulatory regimes? More so too are these regulations being applied to protect the marine environment? Are there necessary provisions in place to achieved sustainable decommissioning after the wells become redundant? How then are the regulations/policies being assessed to determine whether the situations for much they were promulgated are being ameliorated?

The forgone are considered to determine they hold up in the light of the findings unveil so far. For each a chart is given to clearly identify where the Liberian scenario stands. At the end further clarity where necessary is provided for each case.

9.2.0 Nature of the Offshore Oil & Gas Exploration & Production Framework

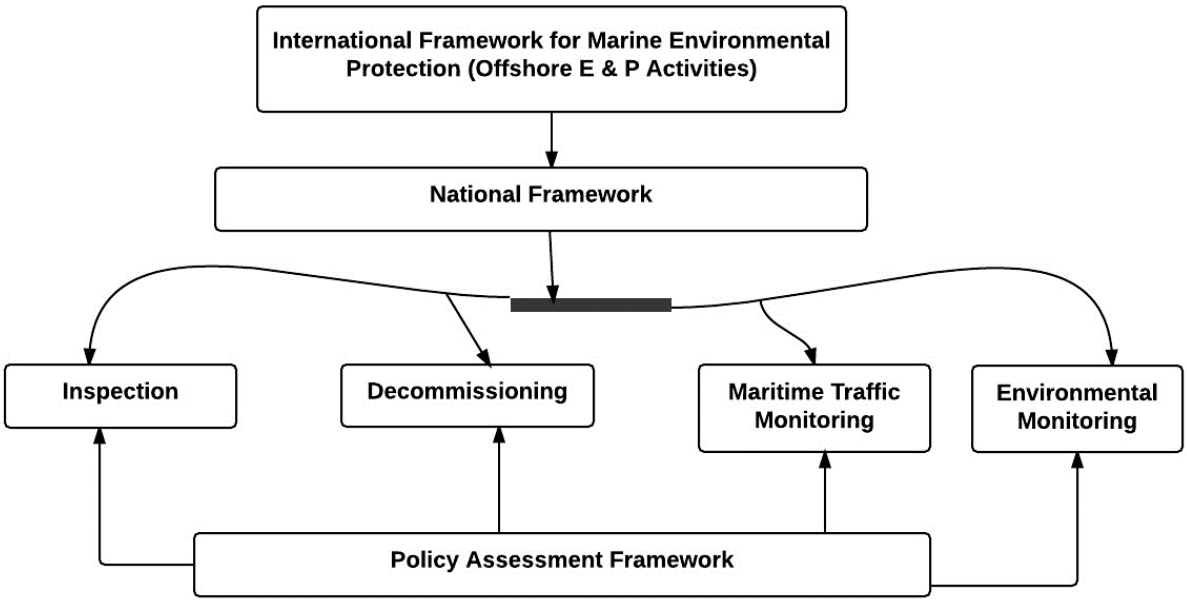

Figure 14: Nature of the Offshore Oil & Gas Exploration & Production Framework

9.3.0 International Framework: Marine Environmental Protection (offshore E&P activities)

Table 5: International Framework

Major International Framework Offshore Installation Inspection & Environmental Monitoring		
Jurisdiction	**Major International regime**	**Major International regime common to all four countries**
Norway	**GC, UNCLOS, MARPOL 73/78,OPRC,CBD,OSPAR, LC, IMO Guidelines, OGP Guidelines, World Bank Guidelines, UNFCCC, Vienna Convention (for the Protection of the Ozone Layer) , Stockholm Convention, Kyoto Protocol**	**GC, UNCLOS, MARPOL 73/78,OPRC,CBD, IMO Guidelines, OGP Guidelines, World Bank Guidelines, UNFCCC, Vienna Convention (for the Protection of the Ozone Layer) , Stockholm Convention**
Canada	**GC, UNCLOS, MARPOL 73/78,OPRC,CBD,OSPAR, LC, IMO Guidelines, OGP Guidelines, World Bank Guidelines, UNFCCC, Vienna Convention (for the Protection of the Ozone Layer) , Stockholm Convention**	
UK	**GC, UNCLOS, MARPOL 73/78,OPRC,CBD,OSPAR, LC, IMO Guidelines, OGP Guidelines, World Bank Guidelines, UNFCCC, Vienna Convention (for the Protection of the Ozone Layer) , Stockholm Convention, Kyoto Protocol**	
Liberia	**GC, UNCLOS, MARPOL 73/78,OPRC,CBD,Abidjan Convention, IMO Guidelines, OGP Guidelines, World Bank Guidelines, UNFCCC, Vienna Convention (for the Protection of the Ozone Layer) , Stockholm Convention**	
MARITIME TRAFFIC MONITORING		
Norway	**Directive 2002/59/EC, SOLAS, COLREGS, A.578 (14) IMO Guidelines for Vessel Traffic Services**	**SOLAS, COLREGS, A.578 (14) IMO Guidelines for Vessel Traffic Services**
Canada	**SOLAS, COLREGS, A.578 (14) IMO Guidelines for Vessel Traffic Services**	
UK	**Directive 2002/59/EC, SOLAS, COLREGS, A.578 (14) IMO Guidelines for Vessel Traffic Services**	
Liberia	**SOLAS, COLREGS, A.578 (14) IMO Guidelines for Vessel Traffic Services**	

9.4.0 National Framework - Offshore Installation Inspection Regime

Table 6: Inspection Regime (Comparing Norway, Canada, UK and Liberia)

Jurisdiction	Regulatory Bodies for Offshore platform Inspections	Main Offshore Regulatory Legislation	Previous Inspection methods	New Inspection Methods	Incidents which influence change of inspection
Norway	PSA	Petroleum Activities Act, Working Environment Act, Health Personnel Act, Fire and Explosion Protection Act, the Pollution Control Act, the Framework Regulations	Prescriptive based	Performance based	Ekofisk Bravo and more emphasis placed on risk management after the Alexander Kielland disaster
Canada	C-LNOPB. CNSOPB, NEB	Canada Oil and Gas Operations Act which covers regulations from E&P to spills and debris liability	Prescriptive based	Performance based	Ocean Ranger disaster (1982)
UK	DTI, HSE	Petroleum Act 1998 and clauses, European Community Act 19 72, Pollution Control and Prevention Act 1999, Offshore Safety Act 1992, Health and Safety at Work 1974, Coastguard Act 1925,, Food and Environment Protection Act 1985	Prescriptive based	Performance based	Piper Alpha
Liberia	NOCAL,EPA, LiMA	New Petroleum Law of Liberia 2013, EPA Act, NOCAL Act, LiMA Act	Not defined	Not defined	No major incident yet

9.5.0 Decommissioning

Table 7: Decommissioning (Comparing Norway, Canada, UK and Liberia)

Jurisdiction	Regulatory Bodies	Regulatory Laws	Disposal Options	Means of Funding Decommissioning
Norway	Ministry of Petroleum and Energy	Norwegian Petroleum Act, Norwegian Removal Grant Act of 1986	Sustainable decommissioning options are clearly defined and allowed	No deductibility of future removal costs from companies & gov't and industry share decommissioning ex-post expenses
Canada	Regulatory Boards: NEB, C-LNOPB,CNSOPB thru Environment Canada and DFO	Canada Oil and Gas Drilling and Production (COGDP) Regulations, Canada Oil and Gas Installations (COGI) Regulations, Canadian Environmental Assessment Act	Sustainable decommissioning options are clearly defined and allowed	Escrow accounts that allocate upfront capital are also conferred with deductions from companies' tax payment for ex-post expenses.
UK	Department of Energy and Climate Change	Petroleum Act 1998, amended in the Energy Act 2008, Transfrontier Shipment of Waste Regulations	Sustainable decommissioning options are clearly defined and allowed	Companies are given the ability to obtain deductions for ex-post removal expenses in their corporate income tax
Liberia	NOCAL thru EPA	New Petroleum Law, NOCAL Act, New Petroleum Policy, EPA Act	Sustainable decommissioning options are not explicitly stated rather that the environment be brought back to its original state to the extent possible	Companies are obligated to give financial assurance for decommissioning

9.6.0 Maritime Traffic Monitoring

Table 8: Maritime Traffic Monitoring (Comparing Norway, Canada, UK and Liberia)

Jurisdiction	Regulatory Body	Regulatory Framework	Services
Norway	Norwegian Coastguard Administration	REG-2009 which spans regulations relating to maritime traffic in specific waters, compulsory pilotage, and provisions pertaining to the marking of permanently located offshore units in the petroleum industry.	INS, NAS, TOS, VTS, Compulsory Pilotage, LRIT services
Canada	Canadian Coastguard, Transport Canada, DFO	Canada Shipping Act	Aerial Surveillance, VTS, LRIT
UK	MCA	Merchant Shipping Regulation 2004	VTS, CERS, LRIT
Liberia	LiMA	LiMA Act 2010	In principle no maritime traffic monitoring system is in place and no policy

9.7.0 Environmental Monitoring

Table 9: Environmental Monitoring (Comparing Norway, Canada, UK and Liberia)

Jurisdiction	Major Environmental Monitoring body	Regulatory Framework	Type of Environmental Monitoring
Norway	Norwegian Environment Agency-sets limits but provisions are in place for third parties to undertake EEM	Petroleum Act, CO2 Tax Act, Sales Tax Act, Greenhouse Gas Emission Trading Act, Pollution Control Act	Inspection, Compliance and Environmental Effects Monitoring
Canada	C-LNOPB. CNSOPB, NEB-EEM are conducted by the regulatory bodies	Canada Oil and Gas Operations Act, Canadian Environmental Assessment Act,	Inspection, Compliance and Environmental Effects Monitoring
UK	Oil and Gas Directorate - no third party provisions	Environmental Assessment of Plans and Programmes Regulations 2004, The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 , The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 , Offshore Chemicals Regulations 2002	Inspection, Compliance and Environmental Effects Monitoring
Liberia	EPA, NOCAL - but the industry virtually monitors itself	EPA Act, Environmental Protection and Management Law, National Environmental Protection Policy, National Biodiversity Conservation Policy, National Petroleum Policy, New Petroleum Law, LiMA Act	Inspection and Compliance Monitoring

9.8.0 Environmental Sustainability Assessment Framework (Regulation/Policy Assessment)

Table 10: Environmental Sustainability Assessment Framework (Comparing Norway, Canada, UK and Liberia)

<table>
<tr><th rowspan="2">Jurisdiction</th><th rowspan="2">Framework</th><th colspan="3">Main Features</th><th rowspan="2">Framework Common to all the four countries</th></tr>
<tr><th>DPSIR</th><th>SEA</th><th>EIA</th></tr>
<tr><td>Norway</td><td>SEA, EIA, DPSIR</td><td rowspan="4">Linkage-based: uses concept of causality (cause-effect); can be tied to sustainability through certain assumptions</td><td rowspan="4">Objective-based: Proactive framework-ensures that a particular initiative contributes to a defined state of sustainability</td><td rowspan="4">Impact-based, reactive in nature; reductionist approach to sustainability; focuses on the impacts of various actions on sustainability of particular systems</td><td rowspan="4">EIA/ESIA</td></tr>
<tr><td>Canada</td><td>SEA, EIA, DPSIR</td></tr>
<tr><td>UK</td><td>SEA, EIA, DPSIR</td></tr>
<tr><td>Liberia</td><td>EIA/ESIA</td></tr>
</table>

Now it can be deduced from the breakdown done that lapses in Liberia's offshore activities are exceedingly clear. The fig below gives a synopsis of those lapses as unveiled within the scope of this dissertation.

9.9.0 A Structure of the Lapses in Liberia's offshore E & P Operations

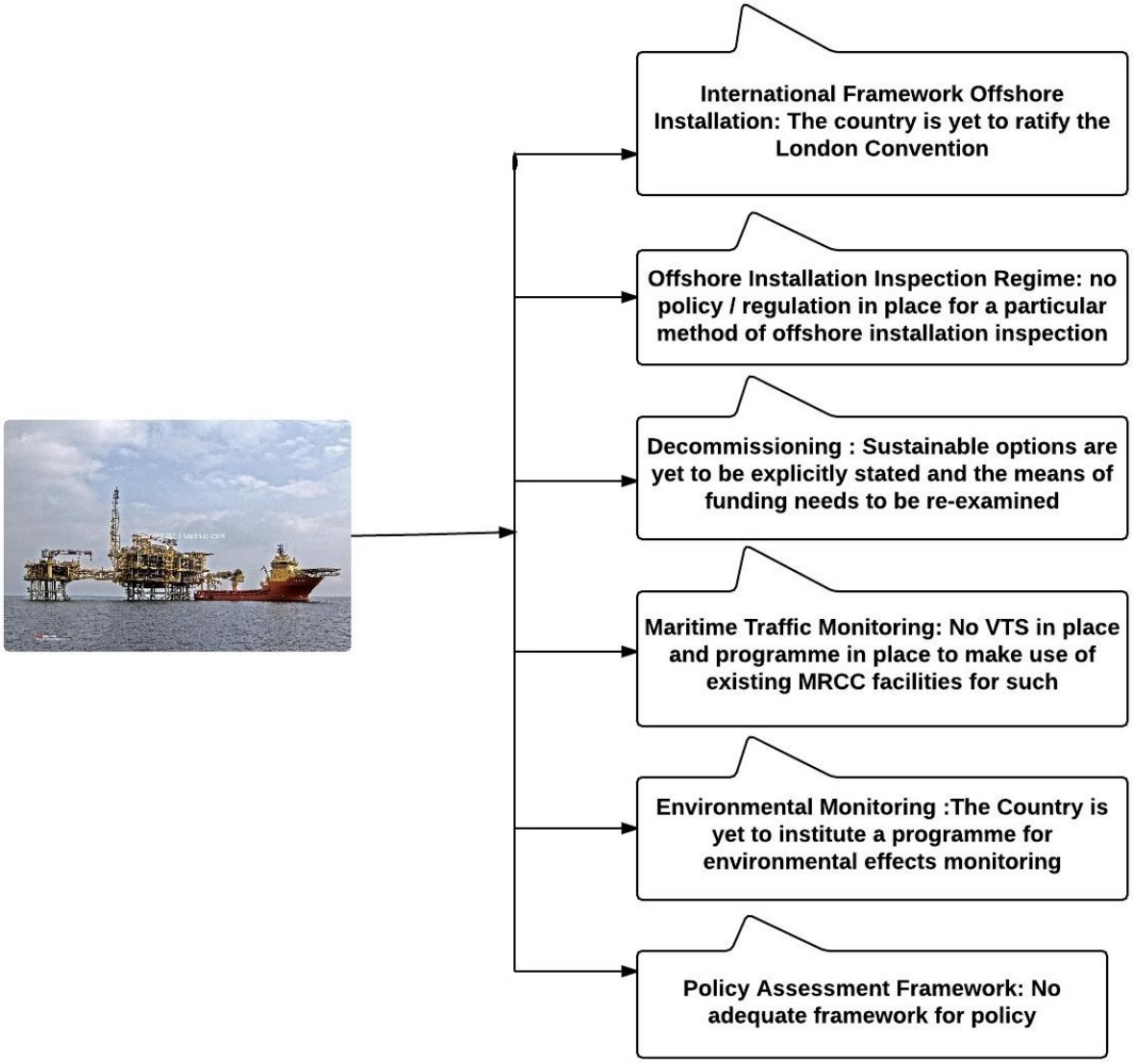

Figure 15: Hypothesized Lapses, Liberia in view of regulatory regimes of Norway, Canada and UK

CONCLUSION AND RECOMMENDATIONS

The West African coastline has become a “hotspot” for oil production, and 17 oil exploration blocks have been designated off the Liberian coast. Liberia’s 579 km coastal zone supports almost 60% of the country’s human population (USAID, 2008) and is endowed with natural resources of both biological and socioeconomic significance, leading to the potential for conflict between oil production, existing human activities and biodiversity (USAID, 2008; Tuagben, 2012).

Offshore Explorations and Production activities, even though are undoubtedly rewarding in terms of economic gains to a nation, but can as well really be a threat to the marine environment due to the operational aspects of getting the resource from the sea-bed, the technology involved, the transportability of the resource and working materials, the discharges from them and the decommissioning process as portrayed in the DPSIR framework. The findings from this work confirm that lapses (see figure 15) do exist in Liberia’s offshore exploration and production regime. However if the lapses as uncovered are succinctly addressed, regulations and policies would be enhanced that would engender a standardized working document for environmental compliance by the offshore companies. An effective environmental monitoring regime would be place to continuously assess the effects of the policy. This is where the DPSIR framework could be an added tool.

While it is true that besides the onshore Simba Energy concession, most of the country’s nascent offshore oil E & P activities are being carried out in deep water basins far from the shoreline. Any major spill/discharges might not affect the coast, but still marine life could adversely be affected. Again accidents are not peculiar to the offshore installations alone. Vessels, for example OSVs and tankers, serving or taking supplies from the installations are also prone to accidents. The data from the MRCC-Monrovia as scrutinized shows an 84.6% chance of maritime accidents that occurred in the country’s EEZ not likely to cause marine environmental hazards. Thus monitoring the maritime traffic becomes an essential component of offshore inspection and monitoring regime. More essentially, as a potential increase in maritime traffic as a result of offshore activities could increase the likelihood of maritime accidents. Such accidents could as well affect the shoreline and the ports.

Hence the issue of establishing legislations for a VTS authority and safety zones around offshore installations could help as well in monitoring the maritime traffic within the offshore

activities areas of Liberia; thus protecting the interests of other users of the sea and as well improving the environmental prospects within these areas.

Given the equipment in place at the MRMRCC and its capacity at handling SAR operations, the MRMRCC could be further enhanced for maritime traffic monitoring in the offshore activity areas.

The offshore installations themselves must be inspected for regulatory compliance. As performance-based type of inspection specifies the outcomes required and combine physical inspection with audits to ensure compliance, it serves as the best method for Liberia to adopt now.

Moreover, as LiMA subscribes to performance-based standards in its flag-state ship inspection and audit framework (Office of the Deputy Commissioner of Maritime Affairs, 2014). It should implement performance-based standards in its port state and coastal state activities. This would go a long way of improving environmental inspections of Liberia offshore installations.

At present there is a lack of overall inspection, monitoring and policy assessment regime. The DPSIR framework for policy assessment is not very complex to put in practice for a developing country such as Liberia. Moreover it assesses cause-effect relationships between human users and the environment. It also has means of evaluating the successes and failures of policies by continuously assessing the opinions (responses) of all stakeholders involved. On the other hand, performance-based inspection ensures that operators have the management systems in place to achieve the specified performance standards or goals set by the regulatory. Thus combining DPSIR framework and performance-based method would ensure that Liberia has a watertight regulatory regime that caters to protection and conservation of the marine environment, guarantee other users of the sea unfettered access and that players in the country's offshore E & P sector would have a standardized working document for environmental compliance.

Clearly there is now a strong international thrust towards the protection and conservation of the marine environment. In its quest to develop the resources of the sea-bed Liberia has to take the appropriate measures to protect and conserve the marine environment. The measures proffer herein would make Liberia's offshore sector sustainable and the country would have therefore shown its commitments to the international community as well as its own citizens.

References

Abdulla, A., & Linden, O. (2008). *Maritime Traffic Effects on Biodiversity in the Mediterranean Sea: Review of Impacts, Priority Areas and Mitigation Measures* (pp. 11, 22, 161–163). Malaga: IUCN Centre for Mediterranean Cooperation. Retrieved from http://www.google.se/books?hl=en&lr=&id=CCa708lYvdIC&oi=fnd&pg=PA159&dq=offshore+oil+sector+olof+linden&ots=O-y-dNu9F0&sig=K9kI9RFICTK64L5MDGVcQxUgB0c&redir_esc=y#v=onepage&q&f=false

Abidjan Convention. (1981). Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of West and Central African Region. Nairobi: UNEP.

Africa Energy Unit, & The World Bank. (2011). *Options for the Development of Liberia ' s Energy Sector*. (M. K. Araya, Ed.) (p. 32,33). Washington, D. C.: The World Bank.

African Petroleum Corp, L. (2014). Liberia | African Petroleum. *Internet*. Retrieved August 01, 2014, from http://www.africanpetroleum.com.au/our-projects/liberia

Akinsanya, I. A. M. (2012). Background Briefing on Liberia ' s Oil Sector, 2, 16.

Altit, F. K., & Igiehon, M. O. (2007). Decommissioning of upstream oil and gas facilities. In *53rd Annual Rocky Mountain Mineral Law Institute* (pp. 129–134). Westminster, Colorado: Rocky Mountain Mineral Law Institute.

Anadarko. (2011). Anadarko Announces Successful Pre-salt Appraisal Well Offshore Brazil, Updates West Africa Activity, 1–2. Retrieved from http://www.anadarko.com/Investor/Pages/NewsReleases/NewsReleases.aspx?release-id=1628189

Atkins, J. P., Burdon, D., Elliott, M., & Gregory, A. J. (2011). Management of the Marine Environment: Integrating Ecosystem Services and Societal Benefits with the DPSIR Framework in a Systems Approach. *Marine Pollution Bulletin*, *62*(2), 215–26. doi:10.1016/j.marpolbul.2010.12.012

Azaino, E. U. (2012). *International Decommissioning Obligations: Are There Lessons Nigeria Can Acquire from the UK's Legal and Regulatory Framework?* University of Dundee.

Barchue, Lawrence D., S. (2005). Making a case for the Voluntary IMO Member State Audit Scheme. In *Auditing Flag States: New Directions for Smaller Maritime Nations* (p. 1). Malmo: International Maritationime organiz.

Bennett, K. C., & Rusk, D. (2002). Regional 2D seismic interpretation and exploration potential of offshore deepwater Sierra Leone and Liberia , West Africa. *Learning Edge (Regional 2D Seismic Interpretation and Exploration Potential of Offshore Deepwater Sierra Leone and Liberia, West Africa)*, *21*(11), 1118–1124. doi:doi: 10.1190/1.1523743

Beyerlin, U., & Marauhn, T. (2011). *International Environmental Law* (pp. 118–120, 121–140). Oxford: Hart Publishing Limited. Retrieved from http://books.google.com/books?id=1PI9QwAACAAJ&pgis=1

Birnie, P. W., Boyle, A. E., & Redgwell, C. (2009). *International Law and the Environment* (pp. 8–17, 137–150, 167–183, 351–356, 362–363, 377–380,). Oxford; NewYork: Oxford University Press, Incorporated. Retrieved from http://books.google.com/books?id=cVlhPwAACAAJ&pgis=1

BNF. (2014). Liberian Coast Guard | Liberia Fisheries. *Bureau of National Fisheries (BNF) Website*. Retrieved September 17, 2014, from http://www.liberiafisheries.net/node/74

Boakye, D., Dessus, S., Foday, Y., & Oppong, F. (2012). *Investing Mineral Wealth in Development Assets Ghana, Liberia and Sierra Leone* (No. 6089) (p. 17). Washington D C. Retrieved from http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-6089

Bratspies, R., Doremus, H., Flatt, V., Glicksman, R., Mintz, J., Rohlf, D., … Zellmer, S. (2010). *Regulatory Blowout: How Regulatory Failures Made the BP Disaster Possible, and How the System Can Be Fixed to Avoid a Recurrence* (No. 1007) (pp. 21–27). Washington D C.

Bush, B. J. (2012). Addressing the Regulatory Collapse Behind the Deepwater Horizon Oil Spill : Implementing a " Best Available Technology " Regulatory Regime for Deepwater Oil Exploration Safety and Cleanup Technology. *University of Oregon*, 535–570.

Buzan, B. (1981). Negotiating by Consensus: Developments in Technique at the United Nations Conference on the Law of The Sea. *American Journal of International Law*, *75*, 324.

Cameron, P. D. (1998). *Decommissioning of Oil & Gas Installations: A Comprehensive Approach to the Legal & Contractual Issues* (p. 5). New York: Barrows Company INC.

Canadian Coast Guard. (2008, March 31). Marine Communications and Traffic Services - CCG - Marine Communications and Traffic Services. *Internet*. Retrieved August 26, 2014, from http://www.ccg-gcc.gc.ca/Marine-Communications/Home#AIS

Canadian Coast Guard. (2011). Canadian Coast Guard Maritime Security Contributions. *CCG Publication*, 5.

Canadian Overseas Petroleum Limited. (2013). Offshore Liberia Basin.

CBD. (2014a). National Biodiversity Strategies and Action Plans (NBSAPs). *Internet*. Retrieved August 02, 2014, from http://www.cbd.int/nbsap/

CBD. (2014b). Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets. *Internet*. Retrieved August 02, 2014, from http://www.cbd.int/sp/

CbI - Cross-border Information - African Energy. (2013, December 5). Liberia activity to accelerate in 2014. *CbI - Cross-Border Information - African Energy*. London. Retrieved from http://archive.crossborderinformation.com/Article/Liberia+activity+to+accelerate+in+2014.aspx?date=20131205#

Chen, M. E. (2007). *National oil companies and corporate citizenship: a survey of transnational policy and practice*. Houston, Texas.

Chevron Corporation. (2014). Liberia Fact Sheet. Retrieved from http://www.chevron.com/documents/pdf/liberiafactsheet.pdf

Chircop, A., & Hildebrand, L. (2001). Beyond the Buzzwords: A Perspective on Integrated Coastal and Ocean Management in Canada, (October).

Chircop, A., Linden, O., & Nielsen, D. (2006). *Places of Refuge for Ships: Emerging Environmental Concerns of a Maritime Custom*. (A. Chircop, O. Linden, & D. Nielsen, Eds.) (pp. 13–16). Leiden: Martinus Nijhoff Publishers. Retrieved from http://www.google.se/books?hl=en&lr=&id=Q0_6pPNR40EC&pgis=1

Cleveland, C. J. (2010). Deepwater Horizon oil spill. *The Encyclodepia of Earth*. Retrieved May 29, 2014, from http://www.eoearth.org/view/article/51cbf0267896bb431f6a0797/

Climate and Pollution Agency. (2011). *Decommissioning of offshore installations* (pp. 25–35). Oslo.

CNSOPB. (2011). *A Synopsis of Nova Scotia's Offshore Oil and Gas Environmental Effects Monitoring Programs* (p. 1). Halifax.

Conn, P., & Rodriguez, G. (2011). New insights into prospectivity of Liberia-Sierra Leone Basin because of improvements in seismic acquisition and processing. *Learning Edge (New Insights into Prospectivity of Liberia-Sierra Leone Basin because of Improvements in Seismic Acquisition and Processing)*, *30*(6), 656–661. doi:10.1190/1.3599151

ConocoPhillips. (1999). Ekofisk I disposal:Impact Assessment Environmental and Societal Impacts. *Phillips Petroleum Company Norway*, 19.

ConocoPhillips. (2014). Reduce, Reuse, Recycle - ConocoPhillips. *ConocoPhillips website*. Retrieved June 14, 2014, from http://www.conocophillips.com/sustainable-development/environment/Pages/reuse-reduce-recycle.aspx

Cooke, R. M., Ross, H. L., & Stern, A. (2011). *Precursor Analysis for Offshore Oil and Gas Drilling: From Prescriptive to Risk-Informed Regulation* (No. 10) (p. 3). Washington D C. Retrieved from http://www.rff.org/RFF/Documents/RFF-DP-10-61.pdf

Cooper, S. M. (2010). Potential field Investigation of the Liberia Basin , West Africa. *Journal of American Science*, *6*(7), 199–207.

CSCAP. (2011). CSCAP MEMORANDUM NO . 16 Safety and Security of Offshore Oil and Gas Installations A Memorandum from the Council for Security Cooperation in the Asia Pacific (CSCAP), (1).

Curran, K. J., Wells, P. G., & Potter, a. J. (2006). Proposing a coordinated environmental effects monitoring (EEM) program structure for the offshore petroleum industry, Nova Scotia, Canada. *Marine Policy*, *30*(4), 400–411. doi:10.1016/j.marpol.2005.03.001

Dagg, J., Holroyd, P., Lemphers, N., Lucas, R., Thibault, B., Severson-baker, C., … Wheeler, B. (2011). *Comparing the Offshore Drilling Regulatory Regimes of the Canadian Arctic , the U*

. S ., the U . K ., Greenland and Norway. (R. Franchuk, Ed.)*Penbina Institute* (pp. 20, 21, 26–27, 33). Drayton Valley.

DAI. (2008). *Liberia Environmental Threats and Opportunities Assessment (ETOA)* (pp. 44, 172). Bethesda. Retrieved from http://pdf.usaid.gov/pdf_docs/PNADN926.pdf

Day, M. D. (2008). Decommissioning of Offshore Oil and Gas Installations. In S. T. Orszulik (Ed.), *Environmental Technology in the Oil Industry* (2nd ed., pp. 189–190, 193–194). Hampshire, Uk: Springer + Business Media B.V.

Derrick Petroleum Services. (2011). Liberia on course to prove oil riches in 2011. Companies that stand to gain.. *Oil and Gas - Mergers and Acquisition Review*. Retrieved June 03, 2014, from http://mergersandacquisitionreviewcom.blogspot.se/2011/06/liberia-on-course-to-prove-oil-riches.html

Det Norske Veritas. (2010). OLF/NOFO – Summary of Differences between Offshore Drilling Regulations in Norway and U.S. Gulf of Mexico, *Rev. 02*, 17.

Det Norske Veritas. (2014). *Enhancing offshore safety and environmental performance: Key levers to further reduce the risk of major offshore accidents* (p. 6). Høvik.

Doyle, A. B., Pappworth, S. S. R., & Caudle, D. D. (2008). Drilling and Production Discharges in the Marine Environment. In S. T. Orsizulik (Ed.), *ENVIRONMENTAL TECHNOLOGY IN THE OIL INDUSTRY* (2nd ed., pp. 155–156, 161–162). Hampshire, Uk: Springer + Business Media B.V.

Dukuly, J. M. (2012). Organization Leading Liberia Petroleum Refining Company Hangs on Cyberoam for its Security Industry / Vertical. *Cyberoam, Unified Threat Management*, 1–2. Retrieved from http://www.cyberoam.com/downloads/CaseStudies/LiberiaPetroleumRefiningCompanyCaseStudy.pdf

Duncan, A., & Sauer, A. (2002). *Changing oil: emerging environmental risks and shareholder value in the oil and gas industry*. Washington, D.C.

Ecobank. (2014). Middle Africa Briefing Note | Energy Exploration in West Africa ' s frontier could unlock 9 billion barrels in Middle Africa Briefing Note | Energy. *Middle Africa Briefing Note | Energy*, (Map 1), 1–6.

EE publishing. (2010). *Handbook on Multi-Level Governance*. (H. Enderlein, S. Wȁlü, & M. Zürn, Eds.) (p. 504). Northampton, MA: Edward Elgar Publishing. Retrieved from http://books.google.com/books?id=YlmoCs207UAC&pgis=1

Ekins, P., Vanner, R., & Firebrace, J. (2005). *Decommissioning of Offshore Oil and Gas Facilities: Decommissioning Scenarios* (p. 14). London.

Elliot, M. (2002). The Role of the DPSIR Approach and Conceptual Models in Marine Environmental Management: An example for Offshore Wind Power. *Marine Pollution Bulletin*, *44*, iii–vii.

EPA. (2011a). *Environmental Protection Agency of Liberia Annual Report* (pp. 7, 17). Monrovia. Retrieved from http://www.epaonline.org/EPA 2011 Annual Report.pdf

EPA. (2011b). Welcome to Environmental Protection Agency of Liberia. *EPA website*. Retrieved June 06, 2014, from http://www.epaonline.org/aboutus.html

EPA & UNDP. (2013). *Liberia National Situation Report on the Sound Management of Chemicals* (pp. iii–v). Monrovia.

Ernst & Young. (2013). *Doing business in Liberia 2013 Pan African Oil and Gas Workshop* (p. 13,14). Paris.

European Union. (2012). *Safety of offshore oil and gas operations : Lessons from past accident analysis*. (M. Christou & M. Konstantinidou, Eds.) (pp. 8, 18). Luxemborg: European Union. doi:10.2790/73321

Evans, M. (2014). *International Law* (pp. 698–702). Oxford: Oxford University Press. Retrieved from http://books.google.com/books?id=GLsoAwAAQBAJ&pgis=1

Evans, S. (1986). Control of marine pollution generated by offshore oil and gas exploration and exploitation: the Scotian Shelf. *Marine Policy*, *10*, 258–70.

Executive Mansion-Liberia. (2013a). Executive_Order_No._48 Liberia.pdf. Monrovia: Ministry of Foreign Affairs.

Executive Mansion-Liberia. (2013b). National Maritime Security Committee. *Media Center*. Retrieved April 27, 2014, from http://www.emansion.gov.lr/2press.php?news_id=2654&related=7&pg=sp

Fehling, A. (2009). *Marine application of the Driver-Pressure-State-Impact-Response (DPSIR) – framework*. University of Kiel.

Ferreira, D. F. (2003). *Fiscal treatment: decommissioning and bonds. Chapter 5. Anticipating Impacts of Financial Assurance Requirements for Offshore Decommissioning: a Decision Model for the Oil Industry*. *Fiscal treatment: decommissioning and bonds.* State University, Campinas, Brazil, Campinas.

Ferreira, D. F., Suslick, S. B., Farley, J., Constanza, R., & Krivov, S. (2004). A Decision Model for Financial Assurance Instruments in the Upstream Petroleum Sector. *Energy Policy*, *32*, 1173–1184.

Forrest, C. (2006). Integrated coastal zone management: A critical overview. *WMU Journal of Maritime Affairs*, *5*(2), 207–222. doi:10.1007/BF03195105

FPA Editorial. (2014). FrontPageAfrica - Opening Bid Rounds For Oil Is Wrong! Lie Catches Up With McClain, NOCAL. *Frontpageafrica online*. Retrieved June 07, 2014, from http://frontpageafricaonline.com/index.php/op-ed/editorial/954-opening-bid-rounds-for-oil-is-wrong-lie-catches-up-with-mcclain-nocal

Fraser, G. S., & Ellis, J. (2009). The Canada-Newfoundland Atlantic Accord Implementation Act: Transparency of the environmental management of the offshore oil and gas industry. *Marine Policy*, *33*(2), 313–316. doi:10.1016/j.marpol.2008.07.012

Frynas, J. G. (2009). *Beyond corporate social responsibility – oil multinationals and social challenges*. Cambridge, UK: Cambridge University Press. Retrieved from http://dx.doi.org/10.1017/

Frynas, J. G. (2010, February). Oil industry's increasing focus on CSR. *Petroleum Economist*.

Frynas, J. G. (2012). Corporate Social Responsibility or Government Regulation ? Evidence on Oil Spill Prevention. *Ecology and Society*, *17*(4).

Gao, Z. (1998). *Environmental Regulation of Oil and Gas* (pp. 1–7). London: Kluwer Law International. Retrieved from http://books.google.com/books?id=tv6VYR5plv0C&pgis=1

Gavouneli, M. (1995). *Pollution from offshore installations* (pp. 40–50). London ; Boston: Graham & Trotman/M. Nijhoff. Retrieved from http://books.google.com/books?id=T1ERAAAAYAAJ&pgis=1

GC. (1958). Convention on the Continental Shelf, April 29, 1958, 52 (1958) (entered into force in 1964). *American Journal of International Law*, *52*, 858.

Global Witness, Liberian Oil and Gas Initiative (LOGI), The Center for Transparency and Accountability in Liberia (CENTAL), Liberia Democratic Institute (LDI), The Liberia Media Initiative for Peace Democracy and Development (LMI), & The Sustainable Development Institute (SDI). (2011). *CURSE OR CURE ? HOW OIL CAN BOOST* (pp. 6, 25). Monrovia.

GMA. (2012). Ghana Maritime Authority (GMA) - News & Events. *GMA website*. Retrieved July 12, 2014, from http://www.ghanamaritime.org/en/posts/the-gma-positioned-to-play-a-crucial-role-in-developing-ghanas-offshore-oil17.php

Goanue, A. v. (2010). Assessing and Developing Policy Options for Addressing Climate Change Mitigation across the Energy Sector. *UNDP Papers*, (August), 14–15.

González, V. (2012). An Alternative Approach for Addressing CO2-Driven Ocean Acidification. *Sustainable Development Law & Policy*, *12*(2), 45–47.

Government of Canada. (1985, April 1). Canada Oil and Gas Operations Act. *Justice Laws Website*. Retrieved August 25, 2014, from http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html?term=response

Government of Canada. (2009). Canada Oil and Gas Drilling and Production Regulations, 1–45. Retrieved from http://laws-lois.justice.gc.ca/PDF/SOR-2009-315.pdf

Government of Canada. (2012, July 6). Canadian Environmental Assessment Act. *Justice Laws Website*. Retrieved August 26, 2014, from http://laws-lois.justice.gc.ca/eng/acts/C-15.2/

Guruswamy, L. (1998). The Promise of the United Nations Convention on the Law of the Sea (UNCLOS): Justice in Trade andJustice in Trade and Environment Disputes. *Ecology Law Quarterly*, *25*(208), 189–225.

Hadden, B. R. L. (2006). The Geology of Liberia : a Selected Bibliography of Liberian Geology , Geography and Earth Science, 5–6.

Halpern, B. S., Longo, C., Hardy, D., McLeod, K. L., Samhouri, J. F., Katona, S. K., … Zeller, D. (2012). An index to assess the health and benefits of the global ocean. *Nature*, *488*(7413), 615–20. doi:10.1038/nature11397

Hamzah, B. a. (2003a). International rules on decommissioning of offshore installations: some observations. *Marine Policy*, *27*(4), 339–348. doi:10.1016/S0308-597X(03)00040-X

Hamzah, B. a. (2003b). International rules on decommissioning of offshore installations: some observations. *Marine Policy*, *27*(4), 339–348. doi:10.1016/S0308-597X(03)00040-X

Hasselström, L., & Cole, S. (2013). *Oil Spills Management* (pp. 16–20). Stockholm.

Higginson, T. (2012). Decommissioning with Abandonment. *Internet*. Retrieved from http://www.bakerbotts.com/infocenter/publications/detail.aspx?id=940

Horsman, T., & Breeze, H. (2006). An Atlas of Human Activities: Reflections on the Past, Present and Future Possibilities. *DFO Website*, 1–31. Retrieved from http://coinatlantic.ca/documents/aczisc_meeting_presentations/48Atlas.pdf

HTC. (2012). National Petroleum Policy Liberia Hydrocarbon Technical Committee (HTC). Monrovia: Interministerial Hydrocarbon Technical Committee.

IAIA. (1998). *Environmental Methods Review : Retooling Impact Assessment for the New Century*. (A. L. Porter & J. J. Fittipaldi, Eds.) (pp. 2–6). Fargo.

IEE. (2010). Arctic Offshore Oil and Gas Guidelines White Paper No . 4 Decommissioning and Site Clearance in the United States and Canada I . Decommissioning and Site Clearance - AOOGG. *Institute for Energy and the Environment*, (4), 5–6.

IFC. (2006). *International Finance Corporation's Performance Standards on Social and Environmental Sustainability*. Washington D C: IFC/World Bank.

IFC. (2007). Environmental , Health , and Safety General Guidelines. *International Finance Corporation-World Bank Group*, 1–49.

Ifesi, A. (2003). Integration of EMS into National Regulatory Frameworks for Offshore Oil and Gas Production. *Centre for Energy Petroleum and Mineral Law Policy*, 92.

ILM. (1993). 32 International Legal Materials (ILM). *International Legal Materials*, *1*, 1072.

IMO. (1972a). Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended (COLREG 1972), Rule 10. *COLREG*.

IMO. (1972b). Convention on the Prevention of Marine Pollution by Dumping of Wastes and other matter. *IMO Website*, 1–16. Retrieved from http://www.imo.org/blast/blastDataHelper.asp?data_id=21278&filename=LC-LPbrochure.pdf

IMO. (1989a). Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone (IMO Resolution A.672 (16).

IMO. (1989b). Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone-IMO Assembly Resolution A 672(16), adopted 19 October 1989. London: IMO Publishing.

IMO. (1991). *OPRC Convention: International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990, Including Final Act of the Conference and Attachment (resolutions 1 to 10).* (pp. 1–38). London: IMO Publishing. Retrieved from http://books.google.com/books?id=vFK3v0ljXbAC&pgis=1

IMO. (2003). *Ships Routeing— (Sales No. IB927E). Rules 1(d) and 10 of COLREG* (8th ed.). London: IMO Publishing.

IMO. (2006). 1996 PROTOCOL TO THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER, 1972. *IMO Website*, 1–25.

IMO. (2012). The LRIT technical documentation (part I) MSC.1/Circ.1259/Rev.5, *44*(0), 63–66. Retrieved from http://www.imo.org/OurWork/Safety/Navigation/Documents/LRIT/1259-Rev.5.pdf

IMO. (2014a). IMO | Automatic Identification Systems (AIS). *IMO website*. Retrieved September 20, 2014, from http://www.imo.org/OurWork/Safety/Navigation/Pages/AIS.aspx

IMO. (2014b). IMO | International Convention on Oil Pollution Preparedness, Response and Co-operation. *Internet*. Retrieved August 02, 2014, from http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-on-Oil-Pollution-Preparedness,-Response-and-Co-operation-(OPRC).aspx

IMO. (2014c). IMO | Places of refuge. *Internet*. Retrieved August 07, 2014, from http://www.imo.org/ourwork/safety/navigation/pages/placesofrefuge.aspx

IMO. (2014d). Long Range Identification and Tracking Systems. *IMO website*. Retrieved July 13, 2014, from http://www.imo.org/blast/mainframe.asp?topic_id=905

IMO. (2014e). Status of Conventions-IMO. London: IMO Publishing. Retrieved from http://www.google.se/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=2&ved=0CCcQFjAB&url=http%3A%2F%2Fwww.imo.org%2FAbout%2FConventions%2FStatusOfConventions%2FDocuments%2Fstatus-x.xls&ei=qdjcU9yfDYShyAOKl4LIDA&usg=AFQjCNFQXk3KVP6-ufR5sSI03ladu1lYOA&sig2=R1DIbzvv5k4Po8_lEZG6Bg

IMO/IPIECA. (2010). *National Workshop for the Development of the National Oil Spill Contingency Plan, Liberia.* (pp. 5–14). Monrovia: giwacaf. Retrieved from http://www.giwacaf.org/userfiles/files/Workshops_Reports/2010 06_Liberia_EN.pdf

IMRF. (2014). West Africa Maritime Search & Rescue Region (WAMSARR): About RMRCC-Monrovia. *International Maritime Rescue Federation Website*. Retrieved August 30, 2014, from http://www.international-maritime-rescue.org/index.php/related-links/liberia

International Maritime Organization MSC. 211(81). (2008). ARRANGEMENTS FOR THE TIMELY ESTABLISHMENT OF THE LONG-RANGE IDENTIFICATION AND TRACKING SYSTEM, *211*(81), 1–2. Retrieved from http://www.imo.org/OurWork/Safety/Navigation/Documents/LRIT/MSC.211(81).pdf

Inuvialuit Regional Corporation. (2014). The Westen Arctic Claim Inuvialuit Final Agreement AS Amended. Tuktoyaktuk: Government of Canada.

Islam, M. R., & Khan, M. I. (2013). *The Petroleum Engineering Handbook: Sustainable Operations (Google eBook)* (Vol. 2013, pp. 9–10). Houston: Gulf Publishing House. Retrieved from http://books.google.com/books?id=xXijAQAAQBAJ&pgis=1

Ite, A. E., Ibok, U. J., Ite, M. U., & Petters, S. W. (2013). Petroleum Exploration and Production : Past and Present Environmental Issues in the Nigeria ' s Niger Delta. *American Journal of Environmental Protection*, *1*(4), 78–90. doi:10.12691/env-1-4-2

ITOPF. (2000). *ITOPF Liberia Country profiles* (pp. 1–5). London. Retrieved from www.itopf.com/country_profiles

IUCN Niger – Delta Panel. (2013). *Sustainable Remediation and Rehabilitation of Biodiversity and Habitats of Oil Spill Sites in the Niger Delta. Main Report including recommendations for the future. A report by the independent IUCN - Niger Delta Panel (IUCN-NDP) to the Shell Petroleum Dev* (pp. 1–17). Gland.

JPT. (1995). Offshore abandonment heats up: North Sea, Gulf of Mexico deepwater platforms are costly, difficult to remove. *Journal of Petroleum Technology (JPT)*, 643–645.

Kamau, N. (2011). King & Spalding: Energy Newsletter | Liberia: Investment Potential in the Oil and Gas Industry in Liberia. *King & Spalding: Energy Newsletter*. Retrieved June 10, 2014, from http://www.kslaw.com/library/newsletters/EnergyNewsletter/2011/October/article6.html

Kay, T., Llp, S., & Essex, J. (2012). Pushing reuse Towards a low - carbon construction industry. *Bio Regional Solutions for Sustainability*, 4–36. Retrieved from http://www.bioregional.com/files/publications/pushingreuse.pdf

Kiss, A. C., & Shelton, D. (2000). *International Environmental Law* (pp. 461–478). New York: Transnational Publishers, Incorporated. Retrieved from http://books.google.com/books?id=yHp_QgAACAAJ&pgis=1

Kiss, A. C., & Shelton, D. (2000). International Environmental Law., 457–478.

Knight, H. G. (1969). Shipping safety fairways: conflict amelioration in the Gulf of Mexico. *J. Mar. L. & Com*, *1*(1), 1.

Koropatnick, T., Johnson, S. K., Coffen-Smout, S., Macnab, P., & Szeto, A. (2012). Development and Applications of Vessel Traffic Maps Based on Long Range Identification and Tracking (LRIT) Data in Atlantic Canada. *Canadian Technical Report of Fisheries and Aquatic Sciences*, (2966), 1–27.

KPMG International. (2011). KPMG International survey of corporate responsibility reporting. *Internet*.

Levy, M. A., Young, O. R., & Zürn, M. (1995). The Study of International Regimes. *European Journal of International Regimes*, *1*(3), 274.

Liberia Maritime Authority. (2012). *Voluntary IMO Member State Audit Scheme WorkshopLiberia* (No. 280512) (Vol. 280512, pp. 25–27). Monrovia.

Liberia Maritime Authority. (2014). Marine Pollution Prevention - Liberia Maritime Authority. *Internet*. Retrieved August 04, 2014, from http://maritimeliberia.com/?safety/pollution.html

Lindøe, P. H., Baram, M., & Paterson, J. (2012). Robust Offshore Risk Regulation – an assessment of US , UK and Norwegian approaches. In *European Safety and Reliabilty Conference* (pp. 4–7, 25–29). Helsinki: ESREL.

LPRC. (2012). Liberia Petroleum Refining Company (LPRC) Annual Report 2012. *LPRC Annual Report*, 1–12, 16–19. Retrieved from http://www.lprclib.com/pg_img/LPRC Annual Report 2012.pdf

Lyons, Y. (2012). Transboundary Pollution from Offshore Oil and Gas Activities in the Seas of Southeast Asia. *Centre for International Law*, 10.

Maes, F. (2008). The International Legal Framework for Marine Spatial Planning. *Marine Policy*, *32*, 802–803. doi:10.1016/j.marpol.2008.03.013

Maher, S. T., Csp, P. E., Long, G. D., Cromartie, R. S., & Sutton, I. S. (2011). *Paradigm Shift in the Regulatory Application of Safety Management Systems to Offshore Facilities Paradigm Shift in the Regulatory Application of Safety Management Systems to Offshore Facilities* (pp. 3–4). Chicago.

Manning, A. P. (1971). *The Role of Compulsory Sealanes in Resolving Multiple-use Conflict on the Continental Shelf* (p. 11). Newport: Naval War College. Retrieved from http://books.google.se/books/about/The_Role_of_Compulsory_Sealanes_in_Resol.html?id=g15AIQAACAAJ&pgis=1

Maritime Security Partnerships. (2008). *Maritime Security Partnerships Committee on the "1,000-Ship Navy" - A Distributed and Global Maritime Network, National Research Council* (pp. 3,10, 67–70). Washington D C: National Academies Press.

MARPOL73/78. (1978). MARPOL73/78.

Marsden, D. S., & Varner, D. R. (2013). *Transboundary Environmental Governance: Inland, Coastal and Marine Perspectives* (pp. 181–190). Ashgate Publishing, Ltd. Retrieved from http://books.google.com/books?id=Do2E8TKknS8C&pgis=1

Martor, B., & Sellers, D. S. (2012). Liberia's plan to reform its petroleum law - Lexology. *Lexology*. Retrieved June 10, 2014, from http://www.lexology.com/library/detail.aspx?g=69ecdfc9-a063-4f91-98b8-f0c8d819bcda

Mason, M. (2003). Civil liability for oil pollution damage : examining the evolving scope for environmental compensation in the international regime. *Marine Policy*, *27*, 4.

Mbendi Energy News. (2014, January). Oil and Gas in Liberia - Overview. *Mbendi*. Retrieved from http://www.mbendi.com/indy/oilg/af/li/p0005.htm#5

MCA. (2004). MGN 438 Consolidated European Reporting System (CERS) - Exemption Arrangements under the Merchant Shipping (Vessel Traffic Monitoring and Reporting), *438*(December 2007), 1–5.

MCA. (2014). Services and information - Maritime and Coastguard Agency - GOV.UK. *Maritime Coastguard Agency*. Retrieved August 28, 2014, from https://www.gov.uk/government/organisations/maritime-and-coastguard-agency/services-information

MLME. (2009). National Energy Policy An Agenda for Action and Economic and Social Development. Monrovia: MLME.

MLME. (2013). The Ministry of Lands, Mines & Energy. *MLME website*. Retrieved June 06, 2014, from http://www.molme.gov.lr/content.php?sub=24&related=1&res=24&third=24

MPE & NPD. (2013). *The norwegian petroleum sector*. (L.-J. Alveberg & E. V. Melberg, Eds.) (p. 52). Stavenger: MPE.

Mukherjee, P. K. (2007). *The penal law of ship-source marine pollution: Selected issues in perspective*. (T. M. Ndiaye & R. Wolfrum, Eds.) (p. 3). Leiden: Martinus Nijhoff.

National Legislature. (1989). *An Act Granting Exclusive Rights To The Liberia Petroleum Refining Company (LPRC) for The Importation, Sale And Distribution of petroleum and Petroleum Products Within The Republic Of Liberia* (pp. 1–3). Monrovia: Government Printing House, Ministry of Foreign Affairs.

National Legislature. (2002). *Title 21 maritime law the liberian maritime regulations* (No. 21) (pp. 7–9). Monrovia.

National Legislature. (2003a). *An Act Adopting the Environment Protection and Management Law of the Republic of Liberia* (pp. 8, 52, 53). Monrovia.

National Legislature. (2003b). *The National Environmental Policy of The Republic of Liberia*. (EPA, Ed.) (pp. 1–38). Monrovia: Ministry of Foreign Affairs.

National Legislature. Armed Forces of Liberia. , Pub. L. No. Section 2.3 (c) & (d) (2008). Liberia.

National Legislature. (2010). An Act to Provide for the establishment of the Liberia Maritime Authority. Monrovia: Ministry of Foreign Affairs.

NBSAP-Liberia. (2004). *Liberia's National Biodiversity Strategy and Action Plan* (pp. 4–8). Monrovia.

NCA. (2014). Vessel Traffic Service in Norway-Norwegian Coastguard Administration (NCA). *Internet*. Retrieved August 09, 2014, from http://www.kystverket.no/en/EN_Maritime-Services/Vessel-Traffic-Service/

NEA. (2014). Managing Norwegian Nature and Preventing Pollution -Norwegian Environment Agency (NEA). *Norwegian Environment Agency website*. Retrieved September 17, 2014, from http://www.miljodirektoratet.no/no/Om-Miljodirektoratet/Norwegian-Environment-Agency/

New York Outer Continental Shelf Office. (1982). *Proposed 1982 outer Continental shelf oil and gas lease sale offshore the North Atlantic states, OCS sale, Volume 2 (Google eBook)* (p. 289). New York: University of Michigan Press. Retrieved from http://books.google.com/books?id=YEDxAAAAMAAJ&pgis=1

NOCAL. (2012). African Petroleum: Significant Oil Discovery at Narina-1. *NOCAL website*. Retrieved June 27, 2014, from http://www.nocal.com.lr/news-and-media/african-petroleum-significant-oil-discovery-at-narina-1?A=SearchResult&SearchID=3026499&ObjectID=4049993&ObjectType=35

NOCAL. (2013). Remarks by the President and CEO of National Oil Company of Liberia (NOCAL) at 1st General Staff Meeting, 1–5. Retrieved from http://www.nocal.com.lr/pdf/Speeches_Presentations/Remarks_at_1st_General_Staff_Meeting_Feb2013.pdf

NOCAL. (2014a). Block Status. *Liberia Basin Status*. Retrieved May 29, 2014, from http://www.nocal.com.lr/operations/block-status

NOCAL. (2014b). NOCAL | Core Principles. *NOCAL website*. Retrieved September 04, 2014, from http://www.nocal.com.lr/about-nocal/core_principles

NOCAL. (2014c). NOCAL | NOCAL Our History. *NOCAL website*. Retrieved June 06, 2014, from http://www.nocal.com.lr/about-nocal/history

Norwegian Environment Agency. (2014). State of the Environment Norway : Oil and gas activities. *Norwegian Environment Agency website*. Retrieved September 03, 2014, from http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/

NPC. (2011). *Safe and Sustainable Offshore Operations* (No. 2) (pp. 13–15, 21). Washington D C.

Office Of Naval Intelligence & U.S. Coast Guard Intelligence Coordination Center. (1999). The Future of Maritime Activities. In *THREATS AND CHALLENGES TO MARITIME SECURITY 2020* (pp. 7–13). Suitland, Maryland: National Maritime Intelligence Center. Retrieved from http://fas.org/irp/threat/maritime2020/TITLE.htm

Office of the Auditor General of Canada. (2012). *Fall 2012 Report of the Commissioner of the Environment and Sustainable Development* (pp. 19–21). Ottawa: Office of the Auditor General of Canada.

Office of the Deputy Commissioner of Maritime Affairs. (2014). Response to Inquiry about Liberia's implementation of IMO Goal-based Standards. *Letter from the Liberia International Ship and Corporate Registry in Response to Inquiry*, 1–3.

Office of The Inspector of Transport. (2012). *Offshore Oil and Gas Resources Sector Security Inquiry* (pp. 45, 48). Canberra: Department of Infrastructure and Transport, Australia.

Offshore Oil & Gas Environment Forum. (2012). *2nd International Expert Meeting on Environmental Practices in Offshore Oil and Gas Activities, Stavanger, Norway, 29-30 June 2000, Meeting Report*. Retrieved from http://books.google.se/books/about/2nd_International_Expert_Meeting_on_Envi.html?id=o2HCXwAACAAJ&pgis=1

OGP. (2012). Offshore Environmental Monitoring for the Oil & Gas Industry. *International Association of Oil & Gas Producers*, (2-4), 15–17.

Oil & Gas UK. (2013). *2013 Decommissioning Insight UK* (p. 6). London.

OPRC. (1990). Articles 2, 3, and 4 of OPRC.

Osmundsen, P., & Tvetera˚ s, R. (2003). Decommissioning of petroleum installations -major policy issues. *Energy Policy*, *31*, 1579–1588.

Osofsky, H. M. (2013). Multidimensional Governance and the BP Deepwater Horizon Oil Spill. *Florida Law Review*, *63*(5), 1079, 1088–1093, 1115–1137.

OSPAR. (1998). OSPAR 98/3 Guidelines.

OSPAR. (2001). *OSPAR Guidelines for Monitoring the Environmental Impact of Offshore Oil and Gas Activities. . .* (Vol. Agreement, p. Agreement 01–10). ASMO.

OSPAR. (2004). *Guidelines for monitoring the environmental impact of offshore oil and gas activities. OIC, 04/14/1-E Annex 6. Meeting of the Offshore Industry Committee (OIC)*. Dublin.

OSPAR. (2014). Contracting Parties - Introduction - About OSPAR - OSPAR Commission. *OSPAR Commission Website*. Retrieved August 30, 2014, from http://www.ospar.org/content/content.asp?menu=00380108110000_000000_000000

Parente, V., Ferreira, D., Santos, E. M. dos, & Luczynski, E. (2006). Offshore decommissioning issues : Deductibility and transferability. *Energy Policy*, *34*, 1993–1995. doi:10.1016/j.enpol.2005.02.008

Paterson, J. (2007). The Evolution of Occupational Health and Safety Law on the UK Continental Shelf. Northern Scotland. *Northern Scotland*, *27*, 43–67.

Paterson, J. (2011). Health and Safety at Work Offshore. In E. J. Paterson, Gordon, G., Usenmez (Ed.), *Oil and Gas Law : Current Practice and Emerging Trends*. Dundee: Dundee University Press. Retrieved from http://trove.nla.gov.au/work/160076038?q=+&versionId=174518969

Pegg, S. (2006). World leaders and bottom feeders: divergent strategies toward social responsibility and resource extraction. In C. May (Ed.), *Global corporate power* (pp. 249–269). Boulder: Lynne Rienner.

Petersen, J. K., & Malm, T. (2006). Offshore Windmill Farms: Threats to or Possibilities for the Marine Environment. *Ambio*, *35*(2), 75–80.

Petroleum Safety Authority. (2010). From prescription to performance in petroleum supervision - Petroleum Safety Authority Norway. *Petroleum Safety Authority website*. Retrieved June 11, 2014, from http://www.psa.no/news/from-prescription-to-performance-in-petroleum-supervision-article6696-878.html

Petroleum Safety Authority. (2014). Ekofisk Bravo (1977) - Petroleum Safety Authority Norway. *Petroleum Safety Authority website*. Retrieved June 14, 2014, from http://www.psa.no/articles-in-safety-status-and-signals-2012-2013/ekofisk-bravo-1977-article9121-1095.html

Roach, J. A., & Smith, R. W. (2012). *Excessive Maritime Claims: Third Edition* (3rd ed., p. 141). Leiden: Martinus Nijhoff Publishers. Retrieved from http://books.google.com/books?id=wVIyAQAAQBAJ&pgis=1

Rochette, J., Wemaëre, M., Chabason, L., & Callet, S. (2014). Seeing beyond the horizon for deepwater oil and gas: strengthening the international regulation of offshore exploration and exploitation. *Institut Du Développement Durable et Des Relations Internationales (IDDRI)*, *01*(14), 1, 7–8.

Royal Academy of Engineering. (2013). *Decommissioning in the North Sea Decommissioning in the North Sea: A report of a workshop held to discuss the decommissioning of oil and gas platforms in the North Sea* (pp. 2, 6, 19–20). London.

SEPA. (2014). Waste hierarchy Scotland Environmental Protection Agency (SEPA). *Internet*. Retrieved July 13, 2014, from http://www.sepa.org.uk/waste/moving_towards_zero_waste/waste_hierarchy.aspx

Shannon, D. E. (2006). National Energy Stakeholders Forum - Create an energized Liberia. *National Energy Stakeholders Forum, Liberia*. Retrieved June 06, 2014, from http://www.nefl.org.lr/press.php?news_id=40

Sieh, R. D. (2014a). allAfrica.com: Liberia Oil Firm Chief Attempts to Ride NOCAL Into Bid Rounds. *allAfrica.com*. Retrieved June 07, 2014, from http://allafrica.com/stories/201403060875.html?viewall=1

Sieh, R. D. (2014b). Liberia Oil Firm Chief Attempts to Ride NOCAL Into Bid Rounds. *Frontpageafrica Online*. Retrieved from http://frontpageafricaonline.com/index.php/op-ed/editorial/954-opening-bid-rounds-for-oil-is-wrong-lie-catches-up-with-mcclain-nocal

Simba Energy. (2012). Simba Energy in Liberia. *Simba Energy Inc.* Retrieved June 07, 2014, from http://www.simbaenergy.ca/projects/liberia.aspx

Smith, C., Papadopoulou, N., Barnard, S., Mazik, K., Patrício, J., Elliott, M., … Eronat, A. H. (2014). Conceptual models for the effects of marine pressures on biodiversity. *DEVOTES/EU*, 5.

Smith, R. W. (2000). *National Claims to Maritime Jurisdiction*. *Limits in the Seas* (Vol. 36, p. 92). Washington, D. C.

SOLEC. (2013). *A Work Group Report to the International Joint Commission Technical Report on Ecosystem Indicators- Assessment of Progress Towards Restoring the Great Lakes 2012-2015 Priority Cycle* (p. 3). Ann Arbor.

SPAWAR Systems Center Pacific USCG. (2014). S-AIS vs VMS vs LRIT What are the differences ? Santiago: USCG.

Statoil. (2014). Monitoring of the Norwegian continental shelf. *Statoil Website*. Retrieved September 03, 2014, from http://www.statoil.com/en/TechnologyInnovation/ProtectingTheEnvironment/EnvironmentalMonitoring/Pages/MonitoringOfTheNorwegianContinentalShelf.aspx

Stokke, O. S. (2002). Beyond Dumping ? The Effectiveness of the London Convention. *Yearbook of Internationl Co-Operation on Environment and Development*, 39.

Svarstad, H., Petersen, L. K., Rothman, D., Siepel, H., & Wätzold, F. (2008). Discursive biases of the environmental research framework DPSIR. *Land Use Policy*, *25*(1), 116–125. doi:10.1016/j.landusepol.2007.03.005

Tarr, P. (2013). *Strategic Environmental Assessment for the Benguela Large Marine Ecosystem* (pp. 3, 10–15). Windhoek.

The Pembina Institute. (2011). Comparing the Offshore Drilling Regulatory Regimes of the Canadian Arctic, the U.S., the U.K, Greenland and Norway-Executive Summary, 1–6. doi:10.1016/S0273-2300(05)80076-5

Therivel, R. (2010). *Strategic Environmental Assessment in Action* (2nd ed., pp. 11–18). London: Earthscan. Retrieved from http://www.google.se/books?hl=en&lr=&id=ORCE-nq3JHgC&pgis=1

Thornton, W., & Twomey, B. (2011). Introduction to Worldwide Decommissioning. In *3rd Annual Offshore Decommissioning Conference*. Singapore: Worldoils.

Transport Canada. (2014, February 19). Surveillance and monitoring of ship pollution with Canada's National Aerial Surveillance Program. *Internet*. Retrieved August 26, 2014, from http://news.gc.ca/web/article-en.do?nid=816759

Tuagben, D. S. (2012). *The Vulnerability of the Coast of Liberia to Marine Oil Spills: Implications for Biodiversity and Renewable Natural Resource Utilization*. University of Cape Town.

UN. (1992a). *United Nations Framework Convention on Climate Change of 16th February 2005 (entered into force)*. Bonn: UNCFCC Secretariat.

UN. (1992b). *United Nations Framework Convention on Climate Change of 16th February 2005 (entered into force)*. Bonn: UNCFCC Secretariat.

UNCLOS. United Nations Convention on the Law of the Sea. , Pub. L. No. Article 76 (1982). Retrieved from http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

UNEP. (1985). *The Vienna Convention for the Protection of the Ozone Layer. Ozone. Nairobi Secretariat / UNEP*. Naroibi Secreatariat/UNEP.

UNEP. (1997). *Environmental management in oil and gas exploration and production An overview of issues and Management Practices* (pp. 2, 4, 16, 22). Paris: UNEP Technical Publication.

UNEP. (2011). *Environmental Assessment of Ogoniland* (pp. 39, 205). Nairobi.

UNEP. (2013). Norway-OEF/UNEP. *United Nations Environmental Programme (UNEP) Offshore Oil and Gas Forum website*. Retrieved July 14, 2014, from http://archive.today/P8GGw

Ungemach-bensaid, S., Geoffroy, J., & Poulenard, D. (2014). Strategic Environmental Assessment: Second version (V2), based on the V3 PO. *EU Environmental Report: Mediterranean Area*, 1–70.

URS. (2013). *Nimba Western Area Iron Ore Concentrator Mining Project , Liberia Environmental and Social Impact Assessment Volume 3 , Part 5 : Air Quality Impact Assessment*. (D. Duce, G. Hearn, G. Gray, C. Ren, T. Romanenko, & M. Edge, Eds.) (Vol. 3, p. 10). Hampshire, Uk: URS/EPA-Liberia.

USAID. (2008). *Liberia environmental threats and opportunities assessment (ETOA). Final Report. Monrovia.* Monrovia.

USEPA. (2014). Compliance Monitoring. *United States Environmental Protection Agency*. Retrieved September 02, 2014, from http://www.epa.gov/compliance/monitoring/

Vinnem, J.-E. (2007). *Offshore Risk Assessment: Principles, Modelling and Application of QRA Studies*. (H. Pham, Ed.) (2nd ed., pp. 5–6). London: Springer-Verlag.

Vinnem, J.-E. (2014a). *Offshore Risk Assessment vol 1.* (H. Pham, Ed.) (3rd ed., Vol. 1, p. 98). London: Springer London. doi:10.1007/978-1-4471-5207-1

Vinnem, J.-E. (2014b). *Offshore Risk Assessment vol 2 Principles, Modelling and Applications of QRA Studies*. (H. Pham, Ed.) (3rd ed., Vol. 2, pp. 700–702). London: Springer London. doi:10.1007/978-1-4471-5207-1

Waheed, B., Khan, F., & Veitch, B. (2009). Linkage-Based Frameworks for Sustainability Assessment: Making a Case for Driving Force-Pressure-State-Exposure-Effect-Action (DPSEEA) Frameworks. *Sustainability*, *1*(3), 441–463. doi:10.3390/su1030441

Wahuemo, G. M. (2013). *Hydrocarbon Exploration and Production on the Liberian Continental Shelf: Liberia's Obligations under International and National Law to Protect the Marine Environment*. UiT The Arctic University of Norway.

Whitaker, M. (1999, December). Emerging "triple bottom line" model for industry weighs environmental, economic, and social considerations. *Oil and Gas Journal*.

White, C., Halpern, B. S., & Kappel, C. V. (2012). Ecosystem service tradeoff analysis reveals the value of marine spatial planning for multiple ocean uses. *Proceedings of the National Academy of Sciences of the United States of America*, *109*(12), 4696–4701. doi:10.1073/pnas.1114215109

Williams, S. (2012). Tiie promise of oil. *New African*, 69.

Wojtanowicz, A. K. (2008). Environmental Control Technology for Oilfield Processes. In S. T. Orszulik (Ed.), *ENVIRONMENTAL TECHNOLOGY IN THE OIL INDUSTRY* (2nd ed., p. 19). Hampshire, Uk: Springer.

Young, O. R., Levy, M. A., & Osherenko, G. (1999). *The Effectiveness of International Environmental Regimes: Casual Connections and Behavioral Mechanisms*. (O. R. Young, Ed.) (p. 1). Cambridge, MA.: MIT Press.

Zawawi, N. A. W. A., Liew, M. S., & Na, K. L. (2014). Decommissioning of Offshore Platform: A Sustainable Framework. *IEEE*, 1. doi:10.1109/CHUSER.2012.6504275

APPENDIX 1

WORLD MARITIME UNIVERSITY
MARINE ENVIRONMENTAL AND OCEAN MANAGEMENT

Questionnaire for Research

TOPIC:

From Exploration Drilling to Decommissioning: Where Does Responsibility Lie For Regulating and Monitoring Offshore Oil Platforms in Liberian Waters?

Date:_____

Inspection for Environmental Compliance	Domestic Regulation giving effect to environmental inspection	Responsible Entity	Frequency of Inspection

Are there organizational policies/regulations in place for an environmentally sound monitoring of offshore oil installations? Yes/No

What impact on the marine environment do these policies hope to mitigate?

Are there regulations in place as regards to decommissioning of offshore oil installations? Yes/No

Do these regulations cover returning the decommissioned areas to a navigable depth? Yes/No

Besides the method of decommissioning are there any mechanisms in place to cater to redundant offshore oil installations? Yes/No

THANKS FOR YOUR HELP

APPENDIX 2

WORLD MARITIME UNIVERSITY
MARINE ENVIRONMENTAL AND OCEAN MANAGEMENT

Questionnaire for Research

TOPIC:

From Exploration Drilling to Decommissioning: Where Does Responsibility Lie For Regulating and Monitoring Offshore Oil Platforms in Liberian Waters?

Date:_____

Domestic Regulation giving effect to Inspection	RISK-BASED (YES/NO)	PRESCRIPTIVE (YES/N0)	Frequency of Inspection (Monthly, etc)
RESPONSIBLE ENTITY:	If yes, why:	If yes, why:	

Are there organizational regulations in place for offshore oil installations inspections?

What impact on the marine environment do these policies/regulations hope to mitigate?

Are there regulations in place as regards to decommissioning of offshore oil installations? Yes/No

Do these regulations cover returning the decommissioned areas to a navigable depth? Yes/No

Besides the method of decommissioning are there any mechanisms in place to cater to redundant offshore oil installations? Yes/No

THANKS FOR YOUR HELP

APPENDIX 3

Summary output of Regression Analysis-Maritime Incidents, Liberia

Regression Statistics	
Multiple R	0.936575
R Square	0.877172
Adjusted R Square	0.846465
Standard Error	2.028479
Observations	6