School for Advanced Legal Studies – Faculty of Law

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Towards Effective Regulation of Offshore Oil and Gas Waste Management in Nigeria

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DECLARATION

Research dissertation presented for the approval of Senate in fulfilment of part of the requirements for the Degree of Master of Laws in approved courses and minor dissertation. The other part of the requirements for this qualification was the completion of a programme of courses.

I hereby declare that I have read and understood the regulations governing the submission of Master of Laws dissertations, including those relating to length and plagiarism, as contained in the rules of the University, and that this dissertation conforms to those regulations.

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Anwuli Irene Ofuani

DEDICATION

This thesis is dedicated to God Almighty for his omnipotent presence during my Masters programme and throughout my life. He makes the impossible possible and without Him I am nothing.

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ABSTRACT

The advancement of technology in the world has led to the rapid development of the offshore oil and gas industry. Consequently, the number of offshore oil and gas installations around the world is on the increase and so is the amount of wastes generated from such installations. The enactment of laws with adequate provisions for the regulation of wastes from offshore oil and gas activities is therefore very necessary. Only a few countries in the world have laws with adequate provisions for regulating offshore exploration and production (E&P) waste management. Nigeria is an example of a country with inadequate offshore E&P waste management laws. This thesis examines the regulation of offshore E&P waste management in Nigeria. It posits that the provisions of Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) with regards to regulating the discharge and management of E&P wastes are inadequate. It also advocates for the amendment of EGASPIN and the development of a law regulating offshore E&P wastes so as to ensure effective offshore E&P waste management in Nigeria.

ABBREVIATIONS

BAT- Best Available Techniques

BEP- Best Environmental Practice

BP- British Petroleum

CBD -United Nations Convention on Biological Diversity

CSD- United Nations Commission on Sustainable Development

DPR- Department of Petroleum Resources

DECC-Department of Energy and Climate Change

EEZ- Exclusive Economic Zone E&P- Exploration and Production

EIA- Environmental Impact Assessment

EGASPIN- Environmental Guidelines and Standards for the Petroleum Industry in Nigeria

EIS- Environmental Impact Statement

E&P Forum- Oil Industry International Exploration and Production Forum

EU- European Union

FRN- Federal Republic of Nigeria.

GT- Tons Gross Tonnage

IAGC- International Association of Geophysical Contractors

IMO- International Maritime Organisation

LOSC- United Nations Convention on the Law of the Sea 1982

LSA- Low Specific Activity

LFN- Laws of the Federation of Nigeria

MARPOL 73/78- International Convention for the prevention of Pollution from ships of 1973 as modified by the Protocol of 1978

NGO- Non Governmental Organisations

NNPC- Nigerian National Petroleum Corporation

NORM- Naturally Occurring Radioactive Materials

OBM- Oil-based fluids/mud

OGP- International Association of Oil & Gas Producers

OPEC- Organisation of Petroleum Exporting Countries

OSPAR Convention- Convention for the Protection of the Marine Environment of the North-East Atlantic 1992

PARCOM- Paris Commission

Pci/gm- PicoCuries per gram

Rems/hr- Roentgen equivalent in man per hour

PPM- Parts of oil per million parts of water by volume

SBM- Synthetic-based fluids/mud

SPDC- Shell Petroleum Development Company of Nigeria Limited

UN- United Nations

UNCED- United Nations Conference on Environment and Development

UNEP- United Nations Environment Programme

UKOOA- United Kingdom Offshore Operators Association

UK- United Kingdom

UKCS- United Kingdom Continental Shelf

UNCLOS- United Nations Convention on the Law of the Sea 1982

WBM- Water based fluids/mud

WWF- World Wide Fund for Nature

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CHAPTER ONE

OFFSHORE OIL AND GAS OPERATIONS AND WASTE MANAGEMENT

I.1. Introduction

The development of the offshore oil and gas industry has been going on for many decades with little thought of the consequences of its activities on the environment. However, in recent years, there has been a clamour by the international community to protect the marine environment from further degradation. Many global, regional and national laws have been made to that effect and some of these laws deal with the offshore oil and gas industry. One area that seems to be deficient in these laws **is the management of wastes generated from operational activities of the offshore oil and gas industry** especially during exploration and production. This is clearly illustrated by the inadequate regulation of offshore exploration and production (E&P) waste management in Nigeria.

Sustainable development of oil and gas resources requires appropriate handling of offshore E&P wastes because inadequate waste management can result in environmental damage and financial liabilities.[1] It is therefore imperative that offshore E&P wastes are adequately managed in order to minimise their potential to cause harm to health or the environment.[2] As such, the need to effectively manage such wastes has become an issue of international concern. The enactment of laws with adequate provisions for the regulation of wastes from offshore oil and gas activities is therefore very necessary. This is because such laws will assist in the reduction of operational pollution from offshore oil and gas activities.

Of all the offshore oil and gas wastes why study the regulation of offshore E&P waste management in Nigeria? Are offshore E&P wastes adequately regulated in Nigeria? What are the reasons for ineffective offshore E&P waste management in Nigeria? Are the wastes adequately regulated in the United Kingdom (UK) and if they are, what aspects of UK law can be incorporated into Nigerian law? These are

[1] H Bashat 'Managing waste in exploration and production activities of the petroleum industry' 1. Available at http://www.eeaa.gov.eg/english/main/Env2003/Day1/Oil/bashat.aeec.pdf. [Accessed 28 August 2009]. Many national laws now have provisions for financial liability for inadequate handling of offshore oil and gas wastes by operators because such wastes can damage the environment by causing pollution and disturbance of the ocean.

[2] *Ibid*.

questions this thesis seeks to answer. In doing this, the thesis attempts to examine the state and adequacy of offshore oil and gas (E&P) waste management laws in Nigeria. The laws of the UK will also be examined to see what can be borrowed by Nigeria to ensure the adequate regulation of offshore E&P waste management. This is because the UK has recognised the need for the effective management of offshore E&P wastes and the protection of the marine environment where offshore activities are carried out. The UK was chosen most importantly because its laws are exemplary and also because Nigeria being a former British colony, fashions most of its laws after the UK.

1.2. Why Offshore Oil and Gas (E&P) Waste Management?

Nigeria has not done much with regards to the enactment of laws that are adequate for offshore E&P waste management. In spite of the expanding literature on oil and gas issues around the world, there is also not much literature on the legal aspects of offshore oil and gas waste management in Nigeria. More attention has been focused on onshore oil and gas activities to the detriment of offshore activities. Consequently, the absence of satisfactory offshore oil and gas waste management laws in Nigeria has contributed to pollution and environmental degradation in the country. Additionally, since offshore activities are carried out in areas of direct government scrutiny, there is potential for excessive pollution and degradation if the problem remains unchecked. Hence, the need for more stringent regulation of offshore oil and gas (E&P) waste management in Nigeria.

1.3. Structure of Thesis

This chapter discusses the definition of wastes and waste management, the types offshore oil and gas wastes, the methods of disposal of offshore oil and gas wastes and the impacts of offshore oil and gas wastes on the marine environment. Chapter two examines the international and regional laws regulating offshore oil and gas waste management. In doing so, chapter two seeks to determine the effectiveness of the laws in addressing offshore oil and gas waste management. Chapter three looks at the laws regulating offshore E&P waste management and offshore environmental protection in Nigeria as well as the efficacy of such laws. Chapter four examines the laws regulating offshore E&P wastes and offshore environmental protection in the

UK. Chapter five makes recommendations for the adequate regulation of offshore oil and gas waste management in order to mitigate the adverse effects of the industry.

1.4 The Meaning of Waste and Waste Management

Waste is technologically and socially connected to human development since industrial development and innovation can also be linked to the generation of waste.[3] It is difficult to specifically define *waste*. Simply put, 'waste' is any unwanted or undesired material or substance.[4] The European Union Waste Framework Directive defines 'waste' as an object the holder discards, intends to discard or is required to discard.[5] The Madrid Offshore Protocol also has a similar definition of waste.[6]

The United Kingdom's Environmental Protection Act defines 'waste' to include any substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of any process.[7]

'E&P waste' is defined as any unavoidable material resulting from an up-stream operation for which there is no economic demand and which must be disposed of.[8] So 'offshore E&P wastes' are undesired substances produced from offshore exploration, production and other related activities that ought to be disposed of or discarded.

Waste management is the human control of the collection, treatment and disposal of different wastes in order to reduce the negative impact waste has on the environment.[9] It includes the collection, transportation, processing, recycling or disposal of waste materials produced by human activities.[10] Waste management is

[3] 'Waste management'. Available at http://www.absoluteastronomy.com/topics/waste_management.html. [Accessed 11 February 2009].
[4] *Ibid*.
[5] European Directive 2006/12/EC as amended by the European Directive 2008/98/EC.
[6] See article 1 of the Protocol for the protection of the Mediterranean Sea against pollution resulting from exploration and exploitation of the continental shelf and the seabed and its subsoil. Available at http://www.unep.ch/regionalseas/main/med/medoffsh.html. [Accessed 28 August 2009].
[7] For more details, see section 75 (2) (a) and (b) of the Environmental Protection Act 1990, Chapter 43 as amended by the Environment Act of 1995. Available at http://www.opsi.gov.uk/acts/acts1990/ukpga_19900043_en_1. [Accessed 28 August 2009].
[8] Bashat (n 1) at 2.
[9] *Supra* (n3).
[10] *Ibid*. This is similar to the definition of waste management in the OCED Glossary of statistical terms. Available at http://stats.oecd.org/glossary/detail.asp?ID=2900. [Accessed 28 August 2009].

applicable to almost all oil and gas operations, from seismic surveys, drilling, field development and production phases to the decommissioning phase.[11]

Once a substance or object has become waste, it will remain waste until it has been fully recovered and no longer poses a potential threat to the environment or to human health.[12] A good waste management policy is therefore useful in the prevention, reduction and control of pollution, the protection of human health as well as the enhancement of the aesthetic value of the environment.

1.5 Types of Offshore Wastes

With the exception of oil, offshore E&P operations are responsible for 98 to 99% of the materials discharged into the sea.[13] A variety of solid and liquid wastes is generated during offshore oil and gas operations and is the result of E&P operations and other human activities on offshore installations.[14] These wastes include E&P wastes, human wastes and industrial wastes.[15] The different types of offshore wastes will now be examined.

1.5.1 Exploration and production wastes

Exploration and production wastes refer to the wastes generated during offshore E&P operations. The E&P wastes discussed below are not all-encompassing but only refer to the common E&P wastes generated in offshore activities. They include drilling fluids/mud; drilling cuttings; produced water; produced sand; storage displacement water; deck drainage; bilge water; well treatment, work-over and completion fluids; hydrostatic test water; and associated wastes.

i. Drilling fluids/mud

Drilling fluids/mud are fluids that are used to control temperature and pressure in drilled boreholes, to cool and lubricate the drill bit and to remove drill cuttings from

[11] Bashat (n 1) at 2.
[12] 'Definition of waste'. http://www.aggregain.org.uk/wastemanagementregulations/background/definiti on of html. [Accessed 15 February 2009].
[13] Maria Gavouneli *Pollution from offshore installations* (1995) 41.
[14] JA Veil 'Offshore waste management: discharge, inject or haul to shore'. Available at http://ipec.utulsa.edu/Conf2001/veil_2.pdf. [Accessed 28 August 2009].
[15] *Ibid*.

boreholes.[16] They usually consist of gelling and deflocculating agents (bentonite clays) filtration control agents, pH and ion-control substances, barites, biocides, corrosion inhibitors, lubricants, defoaming agents and trace elements of heavy metals.[17] Drilling fluids/mud could be oil-based (OBMs), synthetic-based (SBMs), or water-based (WBMs).[18] Of the three types of drilling fluids/mud, WBMs are likely to cause limited environmental damage when used than the other types of drilling fluids/mud while OBMs are more toxic than the others .[19] It is therefore advisable that WBMs be used for offshore E&P operations to minimize damage to the environment.[20]

ii. Drill cuttings

Drill cuttings are small fragments of subsurface rock which break and become integrated in drilling fluids/mud during drilling operations. They vary in size and texture depending on the rock formation which is being drilled.[21]

iii. Produced water

Produced water is water brought to the surface during routine production operations or injected seawater which is used to increase the pressure in oil wells and maximise oil and gas recovery.[22] It includes formation water, condensed water, brine, injection water and other technological wastes which usually consist of oil, natural hydrocarbons, inorganic salts and technological chemicals.[23] The discharge of

[16] Sandra Kloff and Clive Wicks 'Environmental management of offshore oil development and maritime oil transport' (2004) 1 at 27. Available at http://cmsdata.iucn.org/downloads/offshore_oil_eng.pdf. [Accessed 28 August 2009]. See also '2000 Environmental protection and offshore oil' 1 at 21. Available at http://www.dieselduck.ca/library/05%20environmental/2000%20Environmental%20Protection%20and%20offshore%20oil.pdf. [Accessed 28 August 2009].
[17] *Ibid*.
[18] Gaurina-Medimuree Nediljika et al 'Offshore drilling and environmental protection'. Available at http://bib.irb.hr/datoteka/274894.lanakOFFSHORE_DRILLING_AND_ENVIRONMENTAL_PROTECTION.doc. [Accessed 28 August 2009].
[19] *Ibid*.
[20] *Ibid*.
[21] *Ibid*. See also '2000 Environmental protection and offshore oil' (n 16) at 21.
[22] '2000 Environmental protection and offshore oil' (n 16) at 21-22.
[23] Stanislav Patin 'Waste discharges during offshore oil and gas activity'. Available at http://www.offshore-environment.com/discharges.html. [Accessed 29 August 2009].

produced water accounts for the greater portion of wastes arising from offshore oil and gas E&P operations wastes.[24]

iv. Produced sand

Produced sand is sand extracted with oil in varying degrees during drilling and is a potential source of oil pollution.[25] It includes slurried particles of sand used in hydraulic fracturing, accumulated formation sands and scale particles generated during production.[26] It also includes desander discharge from produced water treating systems.[27]

v. Displacement water

This is water that is pumped in and out of storage chambers during oil production and off-loading operations.[28] It is usually contaminated with oil and other chemicals.[29]

vi. Platform Drainage

This is also known as deck drainage or machinery space drainage. Platform drainage is includes water that reaches the deck of offshore installations through precipitation, sea spray, rainwater or from routine operations such as wash down and fire drills.[30] It may be contaminated with oil and grease that lands on the deck of offshore installations.

vii. Bilge water

Bilge water is water that may seep or flow into the structure from various points in offshore installations which could be contaminated with oil.[31]

[24] Lin Zhao et al 'A risk assessment model for produced water discharge from offshore petroleum platforms-development and validation'*(*2008) 56 (11) *Marine Pollution Bulletin* at 1890.
[25] Patin (n 23).
[26] 'Fact sheet and supplemental information for the proposed re-issuance of the NPDES general permit for new and existing sources in the offshore subcategory of the oil and gas extraction point source category for the western portion of the outer continental shelf of the gulf of Mexico' (GMG290000) (December 2006) 1 at 9. Available at www.epa.gov/EPA-IMPACT/2006/December/Day-21/i21890.htm [Accessed 19 February 2009].
[27] *Ibid*.
[28] Offshore waste management guidelines for Canada (August 2002) 1 at 7. Available at www.cnsopb.ni.ca/pdfs/guidelines/owtgo208.pdf. [Accessed 24 February 2009].
[29] *Ibid*.
[30] *Ibid* at 8.
[31] *Ibid*.

viii. Well treatment, work-over and completion fluids

Well treatment fluids are any fluids used to restore or improve productivity by chemically or physically altering hydrocarbon-bearing strata after a well has been drilled.[32] Well completion fluids are the various additives used to prevent damage to the well bore during operations which prepare the drilled well for hydrocarbon production.[33] Work-over fluids are specialty additives used in a producing well to allow for maintenance, repair or abandonment procedures.[34]

ix. Hydrostatic test water

Hydrostatic test water refers to water displaced in pipelines and tanks which are usually kept below or above atmospheric pressure. They are used for checking for leaks and/or structural integrity in such pipelines and tanks.[35]

x. Associated wastes

These are a wide category of small volume waste streams or chemicals that cover all other types of wastes related to oil and natural gas production.[36] They include desalinization unit discharges, blowout preventer control fluids, boiler blowdown, source water and source sand, diatomaceous earth filter media, excess cement slurry and sub sea production discharges etc.[37]

All these E&P wastes are potentially harmful to the marine environment because they are usually contaminated with oil, hydrocarbons, complex chemical compounds and metals of varying toxicity. Thus, it is necessary that there are laws with prescribed guidelines for the disposal of these wastes.

1.5.2 Human wastes

Human wastes are wastes that are derived from basic human activities on offshore installations including garbage, kitchen wastes, sanitary wastes, laundry wastes and

[32] *Supra* (n 26) at 9.
[33] *Ibid*.
[34] *Ibid*.
[35] 'Hydrostatic test water'. Available at http://www.epa.state.oh.us/dsw/permits/GP HydrostaticTestWater.html. [Accessed 24 February 2009].
[36] Patin (n 23).
[37] *Supra* (n 26) at 10.

domestic wastes such as galley, sink and shower drainage.[38]

1.5.3 Industrial wastes

These are wastes that are not specifically associated with the offshore oil and gas industry but are nonetheless generated at offshore installations.[39] They include scrap metal, wood pallets, empty containers, sandblasting grit, used chemicals and spent solvents, paint, packaging materials and cooling water from air conditioners.[40]

Although there is not sufficient data on the total amount of offshore E&P wastes generated and disposed of in Nigeria and the United Kingdom, it is imperative that such wastes are effectively managed since they contain a lot of substances that can have detrimental effects if released into the marine environment.

1.6 Methods of Disposing Offshore Exploration and Production Wastes

The proper management and disposal of offshore E&P wastes is vital to the protection of the marine environment. This is because if such wastes are improperly handled, they can cause extensive damage to the marine environment and its resources.

The three main ways to dispose of offshore wastes are by discharge into the ocean, by onshore disposal and by injection into an injection well or into the annulus of a well being drilled.[41]

1.6.1 Discharge into the ocean

This refers to the overboard discharge of offshore wastes from offshore installations after such wastes have been adequately treated.[42] It is the easiest and cheapest method of disposing of wastes but also the most environmentally damaging if the wastes are not treated before being discharged into the ocean.[43]

Until recently, the oceans were perceived to be limitless dumping grounds and E&P wastes were generally discharged from offshore installations directly into the

[38] Veil (n 14).
[39] *Ibid*.
[40] *Ibid*.
[41] *Ibid*.
[42] Nediljika et al (n 18).
[43] Kloff and Wicks (n16) at 28.

oceans without treatment.[44] However, mounting evidence from the research of environmental scientists has shown that some types of E&P wastes, particularly drilling wastes, could have undesirable effects on marine ecology.[45] It is therefore advisable that the discharge of such wastes into the ocean is subject to laid down procedures. Some countries such as the United Kingdom, the United States of America, Canada and Norway have set standards and procedures for the discharge of the different types of offshore E&P wastes particularly for produced water, drilling fluids/mud and drilling cuttings into the ocean in their oil and gas waste management laws.[46]

1.6.2 Onshore disposal

Onshore disposal of wastes refers to the collection and transportation of offshore E&P wastes to an onshore site for treatment and final disposal if necessary.[47] The wastes taken on shore are usually treated before disposal, recycled, incinerated or minimised and disposed of through other means such as landfills, land farming and composting, etc.[48]

1.6.3 Injection

Injection is basically the injection of fluids into an injection well or any drilled well. It is the technology of placing fluids or substances underground through wells.[49] An injection well is any excavation that is cored, bored, drilled, jetted or constructed, whose depth is greater than its largest surface dimension and which is used or intended

[44] 'Fact sheet- discharge to ocean'. Available at http://web.ead.anl.gov/dwm/techdesc/discharge/index.cfm. [Accessed 29 August 2009].
[45] *Ibid*. There is evidence that drilling wastes such as drilling cuttings, drilling fluids/mud and produced water contain chemical substances and compounds that can cause immense ecological imbalance to the marine environment. See also Rehan Sadiq et al 'Risk-based decision-making for drilling waste discharges using a fuzzy synthetic evaluation technique' (2004) 31(16) *Ocean Engineering* at 1929.
[46] These countries regulate the discharge of E&P wastes through discharge permits and have laid down rules and guidelines for the discharge of E&P wastes especially drilling fluids/mud.
[47] Nediljika et al (n 18).
[48] Richard C. Haut et al 'Minimizing waste during drilling operations' presented at the American Association of Drilling Engineers National Technical Conference and Exhibition, 2007. Available at http://files.harc.edu/Projects/OurWork/MinimizingWasteDrilling.pdf. [Accessed on 29 August 2009].
[49] 'Types of injection wells: Fact sheet for the underground injection program in Arkansas'. Available at http://www.adeq.state.ar.us/water/branch_permits/pdfs_forms/uic_fact_sheet.pdf. [Accessed 29 August 2009].

to be used for the injection of fluids or solids into the subsurface.[50] Injection wells are used for the drainage or disposal of unwanted substances.[51] There are many types of injection wells depending on the type of substance to be disposed of or discharged into the well.[52]

The effective monitoring of these different waste disposal methods is required for the prevention of marine pollution and the protection of the marine environment. This could best be achieved by the adoption of a global convention with standards and procedures as well as monitoring mechanisms for the discharge of E&P wastes.

1.7 Effects of Ineffective Offshore (Exploration and Production) Waste Management

The effective management of offshore E&P wastes is crucial because many offshore installations are located in coastal areas with a number of marine organisms as well as fragile and sensitive ecosystems.[53] Accordingly, the poor management of wastes generated in the course of operational activities involved in offshore E&P operations can impact on the marine environment. It can result in physical, chemical and biological damage to the marine environment and can also affect marine wildlife, especially fish, directly and indirectly.[54] Some of the effects of E&P wastes on the marine environment include: impact on marine fauna and organisms; marine pollution; increase in the toxicity level in the marine environment; noise and vibration; the disturbance of ocean sediments; increases in water column turbidity; and the introduction of non-indigenous species.

i. Impact on marine fauna and organisms

The discharges and wastes generated from offshore E&P operations such as seismic surveys, drilling and dredging affect marine fauna and organisms in many ways. This

[50] 'What is an injection well?' Available at http://h2o.enr.state.nc.us/aps/gpu/uic/index.htm. [Accessed 29 August 2009].
[51] 'Injection wells'. Available at http://www.purdee.edu/envirosoft/groundwater/src/epa.5.htm. [Accessed 23 March 2009].
[52] *Ibid*.
[53] SV Vinogradov and JP Wagner 'Combating operational pollution from offshore petroleum activities: International regime' 1 at 3. Available at http://www.dundee.ac.uk/cepmlp/infoserv/Downloads_Free/CP1-97.pdf. [Accessed 29 August 2009].
[54] Kloff and Wicks (n16) at 25.

includes intoxication and death of species, reduced fertility, feminization of male species, decline of population of species, elimination of embryos, larvae and juveniles, reduction in the feeding base as a result of the avoidance of offshore installations by marine fauna and disturbance of migration patterns and spawning periods.[55] It can also result in a change in taste of species[56] and in so doing make it unfit for human consumption. It can further result in reduced immunity to disease and parasites, suppressed growth, tainted flesh and cellular changes such as lesions in mammals and organisms.[57]

ii. Marine pollution

The normal operational activities such as drilling carried out on offshore installations in the course of exploration and production can cause the pollution of the marine environment.[58] Marine pollution occurs when oil and other complex chemical compounds in the substances used during drilling operations are discharged and/or disposed of into the marine environment.[59] The pollution problems caused by oil and other contaminants in drilling waste fluids to the marine environment were acknowledged many years ago. For instance, such problems were recognised in the Gulf of Mexico over 40 years ago.[60]

iii. Increase in toxicity level of the marine environment

Offshore wastes such as drilling fluids, drilling mud and produced water as well as crude oils contain toxic chemical substances of varying degrees of toxicity.[61] The introduction of these substances into the marine environment can lead to the increase

[55] *Ibid*. See also Marina Heberer and Peter Prentis 'Environmental consequences of offshore oil drilling' (2008) available at http://www.docstoc.com/docs/3571113/Environmental-Consequences-of-Offshore-Oil-Drilling. [Accessed 29 August 2009].
[56] *Ibid*.
[57] Douglas A Holdway 'The acute and chronic effects of wastes associated with offshore oil and gas production on temperate and tropical marine ecological processes' (2002) 44 *Marine Pollution Bulletin* 185 at 196-197.
[58] Vinogradov and Wagner (n 53) at 5.
[59] Kloff and Wicks (n16) at 27.
[60] Jonathan Wills 'Muddied Waters A Survey of Offshore Oilfield Drilling Wastes and Disposal Techniques to Reduce the Ecological Impact of Sea Dumping' (2000) at 15. Available at http://www.alaskaforum.org/other/muddiedwaters.pdf. [Accessed 29 August 2009].
[61] Holdway (n 57) at 190-194.

in the toxicity level of the marine environment thereby negatively impacting on marine organisms, fauna and flora.[62]

iv. Noise and vibration

Offshore exploration and production activities can cause noise pollution as well as vibration. The noise and vibration from offshore machinery and activities such as seismic surveys can result in marine fauna avoiding areas where such activities are carried out.[63]

v. Disturbance of ocean sediments

Dredging can result in the disturbance of ocean sediments.[64] This can result in the disturbance of toxic wastes that have settled into ocean sediments which can in turn result in the toxic wastes being absorbed into the food chain of the marine fauna and organisms in the water column thereby leading to the death of such organisms.[65]

vi. Increases in water column turbidity

Dredging and drilling activities can increase suspended sediments in the water column which can adversely affect marine organisms. The increase in suspended sediments may reduce the amount of light that reaches the ocean floor and could result in the reduction in plant growth.[66]

vii. Introduction of non-indigenous species

The disposal of ballast water of support vessels and oil tankers that transport oil and gas onshore could lead to the introduction of alien and invasive species into the marine environment.[67] This could result in the destruction of indigenous species in the area.

The list of effects of offshore wastes on the marine environment and marine fauna and organisms is not exhaustive as new effects are being discovered from researches carried out by scientists and environmentalists.

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[62] *Ibid*.
[63] Kloff and Wicks (n16) at 25.
[64] *Ibid*.
[65] *Ibid*.
[66] 'Exploration and production in the marine environment'. Available at http://www.aip .com. au/ industry/fact_exploration_marine.htm. [Accessed 13 February 2009].
[67] Kloff and Wicks (n16) at 25.

It is evident from the above-mentioned effects that the poor management of the wastes generated during exploration and production can have negative effects on the marine environment. It can lead to severe damage to the marine environment and consequently the extinction of marine fauna and organisms. It is therefore imperative that offshore wastes are effectively managed to avoid the destruction of marine species and ecosystems. As such, there is a need for the stipulation of adequate legal standards for the regulation of the different types of offshore wastes.

CHAPTER TWO

INTERNATIONAL LAWS REGULATING OFFSHORE OIL AND GAS (E&P) WASTE MANAGEMENT

2.1 Introduction

The existing international regulatory framework for offshore E&P activities is characterised by a piecemeal approach at both global and regional level.[68] Although operational discharges from offshore oil and gas installations have been recognised as a growing source of marine pollution, there are relatively few international rules and regulations that deal with offshore E&P wastes.[69] Most of the rules regulating offshore E&P operations are strewn in various global, regional and soft law instruments and they lack uniformity and consistency.[70] However, a few of these instruments have established standards for E&P operational discharges and the management of such discharges.[71]

The global conventions, regional initiatives and soft law instruments that are applicable to offshore E&P operations would be examined below.

2.2 Global Laws Regulating Offshore Oil and Gas (E&P) Waste Management

There are many global conventions and agreements regulating the protection of the marine environment but none of them exclusively regulates offshore E&P operations.[72] Some global conventions have incorporated provisions relating to oil and gas but are lacking in provisions relating to operational discharges from offshore installations and offshore E&P waste management.[73] For instance, the Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter (London Dumping Convention) and its 1996 Protocol include the disposal of offshore installations and platforms in their scope.[74] However, the convention and

[68] Vinogradov and Wagner (n 53) at 7.
[69] *Ibid*.
[70] Kisi Agyebeng 'Disappearing acts- toward a global liability regime for pollution damage resulting from offshore oil and gas exploration' (2006) Paper 11 *Cornell Law School LL.M Paper Series* 1 at 5.
[71] Vinogradov and Wagner (n 53) at 7.
[72] Kloff and Wicks (n16) at 48. See also '2000 Environmental protection and offshore oil' (n 16) at 7 and Agyebeng (n 70) at 5.
[73] Kloff and Wicks (n16) at 48.
[74] Article III (1) (a) (ii) of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and Article I (4) (1) 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes of 1972.

protocol do not apply to the disposal of wastes arising from operational activities from offshore installations.[75]

As a result of the lack of a global legal regime for offshore operations, there are no legally binding global limits for the discharge of offshore E&P wastes[76] and no global standards for the operation of offshore installations.[77]

The absence of a concrete global convention regulating offshore E&P operations could be attributed to the fact that some international organisations like the United Nations (UN) and International Maritime Organisation (IMO) do not see the need for an international legal regime for offshore oil and gas activities. For instance, in 1996, the United Nations Commission on Sustainable Development (CSD) concluded that there was 'no compelling need at this time to further develop globally applicable environmental regulations in respect of the exploitation and exploration aspects of offshore oil and gas activities.'[78] It could also be because oil and gas resources are usually within national jurisdiction and are therefore subject to national laws.[79] Another reason could be because pollution from offshore E&P operations is not as clearly defined as pollution from other sources.[80] In spite of these reasons, the adoption of a comprehensive global convention to regulate offshore E&P operations is necessary to safeguard the marine environment.

The global laws relating to offshore E&P activities are the 1982 United Nations Convention on the Law of the Sea, the International Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 and the United Nations Convention on Biological Diversity.

2.2.1 The 1982 United Nations Convention on the Law of the Sea

The 1982 United Nations Convention on the Law of the Sea (LOSC) provides a

[75] Article III (1) (b) (i) of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and Article I (4) (2) 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes of 1972.
[76] Kloff and Wicks (n16) at 48.
[77] Chester Brown 'International environmental law in the regulation of offshore installations and seabed activities: The case for a south pacific regional protocol' (1998)17 *Australian Mining & Petroleum Law Journal* 109 at 111.
[78] CSD Decision 4/15- Report of the 4th Session of the CSD. Available at http://www.un.org/esa/dsd/susdevtopics/sdt_oceaseas_documents.shtml. [Accessed 29 August 2009].
[79] Agyebeng (n 70) at 6. See also Gavouneli (n 13) at 42.
[80] Kloff and Wicks (n16) at 48.

comprehensive legal regime for the world's seas and oceans.[81] It was adopted on 10 December 1982 and entered into force on 16 November 1994.[82] It is a widely adopted global convention that has been ratified by 159 parties including Nigeria and the United Kingdom. Nigeria ratified it on 14 August 1986 and the United Kingdom ratified it on 25 July 1997.[83]

LOSC contains general principles that regulate the exploitation of the ocean's resources including oil and gas and recognises the sovereign rights of states to exploit natural resources within their exclusive economic zone (EEZ) and continental shelf.[84] Part XII of LOSC deals with the protection of the marine environment. The sections in Part XII relevant to offshore oil and gas industry are articles 194, 208 and 214.

Article 194 of LOSC generally provides that States should take necessary measures to prevent, reduce and control the pollution of the marine environment.[85] Article 194 (3) (c) provides *inter alia* that states should endeavour to take measures that will "minimize to the fullest possible extent pollution from installations and devices used in the exploration or exploitation of natural resources of the seabed and subsoil."[86]

Article 208 of LOSC also directs States to adopt laws and regulations as well as other measures to prevent, reduce and control the pollution of the marine environment arising from seabed activities and from artificial islands and installations under their jurisdiction.[87] It further provides that such laws, regulations and measures should conform to international rules, standards and recommended practices and should be harmonised regionally.[88]

[81] Vinogradov and Wagner (n 53) at 8.
[82] The United Nations Law of the Sea Convention 1982, (1982) 21 ILM 1261.
[83] Chronological lists of ratifications of, accessions and successions to the Convention and the related agreements as at 20 July 2009. Available at http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm#The%20United%20Nations%20Convention%20on%20the%20Law%20of%20the%20Sea. [Accessed 15 September 2009].
[84] Articles 56 & 77, LOSC. These articles confer rights and duties on coastal states for the exploitation of natural resources in their EEZ and continental shelf respectively.
[85] Article 194, LOSC.
[86] *Ibid*.
[87] Article 208 (1) & (2), LOSC.
[88] Article 208 (3) & (4), LOSC.

Article 214 of LOSC further enjoins States to enforce their laws in accordance with article 208 and to adopt laws and regulations to implement international rules and standards to prevent, reduce and control the pollution of the marine environment arising from seabed activities and from artificial islands and installations under their jurisdiction.

The weakness of LOSC is that it does not set quantitative standards but leaves the development of laws and regulations to the coastal States.[89] It however provides an important framework for future legal development, rather than operational obligations.[90] It therefore recognises the need for the development of laws for offshore E&P activities though this has not been attained at the international level.[91] Besides, it can be construed to apply to offshore installations and wastes generated from offshore operations.[92]

Although articles 194, 208 and 214 do not specifically mention offshore installations in their provisions, there is nothing in them that expressly exclude offshore installations. So it can be inferred that the articles regulate offshore installations since offshore installations are used in the exploration or exploitation of natural resources of the seabed and subsoil. In addition, the proper disposal and management of E&P wastes is one measure that can be used to effectively prevent, reduce and control the pollution of the marine environment as envisaged by the above-mentioned articles. It is therefore submitted that parties to LOSC should include waste management and disposal provisions in their national and regional laws regulating offshore E&P operations in accordance with the provisions of Article 214.

2.2.2 The International Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 (MARPOL 73/78)

The combined instrument of the International Convention for the Prevention of Pollution from Ships of 1973 and its protocol of 1978 came into force on 2 October

[89] Brown (n 77) at 121.
[90] Zhiguo Gao 'Environmental regulation oil and gas in the twentieth century and beyond: an introduction and overview' in Zhiguo Gao (ed) *Environmental regulation of oil and* gas (1998) 3 at 16.
[91] *Ibid*.
[92] Kloff and Wicks (n16) at 51.

1983.[93] Nigeria and the United Kingdom are parties to MARPOL 73/78 and ratified it on 24 August 2002 and 2 October 1983 respectively.[94] The objective of MARPOL 73/78 is to reduce the volume of harmful substances entering into the world's oceans and marine environment.[95] MARPOL 73/78 primarily regulates vessel-source pollution but also contains provisions that are applicable to offshore oil and gas installations.

MARPOL 73/78 defines *ship* to include 'vessels of any type operating in the marine environment' including floating craft and fixed or floating platforms.[96] However, in its definition of 'discharge', it excludes the release of harmful substances directly arising from the exploration, exploitation and associated offshore processing of seabed mineral resources.[97] Also, the 'Unified Interpretations' of MARPOL 73/78 provide that MARPOL 73/78 applies only to discharges from platform drainage but not to offshore processing drainage, production water discharge and displacement discharge.[98] The application of MARPOL 73/78 is therefore limited to discharges from offshore installations that do not arise from exploration, exploitation and processing of seabed minerals.[99] In other words, MARPOL 73/78 does not apply to operational discharges from offshore installations and so does not apply to the management of offshore E&P wastes. Nonetheless, MARPOL 73/78 seems to apply to offshore installations to a very limited extent. Regulation 39 of Annex I provides that offshore platforms and drilling rigs, when engaged in the exploration, exploitation and associated offshore processing of sea-bed mineral resources, must comply with the

[93] International Convention for the Prevention of Pollution from Ships, 1973 as Modified by the Protocol of 1978 relating thereto (MARPOL). Available at http://www.imo.org/conventions/contents.asp?doc_id=678&topic_id=2583. [Accessed 29 August 2009].
[94] Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973, as amended (MARPOL PROT 1978). Available at http://imo.amsa.gov.au/public/parties/marpol78.html. [Accessed 15 September 2009]
[95] John R Lethbridge 'MARPOL 73/78 (International Convention for the prevention of Pollution)' (2005) 1. Available at http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1119275973157/td-ps4.pdf. [Accessed 30 August 2009].
[96] Article 2 (4) of MARPOL 73/78.
[97] *Ibid*, Article 2 (3) (b) (ii).
[98] MARPOL 73/78 (Consolidated Edition. 1991). Articles. Protocols, Annexes, Unified Interpretations of the International Convention for the Prevention of Pollution from Ships. 1973, as modified by the Protocol of 1978 relating; thereto, IMO, London (1992) cited in Vinogradov and Wagner (n 53) at 17.
[99] Brown (n 77) at 122.

requirements of Annex I applicable to ships of 400 tons gross tonnage and above other than oil tankers.[100]

The inadequacy of MARPOL 73/78 in controlling the discharge of E&P wastes from offshore installations is a weakness which needs to be corrected. This is because most E&P wastes contain harmful substances that need to be properly managed for the protection of the marine environment. It is therefore imperative for IMO and parties to MARPOL 73/78 to take steps to include standards and procedures for the management of wastes discharged during offshore E&P operations. This is necessary as there is no other international law that adequately regulates the discharge of oil and E&P wastes from offshore installations.

2.2.3 The United Nations Convention on Biological Diversity

The United Nations Convention on Biological Diversity (CBD) was adopted on 22 May 1992 and came into force on 29 December 1993.[101] Nigeria and the United Kingdom are parties to the Convention and ratified the Convention on 29 August 1994 and 03 June 1994 respectively.[102] The objectives of the Convention are the conservation, sustainable use, access and benefit sharing of biological diversity.[103]

The Convention does not specifically regulate offshore oil and gas operations but it contains some provisions that can be construed to apply to offshore E&P operations.[104] Articles 7 and 14 are examples of such articles.

Article 7 provides that contracting parties should identify and monitor processes and activities that have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity.[105] This article is applicable to offshore E&P operations because E&P wastes have significant adverse effects on biological diversity in the marine environment. Thus, the monitoring of offshore E&P activities in line with article 7 could help to prevent indiscriminate

[100] Regulation 39 (2), Annex 1 of MARPOL 73/78.
[101] Lyle Glowka et al *A guide to the convention on biological diversity* (1994) 1.
[102] List of parties to the Convention on Biological Diversity. Available at http://www.cbd.int/information/parties.shtml. [Accessed 15 September 2009].
[103] Article 1, CBD.
[104] Vinogradov and Wagner (n 53) at 24.
[105] Article 7 (c) & (d), CBD.

disposal of E&P wastes into the marine environment thereby preventing pollution and the destruction of biological diversity.

Article 14 of CBD advises Contracting Parties to take measures to introduce 'environmental impact assessment requirements' for activities which are 'likely to have significant adverse effects on biodiversity'.[106] This provision is relevant to offshore E&P activities because if environmental impact assessment is carried out, it would include procedures to be adopted for the management of E&P wastes in order to avoid the negative impacts of such wastes on biological diversity and the marine environment.

The Convention could therefore be used as a measure to ban or subject E&P activities to more stringent conditions in marine areas.[107] Its relevance to the offshore oil and gas industry is also quite apparent since E&P operations will always result in interference with biological resources and could result in various environmental problems like pollution and climate change.[108] Thus, article 7 and 14 of CBD possess the potential to directly impact on offshore E&P operations.

2.3 Regional Arrangements Regulating Offshore Oil and Gas (E&P) Waste Management

Regional agreements have proved to be a more accepted way of dealing with environmental problems of common concern.[109] In many cases, the suitable level of environmental action is the regional one because it offers the opportunity for custom-built regimes and more stringent legislative standards as limited membership often implies a higher common denominator.[110] Most of the regional conventions on the protection of the marine environment contain general provisions relating to pollution from seabed activities, but only few of them are supplemented by protocols which specifically address offshore E&P activities.[111]

The regional initiatives with provisions regulating offshore E&P waste management are the UNEP Regional Seas Programme, the Helsinki Convention and

[106] Article 14 (a), CBD.
[107] Vinogradov and Wagner (n 53) at 25.
[108] Zhiguo Gao (n 90) at 18.
[109] Vinogradov and Wagner (n 53) at 35.
[110] *Ibid*.
[111] *Ibid* at 36.

the OSPAR Convention. The provisions of these conventions with regards to offshore E&P waste management will be examined subsequently.

2.3.1 UNEP Regional Seas Programme

The United Nations Environmental Programme (UNEP) has adopted 10 regionally based conventions covering some seas to ensure the protection of the marine environment.[112] The regional seas programme covers the Mediterranean region; the Persian (Arabian) Gulf region; the Caribbean region; the West and Central African region; the East African region; the East Asian region; the Red Sea and the Gulf of Aden; the South Pacific region; the South-East Pacific region; and the South-West Atlantic region.

Nigeria is a party to the Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region of 1981 (Abidjan Convention) and ratified it on 6 June 1984.[113]

Each of the regional seas conventions has general provisions for the prevention of marine pollution from sea bed activities. For instance, articles 8 of the Abidjan Convention provides that the parties to the Conventions should 'take measures to prevent, reduce and combat pollution' arising from direct or indirect exploration or exploitation of the seabed. They contain no further provisions or protocols on the measures to be adopted to control pollution resulting from the exploration or exploitation of the seabed.

However, the Kuwait Regional Convention for Co-operation in the Protection of the Marine Environment from Pollution of 1978 (Kuwait Convention)[114] and the Convention for the Protection of the Marine Environment and Coastal Region of the

[112] The UNEP regional seas conventions are the 1976 Barcelona Convention; the 1978 Kuwait convention; the 1981 Abidjan convention; the 1981 Lima Convention; the 1982 Jeddah Convention; the 1983 Cartegena Convention; the 1985 Nairobi Convention; the 1986 Noumea Convention; the 1996 Bucharest Convention and the 2002 Antigua Convention.
[113] Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention) 1981, (1981) 20 ILM 746.
[114] The Kuwait Convention (1978) 17 ILM 511.

Mediterranean of 1995 (Barcelona Convention)[115] have protocols dealing with offshore activities.

The Kuwait Protocol[116] has detailed measures for dealing with the pollution of the Persian Arabian Gulf from exploration and exploitation activities on the continental shelf. It is one of the first regional protocols to deal with marine pollution resulting from the exploration and exploitation of the continental shelf.[117] It contains provisions on licensing for offshore exploitation and exploration activities,[118] environmental impact assessment[119] and chemical use plans[120] and sets out standards for regulating E&P waste discharges from offshore installations.[121]

The Madrid Offshore Protocol[122]which complements the 1976 and revised 1995 Barcelona Conventions is very comprehensive and innovative. It contains detailed provisions regulating offshore E&P activities and the management of E&P wastes. It contains provisions with requirements for written authorization for all exploration or exploitation activities including the erection of installations;[123] use of best available, environmentally effective and economically appropriate techniques;[124] chemical use plans;[125] regulation of oil, oily mixtures, drilling fluids and cuttings[126]and establishment of national monitoring systems.[127] The provisions of the Madrid Offshore Protocol are more substantial than those of other offshore protocols and would be very useful in the management of E&P wastes and the prevention of marine pollution, when it comes into force.

[115] Barcelona Convention. Available at http://www.unep.ch/regionalseas/main/med/medconvi.html. [Accessed 5 September 2009].
[116] Kuwait Protocol Concerning Marine Pollution Resulting from Exploration and Exploitation of the Continental Shelf. Available at http://sedac.ciesin.columbia.edu/entri/texts/acrc/ProtKuwait.txt.html. [Accessed 5 September 2009]. The Protocol was adopted on 29 March 1989 and entered into force on 17 February 1990.
[117] Vinogradov and Wagner (n 53) at 47.
[118] Article III, Kuwait Protocol.
[119] Article IV (a), Kuwait Protocol.
[120] Article XI (1) (a) & (b), Kuwait Protocol.
[121] Article IX, Kuwait Protocol.
[122] The Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil. Available at http://www.unep.ch/regionalseas/main/med/medoffsh.html. [Accessed 5 September 2009]. It was signed in Madrid, Spain on 14 October 1994 and is not yet in force.
[123] Article 4(1), Madrid Offshore Protocol.
[124] Article 8, Madrid Offshore Protocol.
[125] Articles 9(1) & (2), Madrid Offshore Protocol.
[126] Article 10 and Annex V, Madrid Offshore Protocol.
[127] Article 19, Madrid Offshore Protocol.

2.3.2 The 1992 Helsinki Convention

Annex VI of the 1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention) contains regulations that deal with the prevention of pollution from offshore activities.[128]

It provides for the use of Best Available Technology (BAT) and Best Environmental Practice (BEP) to prevent and eliminate pollution from offshore activities.[129] It contains provisions on environmental impact assessment and monitoring and monitoring of 'the consequent effects' of the exploitation and exploration phases of offshore E&P operations.[130] It also regulates discharges of drilling mud and cuttings during the exploration phase subject to approval and authorization by the appropriate national authority and prohibits the discharge of cuttings in specifically sensitive parts of the Baltic Sea Area.[131] It also prohibits the discharge of chemicals and materials produced during the exploitation stage except in exceptional circumstances and subject to permission from the appropriate national authority.[132] It also prohibits the discharge of production water and displacement water unless its oil content is proven to be less than 15 mg/.[133]

The regulations of the Helsinki Convention set out relatively detailed procedures and measures regarding offshore E&P operations particularly in the area of waste management.[134]

2.3.3 *The 1992 OSPAR Convention*

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) was opened for signature on 22 September 1992 and

[128] Annexes to the Helsinki Convention of 1992. Available at http://www.helcom.fi/Convention/en_GB/annexes/#top. [Accessed 5 September 2009]. The 1992 Helsinki Convention replaces the 1974 Helsinki Convention.
[129] Regulation 2 of Annex II defines 'Best Environmental Practice' as the application of the most appropriate combination of measures. Regulation 3 of Annex II defines 'Best Available Technology' as the latest stage of development of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges.
[130] Regulation 3 of Annex VI, 1992 Helsinki Convention.
[131] *Ibid*, regulation 4.
[132] *Ibid*, regulation 5 (a).
[133] *Ibid*, regulation 5 (b).
[134] Vinogradov and Wagner (n 53) at 37.

came into force on 25 March 1998.[135] It replaced the former Oslo and Paris Conventions, but decisions, recommendations and all other agreements adopted under those conventions continue to apply, unless and until they are terminated by new measures adopted under the 1992 OSPAR Convention.[136] The United Kingdom is a party to the OSPAR Convention.

Annex III of the OSPAR Convention deals with the prevention and elimination of pollution from offshore sources.[137] It contains provisions for the use of best available techniques best environmental practice and clean technology in adopting programmes and measures;[138] inspection of vessels and aircrafts and reporting requirements;[139] and collection of information, listing and phasing out of toxic and persistent substances used in offshore activities by the OSPAR Commission.[140]

Annex III of the OSPAR Convention is cast in fairly general terms.[141] It does not provide any technical requirements and standards but apparently leaves the development of such requirements and standards to the OSPAR Commission.[142] As a result of this, decisions and recommendations have been adopted by the Paris Commission (PARCOM) and OSPAR Commission for controlling the discharge of E&P wastes.

2.4 Soft Law Instruments

'Soft law' consists of non binding instruments, such as international conference declarations, recommendations and government and industry guidelines that may potentially evolve into binding legal standards.[143] They are only proposals for development or agreed non-binding plans of action which can only become law by customary, treaty or other law-making process which they often precede.[144] 'Soft law' is valuable because it can capture emerging notions of international public order

[135] Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) 1992, (1993) ILM 1072.
[136] *Supra* (n 60) at 19.
[137] *Supra* (n 135).
[138] *Ibid*, article 2 of Annex III.
[139] *Ibid*, article 9 of Annex III.
[140] *Ibid*, article 10 of Annex III.
[141] RR Churchill and AV Lowe *The law of the sea* 3ed (1999) 372.
[142] Vinogradov and Wagner (n 53) at 42.
[143] *Ibid* at 27.
[144] Martin Dixon *Textbook on international law* 6ed (2007) 51.

and extend them to matters previously of exclusive national jurisdiction.[145] Thus, soft law instruments play an important role especially in countries and regions where there are no existing regulatory framework to deal with offshore oil and gas operations.[146] There are many soft law measures in the form of declarations and guidelines that deal with offshore oil and gas operations. They include Agenda 21, UNEP Guidelines, Arctic Guidelines, World Bank Guidelines, World Wide Fund for Nature (WWF) Guidelines and Oil Industry Guidelines.

2.4.1 Agenda 21

Agenda 21 deals with pollution from offshore exploration and production activities but is legally non binding. Agenda 21 was adopted at the United Nations Conference on Environment and Development (UNCED) in 1992.[147] Paragraph 17.30 of Agenda 21 advises States to assess the need for additional measures to address degradation of the marine environment with respect to discharge, emissions and safety from offshore oil and gas platforms.[148]

2.4.2 UNEP Guidelines

In 1981, a UNEP Working Group of Experts on Environmental Law produced the *Conclusions of the study of the legal aspects concerning the environment related to offshore mining and drilling within the limits of national jurisdiction*.[149] The 'conclusions' were approved as guidelines for national practice by UNEP and the United Nations General Assembly in 1982.[150] The guidelines contain recommendations for the prevention/reduction of pollution; adoption of effective laws that meet international standards; prior authorisation; environmental impact assessment; environmental compliance monitoring; exchange of information and consultation; safety measures; and liability and compensation for offshore mining and drilling operations. The guidelines are general and unspecific and do not stipulate any quantified standards for state practice. They however provide a basis for development of legally binding international instruments and were instrumental

[145] Vinogradov and Wagner (n 53) at 27.
[146] *Ibid* at 66.
[147] Agenda 21. Available at http://www.un.org/esa/dsd/agenda21/. [Accessed 30 August 2009].
[148] *Ibid*.
[149] Decision iO/l4/VI of the Governing Council of UNEP, of 31 May 1982. Available at http://www.unep.org/law/PDF/UNEPEnv-LawGuide&PrincN04.pdf. [Accessed 30 August 2009].
[150] *Ibid*.

to the development of a number of regional arrangements related to offshore operations such as the UNEP Regional Seas Programme.[151]

2.4.3 Arctic Guidelines

The guidelines were revised by the Arctic offshore oil and gas guidelines of 2002[152] and 2009.[153] The guidelines are general in nature and contain recommendations on environmental impact assessment; environmental monitoring; safety and environmental management including compliance monitoring, auditing and verification; operating practices including waste management, use and discharge of chemicals and air emissions; emergency preparedness and response; and decommissioning and site clearance. The provisions on waste management are not detailed and do not lay down standards for the management of offshore E&P wastes.

2.4.4 World Bank Guidelines

In 1983, the World Bank produced the *offshore hydrocarbon resource drilling operations–effluent guidelines* which contained recommendations on environmental technologies to deal with offshore effluents.[154] The World Bank also produced environmental guidelines in 1988 and 1995 with recommendations on environmental technologies and environmental management requirements relevant to offshore oil and gas activities.[155] In 1998, the World Bank Group produced the *Pollution Prevention and Abatement Handbook* which contained general environmental principles which can be applied to the offshore oil and gas industry.[156] The World Bank Group also produced the *Environmental, Health and Safety Guidelines- Oil and Gas Development (Offshore)* on 22 December 2000 which contained more

[151] Vinogradov and Wagner (n 53) at 31.
[152] Arctic offshore oil and gas guidelines, 2002. Available at *http:*//old.pame.is/sidur/uploads/ArcticGuidelines.pdf. [Accessed 30 August 2009].
[153] Arctic offshore oil and gas guidelines, 2009. available at http://arcticcouncil.org/filearchive/Arctic%20Offhsore%20Oil%20and%20Gas%20Guidelines%202009.pdf. [Accessed 30 August 2009].
[154] 'Basic Documents and Guidelines Concerning Environmental Practices in Offshore Oil and Gas Activities'. Available at http://www.oilandgasforum.net/education/Guidelines/Relevant_guidelines.htm. [Accessed 30 August 2009].
[155] *Ibid*.
[156] Pollution Prevention and Abatement Handbook. Available at http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_genenv_WB/$FILE/genenv_PPAH.pdf. [Accessed 30 August 2009].

detailed recommendations on the disposal/management of offshore E&P wastes.[157] The 2000 guidelines contained provisions that set levels for the discharge of liquid effluents such as oily water, deck drainage and drilling fluids, solid wastes and hazardous wastes. They also contained provisions on environmental best practices on drilling management, produced water management and chemical management; emergency preparedness and response; oil spill response plan; human health and safety; and monitoring, reporting and supervision.

In April 2007, the World Bank Group further produced the *Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development* which replaced all the other World Bank guidelines.[158] The 2007 guidelines contain recommendations on the use of treatment technologies and management options for the different types of E&P wastes.

2.4.5 World Wide Fund for Nature (WWF) Guidelines

In 1994, WWF produced guidelines on the *Application of Strategic Environmental Assessment in Relation to Offshore Oil and Gas Resource Exploration*[159] which contained provisions with procedures for environmental impact assessment (EIA) and environmental management. WWF also produced similar EIA guidelines in 1998[160] as well as *Environmental Best Practice and the Move toward Zero Discharge in the Offshore Oil and Gas Industry* which deals with environmental technologies for achieving a zero discharge from offshore operation.

2.4.6 Oil Industry Guidelines

Some oil and gas organizations that are key players in the industry have also made recommendations to guide their members in the management of offshore E&P wastes. In 1992, the International Association of Geophysical Contractors (IAGC)

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[157] International Finance Corporation Environmental, Health and Safety Guidelines- Oil and Gas Development (Offshore), December 2002. Available at http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_offshoreOG/$FILE/offshoreoil.pdf. [Accessed 30 August 2009].

[158] International Finance Corporation Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development. Available at http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_OffshoreOilandGas/$FILE/Final+-+Offshore+Oil+and+Gas+Development.pdf. [Accessed 30 August 2009].

[159] *Supra* (n 154).

[160] 'The Application of EIA in Relation to Offshore Oil and Gas Exploitation' (1998). Available at http://www.oilandgasforum.net/education/Guidelines/Relevant_guidelines.htm. [Accessed 30 August 2009].

produced *Environmental Guidelines for World-Wide Geophysical Operations* which were recommendations on environmental impact assessment, environmental management and applicable environmental technologies for offshore E&P activities.[161]

The Joint Links Oil and Gas Consortium which consisted of a group of non governmental organisations produced a document titled *Polluting the Offshore Environment* in 1996 which provided guidance on environmental impact assessment and environmental technologies for offshore oil and gas operations.

Petroconsultants (now known as Information Handling Services (HIS) Energy Group) produced guidelines on *operational discharges from offshore oil and gas exploration and exploitation activities: regulatory requirements and enforcement practices* in 1997 which included offshore environmental management and technologies for managing operational discharges.[162]

The International Association of Oil & Gas producers (OGP) (formerly the Oil Industry International Exploration and Production Forum (E&P Forum)) have produced a number of guidelines for offshore oil and gas activities.[163] The guidelines include exploration and production waste management guidelines (1993); guidelines for the development and application of health, safety and environmental management systems (1994); E&P forum guidelines for the planning of down hole injection programmes for oil-based mud wastes and associated cuttings from offshore wells (1993); quantitative risk assessment data directory (1996); the physiological effects of processed oily drill cuttings (1996); technologies for handling produced water in the offshore environment (1996); production water: current and emerging technologies (1994); North Sea produced water: fate and effects in the marine environment (1994) and the OGP HSE management-guidelines for working together in a contract environment (1999).[164] OGP has also produced a

[161] *Supra* (n 154).
[162] *Ibid*.
[163] The association changed its name in 1999.
[164] *Supra* (n 154).

number of reports on the performance of the offshore oil and gas industry, offshore operations and E&P wastes and waste management.[165]

The UK Offshore Operators Association (UKOOA) - the representative organisation for the UK offshore oil and gas industry- has also produced guidelines for offshore E&P waste management and disposal.[166]

2.5 Conclusion

From the foregoing, it is clear that there is no international convention regulating offshore E&P waste management. It is unsatisfactory that some conventions such as MARPOL 73/78 and the London Dumping Convention specifically exempt offshore operations from their scope of application. Also, even though some of the regional conventions like the OSPAR and Helsinki Conventions and the Madrid Offshore Protocol have set out standards for the discharge and management of E&P wastes, they are not wide ranging but are restricted to particular regions. In addition, the soft law provisions are not legally binding and are at best a guide for good practice by States. Moreover, most of the soft law provisions are outdated.

Hence, there is a need for a global regime to regulate offshore operations and set uniform standards for the management of wastes generated in the course of such operations. In fact, some organizations such as Greenpeace and WWF have recognised this need and have called on IMO and UNEP for the amendment of the Conventions under their auspices such as MARPOL 73/78 and the London Dumping Convention to include offshore operations.[167] In 2002, the Netherlands proposed that the London Dumping Convention be extended to include offshore oil and gas issues including discharges from offshore platforms and the removal and disposal of offshore platforms.[168] Hopefully, an international convention will be adopted soon to deal with offshore oil and gas issues including E&P waste management. In the meantime, offshore oil and gas matters are mostly regulated by national laws.

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[165] The OGP Reports are available at http://www.ogp.org.uk. [Accessed 11 August 2009].
[166] The UKOOA guidelines are available at http://trends.risoe.dk/detail-organisation.php?id=54. [Accessed 11 August 2009].
[167] Kloff and Wicks (n16) at 48; Brown (n 111) at 125.
[168] LC 24/14-Future objectives for the London Convention 1972 and the 1996 Protocol thereto submitted by the Netherlands. Available at http://www.sjofartsverket.se/upload/4945/24-14.pdf. [Accessed 30 August 2009].

CHAPTER THREE

THE REGULATION OF OFFSHORE OIL AND GAS (E&P) WASTE MANAGEMENT IN NIGERIA

3.1 Introduction

One of the problems facing the oil and gas industry in Nigeria is the management of wastes arising from operational activities of oil and gas companies.[169] Unfortunately, there is inadequate regulation of offshore E&P waste management in Nigeria. This problem of inadequate regulation has contributed to environmental problems such as pollution and severe ecological damage in regions where offshore oil and gas activities are carried out.[170] This is because several tons of E&P wastes are generated daily and discharged into the surrounding environment at standards below acceptable international limits.[171] More over, the Nigerian government seems to be more concerned about regulating the economic aspects of oil and gas activities than the environmental aspects. The oil and gas industry in Nigeria therefore illustrates the challenge of harmonizing environmental policies and socio-economic development in order to attain sustainable development.[172]

Oil and gas matters in Nigeria are in the exclusive legislative list and within the legislative competence of the federal government.[173] Thus, the regulation of offshore oil and gas activities is centralised and under the jurisdiction of the federal government.

There are a several pieces of oil and gas legislation with provisions relating directly or indirectly to the discharge of wastes from oil and gas activities but they are either usually outdated, not detailed, limited in scope or do not apply to offshore activities. These laws include the Oil in Navigable Waters Act 1968,[174] Petroleum

[169] S I Onwukwe and N C Izuwa 'Drilling wastes generation and management strategy in the oil industry' (2004) 34 *Nigerian Society of Chemical Engineers Proceedings* 1.
[170] Engobo Emeseh 'The limitations of law in promoting synergy between environment and development policies in developing countries: a case study of the petroleum industry in Nigeria' at 2. Available at http://userpage.fu-berlin.de/ffu/akumwelt/bc2004/download/emeseh_f.pdf. [Accessed 30 August 2009]. See also Onah R Ogri 'A review of the Nigerian petroleum industry and the associated environmental problems' (2001) 21 (1) *The Environmentalist* at 11.
[171] M J Ayotamuno et al 'Effluent quality and wastes from petroleum drilling operations in the Niger Delta, Nigeria' (2002) 13 (2) *Journal of Environmental Management and Health* 207 at 208.
[172] Emeseh (n 170) at 7.
[173] Part 1 of the second schedule to the Constitution of the Federal Republic of Nigeria.
[174] Cap. 337 LFN 1990.

(Drilling and Production) Regulations 1969[175] and National Effluent Limitation Regulations of 1991.[176] The National Policy on the Environment of 1989 also has provisions relating to the oil and gas industry.[177] It must be mentioned that most of these laws and policies have not been amended or updated since their enactment. Consequently, there is currently no specific comprehensive law regulating the offshore E&P activities, in general, and offshore E&P waste management in particular. Thus, like many African countries, environmental regulation of offshore oil and gas activities is still emerging in Nigeria.[178] However, the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) were issued in 1991 for the regulation of oil and gas wastes including offshore E&P wastes.[179]

This chapter gives an overview of the oil and gas industry in Nigeria for an understanding of its history and development. It also examines the regulation of offshore E&P waste management in Nigeria and whether there are laws in place for the protection of habitats and species in offshore oil and gas areas from the impacts of offshore E&P wastes. It also discusses the reasons for the inadequate regulation of offshore E&P waste management in Nigeria.

3.2 Overview of the Oil and Gas industry in Nigeria

The exploration for oil in Nigeria began in 1908 by a German company, Nigerian Bitumen Corporation in the Araromi area of Ondo State. The company stopped prospecting because of the commencement of World War I in 1914.[180] There was no more prospecting and exploration in Nigeria until 1936. In 1936, Shell D' Arcy was granted sole exploration rights for petroleum resources throughout Nigeria. It began exploration in 1937 but that was put on hold by the commencement of World War

[175] Cap. 350 LFN 1990.
[176] Cap. 131 LFN 1990.
[177] National Policy on the Environment of 1989 (FEPA 1989).
[178] Soji Awogbade 'What is the Place of Practice of Environmental Law in Africa's Development?' Available at http://www.aelex.com/files/Africas-Development.doc.doc. [Accessed 30 August 2009].
[179] Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN), Revised Edition 2002. The guidelines were issued by the Department of Petroleum resources in 1991 pursuant to the mandate in the Petroleum Act and other oil and gas laws and regulations mentioned above for the establishment of guidelines, standards and procedures for environmental control for oil and gas activities.
[180] 'Nigeria- exploration history'. Available at http://www.allbusiness.com/mining/oil-gas-extraction-crude-petroleum-natural/288169-1.html. [Accessed 30 August 2009].

II.[181] In 1947, Shell D' Arcy teamed up with British Petroleum to form Shell-BP, Nigeria.[182] They discovered oil in 1956 at Oloibiri in the present Bayelsa State of the Niger Delta Region and began production of oil in 1958.[183] However, the group's sole rights were limited later by the Nigerian government after gaining independence in 1960. Other companies were invited to explore for oil onshore and offshore but the offshore exploration activities proved to be more successful than the onshore exploration for many of the companies.[184] Consequently, there are a lot of offshore exploration and production activities in Nigeria.

Nigeria became a member of the Organisation of Petroleum Exporting Countries (OPEC) in 1971 and established the Nigerian National Petroleum Corporation (NNPC) in 1977.[185] The responsibility of NNPC is to control the petroleum industry on behalf of the Nigerian Government by entering into joint venture agreements or production sharing contracts between oil companies and the State.[186] Nigeria has proven crude oil reserves of about 36,220 billion barrels and proven natural gas reserves of about 181,900 billion cubic feet.[187] It began producing and exporting liquefied natural gas in 1999.[188] The production and exportation of petroleum resources is of immense importance to the Nigerian economy as it accounts for about 90% of its gross earnings.[189] The major oil companies involved in joint venture agreements with the Nigerian government are Shell Petroleum Development Company of Nigeria Limited (SPDC), Chevron, Exxon-Mobil, Agip and Total.

The major law regulating the oil and gas industry in Nigeria is the Petroleum Act 1969 and its related regulations.[190] The Petroleum Act regulates all the stages of

[181] *Ibid*.
[182] *Ibid*.
[183] *Ibid*.
[184] *Ibid*.
[185] 'History of the Nigerian petroleum industry'. Available at http://www.nnpcgroup.com/history. [Accessed 30 August 2009]. See also Section 5 (1) (g) of the Nigerian National Petroleum Corporation Act CAP 320 Laws of the Federation of Nigeria 1990.
[186] *Ibid*.
[187] 'Nigeria energy profile'. (2008 Estimates). Available at http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=NI. [Accessed 30 August 2009].
[188] 'NLNG'. Available at http://www.nlng.com/NR/exeres/547F159C-1544-45DD-8D7F-92FF61E19E3 C%2 C frameless.htm. [Accessed 24 April 2009.]
[189] 'History of the Nigeria oil and gas industry'. Available at http://moneyplanets.blogspot. com/2008/12 /history-of- nigeria-oil-and-gas-industry.html. [Accessed 13 February 2009].
[190] CAP 350 Law s of the Federation of Nigeria 1990.

oil and gas production from exploration to marketing operations. The Department of Petroleum Resources (DPR) is responsible for ensuring compliance with the provisions of the Act.[191] Nigeria also has some oil and gas laws with environmental provisions but the laws are either inadequate or lack provisions regulating offshore oil and gas operations.

Nigeria is also party to several global and regional environmental conventions such as the 1982 United Nations Convention on the Law of the Sea (UNCLOS)[192]; the International Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 (MARPOL 73/78)[193]; the London Dumping Convention of 1972 and its Protocol of 1996[194]; and the Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region of 1981 (Abidjan Convention).[195] However, since few of those conventions are of much relevance to the offshore oil and gas operations, they are not very helpful.

Having discussed the overview of the oil and gas industry, the adequacy of the standards prescribed in EGASPIN for managing offshore E&P wastes in Nigeria will be discussed in the next section.

3.3 Regulation of Offshore E&P Waste Management in Nigeria

The management of offshore E&P wastes in Nigeria is regulated by EGASPIN. The Petroleum Act, 1969 empowers the Minister of Petroleum Resources to make regulations for the prevention of pollution of water courses and the atmosphere. As a result of that provision, the Petroleum Regulations 1967, the Petroleum (Drilling and Production) Regulations 1969 and the Oil in Navigable Waters Act 1968 were made. The regulations authorise the issue of licences/permits and establishment of

[191] 'Environmental laws governing petroleum and other related operations in Nigeria offshore from mobilisation to decommissioning of such operations (including seismic and fishing activities) in the areas of waste and hazardous materials toxic chemicals including carriage and disposal'. Available at www.standard.digibooks.cn/Download.asp?ID=226309. [Accessed 30 August 2009].
[192] LOSC (n 82).
[193] MARPOL 73/78 (n 93).
[194] 'London convention 1972'. Available at http://www.imo.org/home.asp?topic_id=1488. [Accessed 30 August 2009].
[195] Abidjan Convention (n 113).

guidelines, standards and procedures for environmental control.[196] EGASPIN was made pursuant to provisions of the regulations.[197] Thus, the provisions of EGASPIN are binding on all offshore operators in Nigeria.[198] The DPR is responsible for administering and ensuring compliance with the provisions of EGASPIN.

EGASPIN has prescribed standards and procedures for the effective evaluation and monitoring of the discharge of the different categories of E&P wastes into the environment.[199] Notwithstanding these standards and procedures, the regulation of E&P wastes is still unsatisfactory because some of the standards and procedures are inadequate. Adequate regulation of the wastes in Nigeria is also hindered by some factors which will be discussed subsequently.

The standards and requirements set out by EGASPIN for the regulation of the major offshore E&P wastes generated in Nigeria are now examined.

3.3.1 Produced Water

A permit is required under EGASPIN for the discharge of produced water and all existing point sources of produced water have to be registered with the Director of Petroleum Resources.[200] A written approval of the Director of Petroleum Resources must also be obtained before any changes can be made to any operation or process which may change or cause a material increase or decrease in the quantity and quality of produced water discharged.[201] The requirement of obtaining of a permit/approval is fundamental for restricting the discharge of produced water. This is because the discharge of produced water without a permit is prohibited and is an offence punishable by fine, imprisonment and/or revocation of permit or petroleum licence.[202] Operators are therefore held accountable for the discharge of produced water without a permit. However, certain activities such as unplanned discharges of produced water and the transfer of produced water to another field for treatment and

[196] EGASPIN, part I, articles 2 and 3. For instance, sections 25 and 36 of Petroleum (Drilling and Production) Regulations 1969 provide for the issuing of licences/permits and establishment of guidelines, standards and procedures for environmental control during drilling and production activities.
[197] Section 8(i) b (iii) of Petroleum Act, 1969, CAP 350 Law s of the Federation of Nigeria 1990.
[198] This is because it is made pursuant to Petroleum Act and other oil and gas regulations and its wording indicates that its provisions are mandatory.
[199] EGASPIN, part I.
[200] *Ibid*, article 3.2.1, part III.
[201] *Ibid*, article 3.2.3, part III.
[202] *Ibid*, part III and part IX.

subsequent re-injection are not covered by the permit or approval. It is therefore necessary that such activities are made subject to a permit under EGASPIN or an appropriately developed offshore oil and gas law.

The discharge of produced water into offshore waters is permitted if an oily water treatment system is installed, oil has been separated from the produced water and the minimum concentration of the dispersed oil in water does not exceed 40mg/l.[203] This is the current practice in countries like the UK for the prevention of oil pollution although the minimum concentration of oil in dispersed water in UK is 30mg/l.

The effluent limitation for the discharge of produced water into offshore water bodies is 40mg/l of oil and grease content.[204] Non compliance with this limit is backed by sanctions. Thus, operators who exceed this limit or fail to adhere to the limit would be guilty of an offence. However, this 40mg/l limitation is not in line with contemporary offshore waste management practices because many countries have increased their limits for the discharge of produced water.[205] For instance, the effluent limitation for discharge of produced water in OSPAR countries such as the United Kingdom is 30mg/l.[206] It is therefore desirable for this standard to be incorporated into Nigerian offshore oil and gas laws.

There are also requirements for sampling, analysis and monitoring of the discharge of produced water. Sampling and analysis of the discharge produced water must be undertaken once a week and reported monthly to the Director of Petroleum Resources to ensure compliance with the effluent limitation.[207] The Director must also be informed weekly of situations of significant non compliance with the effluent limitation.[208] Offshore oil and gas operators must also complete a chemical analysis of produced water and monitor the volume, rate, method and frequency of the

[203] *Ibid*, article3.6.2 (b), part III.
[204] *Ibid*, article 3.8.2, part III.
[205] Australia also increased its effluent limitation standard for produced oil from 50 to 30 mg/l in 2007.
[206] OSPAR Recommendation 2001/1for the Management of Produced Water from Offshore Installations (Consolidated text). Available at http://www.ospar.org/v_measures/get_page.asp?v0=010 1e_consol %20Produced%20water.doc&v1=4. [Accessed 28 August 2009]. See also Section 8.2.2 of the guidance notes on the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations.
[207] Part III of EGASPIN, article 3.8.3.
[208] *Ibid*.

discharge of produced water.[209] Although these requirements are commendable, they depend on the goodwill of offshore operators for compliance. There is no guarantee that the operators would provide accurate reports on the results of sampling and monitoring carried out. If not carried out properly or not carried out at all, the purpose of the requirements would be undermined. DPR should therefore designate officials specifically for monitoring the discharge of produced water and other E&P wastes. Moreover, there are no defined parameters for carrying out the sampling and analysis. Thus, a clearly defined system should be established for carrying out sampling and analysis of produced water in Nigeria.

Although there is a provision for the notification of DPR in situations of significant non-compliance with the effluent limitation for produced water, there is no yardstick for determining what will comprise non compliance. It is therefore important for a parameter to be set for situations of non compliance with the effluent limitation so that DPR can be notified of such situations.

3.3.2 Drilling Fluids/Mud and Drill Cuttings

An environmental permit must be obtained from DPR before drilling operations can commence in Nigeria.[210] Thus, an environmental permit is required for the use and discharge of drilling fluids/mud. The application for an environmental permit must include the treatment and disposal programmes for drilling fluid and drill cuttings as well as detailed information and an approval letter for the mud system to be used.[211] A formal application for the use of oil-based fluids/mud (OBMs) must also be made to DPR and must be justified on geological, safety and/or economic grounds.[212] The permitting requirement reflects the practice in many countries and is essential for controlling the discharge of drill cuttings and drilling fluid/mud into the offshore environment. It is helpful because the discharge of drill cuttings and fluids/mud without a permit is prohibited and is an offence.[213] So, it serves as a deterrent as operators would not want to be held liable and risk revocation of their drilling licences. However, the transfer of drill cuttings to another field for treatment and re-

[209] *Ibid*, article 4.1.1, 4.1.2 and table III-2.
[210] *Ibid*, article 3.2.1, part II.
[211] *Ibid*, article 3.2.1.2, part II.
[212] *Ibid*, article 2.0, Appendix II-1.
[213] *Ibid*, part IX.

injection is not covered by a permit under EGASPIN and needs to be addressed by DPR.

The use of less toxic drilling materials such as water based generic fluids/mud is recommended under EGASPIN. This is the practice in countries like the UK because the water based fluids/mud do not cause severe damage to the environment.

The discharge of spent oil based drilling mud/fluids and whole fluids/mud into offshore waters is prohibited. However, the discharge of whole drilling mud/fluids, spent drilling mud/fluids, OBMs or synthetic based mud (SBMs) and drill cuttings is permitted in offshore areas 12 nautical miles away from the shoreline and of depth not less than 200 feet provided the limitations specified below are satisfied.[214]

The discharge of cuttings contaminated with water based mud (WBMs) into offshore waters without treatment is permitted provided the discharge does not contain free oil as determined by a visual sheen on the receiving water surface.[215] Special approval must be sought and granted by the Director of Petroleum Resources, when such discharge is into vulnerable areas or close to shore.[216] The discharge of cuttings contaminated with oil from low toxic mineral OBM system into offshore waters is also prohibited unless treated to a residual oil content less than 10g/kg, i.e. 1% of oil-on-cuttings.[217] In addition, the discharge of cuttings contaminated with oil from synthetic/pseudo oil based mud systems into offshore waters is prohibited unless treated to a residual oil content of less than 50g/kg, i.e. 5% of oil-on -cuttings. Cuttings contaminated with esters may be discharged in offshore waters only when the residual oil content is less than 100g/kg, i.e. 10% of ester-on -cuttings.[218]

The discharge limitation for cuttings contaminated with WBMs is in line with the discharge standards of countries like the UK and Norway. However, the discharge limitation for OBMs and SBMs is low and needs to be increased in line

[214] *Ibid*, article 3.4.1.1, part II.
[215] *Ibid*, article 3.5.6.1, part II.
[216] *Ibid*.
[217] *Ibid*.
[218] *Ibid*. This is close to the United States of America's standard of 9.4% of ester-on-cutting.

with international practice. For instance, in India and OSPAR countries such as the UK, the discharge of OBMs and oil phase fluids (OPF) which include SBMs is prohibited unless treated to 1% of OPF/OBM contamination by dry weight. Thus, DPR should set the limitation for OBMs and SBMs to reflect the trend in those countries.

There is a mandatory monitoring requirement for operators to observe the volume, rate, method and frequency of the discharge of fluids/cuttings.[219] There is also a requirement for sampling and analysis of the mud system and/or base oil to determine whether they contain toxic and hazardous substances.[220] A final well report containing the types, composition and quantity of mud/mud additives used, volume of drilling fluids discharged and the volume of drill cuttings produced and discharged must also be submitted to the Director of Petroleum Resources.[221] These requirements are also in place in the UK. They are however dependent on the goodwill of offshore operators to effectively undertake these requirements and it is anyone's guess if they will be complied with without supervision from DPR. Therefore, the DPR has to play a more active role in ensuring that the requirements are carried out efficiently.

In addition, the point of discharge of the cuttings of oil and water based mud must be properly designated on the installation.[222] This requirement is to enable DPR Inspectors identify, inspect and monitor the points of discharge and to take samples for analysis where necessary. It is however submitted that the point of discharge should also be included in the environmental permit for the purpose of clarity.

3.3.3 Produced Sand

There is no clear permitting requirement for the discharge of produced sand in EGASPIN. The discharge of produced sand under EGASPIN must be through methods that do not endanger human life and living organisms and cause significant pollution to ground and surface waters.[223] The approved methods for disposing of produced sand are recycling, incineration, solidification, land farming and land

[219] *Ibid*, article 3.8.1.1 and table 11-8, part II.
[220] *Ibid*, article 3.3, part II.
[221] *Ibid*, article 3.8.1.3, part II.
[222] *Ibid*, article 3.5.6.2, part II.
[223] *Ibid*, article 3.6.4.1, part II.

filling. Any other method(s) acceptable to the Director of Petroleum Resources can be used after an approval has been sought for and given.[224] However, it is not clear whether produced sand can be discharged into offshore waters or must be strictly disposed of by the aforementioned methods. It is therefore suggested that the DPR clarify this issue and that the standard for the discharge of produced sand into offshore waters should be as agreed with DPR.

The discharge of produced sand containing low specific activity (LSA) or naturally occurring radioactive materials (NORM) is subject to an approval granted by the Director of Petroleum Resources.[225] This provision conforms to international standards as many countries require authorisation for the discharge of substances containing LSA/NORM.[226] Although the discharge of produced sands containing LSA/NORM into inland and near shore waters is prohibited unless treated to the satisfaction of the Director of Petroleum Resources, no mention is made of discharge into offshore waters.[227] Consequently, it is not clear if produced sands containing LSA/NORM can be discharged into offshore waters. Accordingly, the issue needs to be clarified by DPR.

Additionally, the presence of produced sands containing LSA/NORM levels of 50 micro rems/hr (roentgen equivalent in man per hour) above background concentrations or 30pci/gm (picoCuries per gram) must be reported to the Director of Petroleum Resources within 24 hours.[228] This requirement allows DPR to take appropriate measures to mitigate the effect of such contaminated sand and prevent further discharge.

The sampling and monitoring requirements discussed for the discharge of produced water are also applicable to the discharge of produced sand.

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[224] *Ibid*.
[225] *Ibid*, article 3.6.4.2, part II.
[226] One of such countries is the UK and it requires authorisation under its Radioactive Substances Act for the discharge of produced sands containing LSA/NORM.
[227] *Supra* (n 212).
[228] *Ibid*. The terms rems/hr and pci/gm are measurements of radioactive concentration. A 'rem' is a unit of radiation dose and is used to describe how much radiation "energy" is deposited in someone or something. 'Pci/gm refers to the amount of radioactivity in a particular solid substance. See'Basic concepts'- Radiation-related consulting and services from Integrated Environmental Management, Inc. Available at http://www.iem-inc.com/primrite.html. [Accessed 22 September 2009]

3.3.4 Displacement Water

There is no provision in EGASPIN regulating the discharge of displacement water. It is therefore imperative for an effluent limitation to be established to regulate the discharge of displacement water. The effluent limitation for the discharge of displacement water in some countries such as the UK is 40mg/l.[229] This standard should be incorporated into EGASPIN or an appropriately developed offshore oil and gas law to control the discharge of displacement water.

3.3.5 Deck Drainage

There is no effluent limitation for the discharge of deck drainage in EGASPIN. It only provides that deck drainage may be collected and treated separately for oil removal by gravity separation or handled by the produced water treatment system before discharge.[230] It is therefore not clear if all that is required for the discharge of deck drainage into offshore waters is to it treat first.

Nigeria is a party to MARPOL 73/78 and the effluent limitation of oil in water and oily mixtures for machinery space drainage (deck drainage) from offshore installations under MARPOL 73/78 is 15ppm.[231] This is the international standard for the discharge of deck drainage. However, Nigeria has not implemented the provisions of MARPOL 73/78 into its laws and so the limitation is not applicable in Nigeria. It is therefore imperative that this standard is incorporated into EGASPIN or the provisions of MARPOL 73/78 are implemented in Nigerian Law to ensure the regulation of deck drainage in Nigeria.

There are however mandatory monitoring requirements for the discharge of deck drainage similar to the requirements discussed for drilling fluids/mud.

It is worth mentioning that there is provision for inspections by authorised inspectors under EGASPIN for the purpose of enforcing compliance with its provisions. An inspector may without warrant require permits, licences, certificates, other documents and equipment to be produced for examination; enter and search oil

[229] This is the standard in the United Kingdom and Norway.
[230] Article 2.4.1, part II of EGASPIN.
[231] Regulation 15, Revised Annex I of MARPOL 73/78. Available at http://www.amsa.gov.au/Marine_Environment_Protection/Revision_of_Annexes_I_and_II_of_L_73-MARPOL78/117-52.pdf. [Accessed 30 August 2009].

and gas facilities on suspicion that an offence has been committed; perform tests and take samples and arrest persons suspected of committing an offence.[232] These inspection powers are however discretionary.[233] There are also no provisions for the issue of enforcement notices and prohibition notices like in the UK for situations where the provisions of EGASPIN have been contravened and to avoid, minimise or cease activities that involve risk of pollution, respectively. It is therefore necessary that these notices be included into EGASPIN for better regulation of offshore E&P waste management.

There is also a requirement under EGASPIN for the submission of a waste release inventory to the Director of Petroleum Resources at the end of each year for an account of the total release of all effluents (wastes) discharged onsite from offshore installations.[234] This is similar to the requirement for the maintenance of record books to keep track of the amount of E&P wastes discharged from offshore installations in the UK. This requirement is therefore because it keeps DPR informed on the total wastes that have been discharged from offshore installations. It however depends on the goodwill of the operators to give an accurate account of the total amount of wastes discharged from their installations. Thus, accurate reports may not be given especially in situations of non compliance with effluent limitations for the wastes. It is submitted that the inventory should be inspected monthly by inspectors when inspecting offshore installations to ensure accuracy of the reports.

3.4 Protection of the Environment from the Effects of Offshore E&P Wastes in Nigeria

There are no laws regulating the protection of habitats and species located in areas where offshore E&P activities are carried out from the impacts of ineffective offshore E&P waste management. This is unsatisfactory because as discussed in chapter two, offshore E&P wastes have adverse effects which can cause damage or destruction of such habitats and species. In fact, some countries like the UK have laws that protect habitats located in areas where offshore activities are carried out from the negative impacts of such activities. Regrettably, the Nigerian Constitution

[232] Article 4.1, part IX of EGASPIN.
[233] This is illustrated by the use of the word 'may' in the guidelines.
[234] Article 3.8.1.3.1, part II and article 4.1.3, part III of EGASPIN.

which is the basis for environmental protection in Nigeria is not helpful in this regard as illustrated by section 20.[235]

Section 20 of the 1999 Constitution of Nigeria provides that 'the state shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria'. On the face of it, this provision could be invoked for the protection of the offshore marine environment of Nigeria from offshore E&P activities especially the discharge of E&P wastes. Unfortunately, it is contained in the fundamental objectives and directive principles of state policy which are non justiciable and unenforceable. So the Nigerian government cannot be compelled to enforce the provisions of section 20 of the 1999 Constitution against offshore operators whose activities damage or destroy offshore habitats and species. There is therefore a need for a law to ensure protection of habitats and species located in areas where offshore E&P activities are carried out from the impacts of E&P wastes.

Nonetheless, the Environmental Impact Assessment Decree[236] contains some provisions that can be used to protect habitats located in areas where offshore activities are carried out. Oil and gas development is one of the activities listed in the decree for mandatory study by a review panel.[237] The decree makes EIA compulsory for any activity likely to significantly affect the environment and the significant environmental issues must be identified and studied before embarking on such activity. [238] Additionally, one of the issues that must be included in the EIA is whether the Nigerian environment is likely to be affected by the proposed activity.[239] In carrying out a mandatory study of the activity, the review panel must consider the environmental effects of such activity.[240] Such activity may also be subject to supervision after an EIA has been carried out.[241] Hence, the EIA Decree could therefore be used to protect offshore habitats from adverse effects of E&P wastes because offshore E&P activities are subject to EIA prior to their approval as well as supervision after approval.

[235] Chapter II of the Constitution of the Federal Republic of Nigeria 1999, Cap C 34, LFN 2004.
[236] Environmental Impact Assessment (EIA) Decree No. 86 of 1992.
[237] *Ibid*, section 12 (a) of the schedule.
[238] *Ibid*, sections 2 and 3.
[239] *Ibid*, section 4 (g).
[240] *Ibid*, section 17 (a)
[241] *Ibid*, section 10.

3.5 Factors Responsible for Inadequate Regulation of Offshore E&P Waste Management in Nigeria

In addition to the absence of adequate legislation, there are some other factors that hinder the effective regulation of offshore E&P waste management in Nigeria. These factors which also apply to all oil and gas activities include the attitude of the government in enacting and amending oil and gas laws; lack of implementation and enforcement; corruption; financial, technical and capacity constraints of regulatory agencies; political instability and civil strife; fragmentation and overlapping competencies of government regulatory agencies and absence of environmental nongovernmental organisations.

i. Attitude of the Government in Enacting and Amending Oil and Gas Laws

The lackadaisical attitude of the government with regards to enacting and amending oil and gas laws is a problem hindering adequate regulation of offshore waste management in Nigeria. It seems that the Nigerian government has little or no concern with enacting laws for the regulation of the adverse effects of offshore oil and gas activities. Over the past 20 years, no law with appropriate environmental standards for regulating the oil and gas industry has been enacted. Apart from EGASPIN which was revised in 2002, most of the existing laws have also not been amended in over 20 years. Additionally, even where amendments are made to the laws, it takes the government a considerable amount of time to make such amendments.[242] This is rather disheartening because Nigeria is a major oil producer and generates tons of wastes that contribute immensely to its environmental problems. As such, the government ought to be proactive in its environmental regulation of oil and gas activities so as to ensure adequate protection of the environment.

ii. Lack of Enforcement of Oil and Gas Laws

The inability to effectively ensure an enforcement process to enable the workability of laws is a common problem in Nigeria.[243] Accordingly, environmental provisions in oil and gas laws are usually not enforced. This is attributable to insufficient

[242] For instance, EGASPIN is meant to be revised every 5 years but it took DPR 11 years to revise it.
[243] Omobolaji Adewale 'The Right of the Individual in Environmental Protection: A Case Study of Nigeria' (1991) l2 (4) *Rivista Giuridica DeIl' Ambiente* 649 at 650.

oversight and unwillingness on the part of government to effectively enforce its laws and regulations.[244] The Nigerian government would rather favour the oil companies because its priority is the achievement of economic growth and attracting investment through development of projects that create of a competitive and favourable investment climate.[245] Thus, lack of zeal and weak governance by the government is a barrier to the effective regulation of offshore E&P waste management in Nigeria.[246]

iii. Corruption

Corruption involving government officials and oil corporations is a major problem hindering the environmental regulation of offshore waste management in Nigeria. It is often characterised by oil companies bribing officials of regulatory agencies to avoid action being brought against them for contravening provisions of oil and gas laws. In some instances, the officials hold seats of power in oil corporations and then switch over to their official positions when their term has ended.[247] As such, they work closely with the oil corporations and are unwilling to bring enforcement actions against such corporations when they contravene environmental provisions of oil and gas laws.

Another form of corruption involves misappropriation of funds designated for oil and gas environmental projects and purchase of equipment or the collection of a percentage from the contractors involved in such projects by officials of regulatory agencies like DPR.[248] This results in the haphazard execution of such projects or the purchase of substandard equipment and culminates in ineffective regulation of oil and gas activities.

iv. Financial, Technical and Capacity Constraints of Regulatory Agencies

The effective regulation of oil and gas activities including offshore E&P waste management requires funding, state-of-the-art equipment and trained personnel.

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[244] Awogbade (n 178) at 12, Emeseh (n 170) at 20.
[245] Emeseh (n 170) at 20.
[246] *Ibid*.
[247] Chris Bentley et al 'The oil crisis in the Niger River Delta'. Available at http://www.dnr.cornell.edu/saw44/NTRES331/Products/Spring%202008/Papers/Oil_Crisis_in_Niger_River_Delta.doc. [Accessed 30 August 2009].
[248] C I Obi 'Political and Social Considerations in the Enforcement of Environmental Law" in M A Ajomo & O Adewale (eds) *Environmental Law and Sustainable Development in Nigeria* 1st ed *(1994)* 67 at 73-74.

Regrettably, DPR has limited financial resources, technical expertise and manpower to establish efficient legislative and regulatory structures. This is because most oil and gas agencies such as DPR are governmental agencies which are dependent on the limited funding allocated to them by the government.[249] As a result of this, they are usually unable to acquire the appropriate equipment and dispatch personnel to carry out functions vital for environmental regulation of oil and gas activities such as monitoring, reporting and inspecting.

v. Political Instability and Civil Strife

Political instability is also a problem affecting the regulation of offshore waste management in Nigeria. In the past, political instability was characterised by incessant changes in governments which in turn resulted in changes in the leadership and structure of oil and gas agencies or a total dissolution of oil and gas regulatory agencies.[250] At present, while there are no longer constant changes in government, the leadership and structure of the ministries and agencies are still constantly altered by the government resulting in the impediment of existing regulatory mechanisms for oil and gas regulation.

Civil strife also affects environmental regulation of offshore waste management in Nigeria. This is apparent in the current crisis in the Niger-Delta region of the country which is an impediment to effective regulation because officials of DPR are not allowed access into the region to carry out their functions.[251]

vi. Fragmentation and Overlapping Competencies of Government Regulatory Agencies

Another factor affecting the environmental regulation of offshore waste management in Nigeria is the fragmentation and overlapping competencies amongst the different governmental agencies involved in environmental management. So conflicts over the delineation of responsibilities and the duplicating of functions of these agencies in

[249] Emeseh (n 170) at 22.
[250] Adegoroye Adegoke 'The challenges of environmental enforcement in Africa: the Nigerian experience' (1994) 1 Proceedings of the Third International Conference on Environmental Enforcement 43 at 51. Available at http://www.inece.org/3rdvol1/pdf/adegoro.pdf. [Accessed 29 August 2009].
[251] The crisis began in 1999 and has resulted in attacks on oil and gas facilities, kidnapping of oil workers and forced oil production shutdowns of up to 800,000 barrels per day since December 2005.

dealing with environmental issues are common.[252] This usually results in weak coordination in addressing such environmental issues. For instance, in the past, there was conflict between the defunct Federal Environmental Protection Agency (now replaced by the National Environmental Standards and Regulations Enforcement Agency) and DPR over issues of establishment and enforcement of standards for pollution control in the oil and gas industry.[253] This conflict resulted in duplication of responsibilities and lack of cooperation between the agencies but was resolved after years of strained relationship between them.[254] Hence, the government needs to spell out the responsibilities of agencies involved in environmental regulation and remove areas of overlap.

vii. ***Absence of Environmental Non Governmental Organisations (NGOs)***

Environmental NGOs play a vital role in creating awareness on environmental issues and influencing policies aimed at protecting the environment.[255] In fact, NGOs put pressure on the government to provide adequate protection of the environment. For instance, in the UK, Greenpeace Limited succeeded in a judicial review action against Secretary of State for Trade and Industry for the application of the Conservation (Natural Habitats) Regulations to offshore areas and subsequently influenced the enactment of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001.[256] However, the presence of environmental NGOs in Nigeria is negligible. Even though a few environmental NGOs exist, their activities are yet to be appreciable.[257] This is because they are severely limited by financial resources and governmental intervention.[258] The presence of dynamic NGO action is therefore needed in Nigeria to aid in the enactment of legislation and introduction of more stringent measures for the regulation of offshore oil and gas activities particularly offshore E&P waste management.

[252] Adegoke (n 250) at 51.
[253] *Ibid* at 53.
[254] *Ibid*. In fact, the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007regulates all aspects of environmental protection in Nigeria except in the oil and gas industry but there are still some areas of overlapping competencies between NESREA and DPR in terms of environmental regulation.
[255] A Chitra 'Role of Ngo's In Protecting Environment And Health' in Martin J Bunch et al (eds*) Proceedings of the Third International Conference on Environment and Health* (2003) 105 at 106.
[256] *R v Secretary of State for Trade and Industry ex parte Greenpeace Ltd (QBD) CO/1336/1999 5 November 1999, unreported.*
[257] Lawrence Atsegbua et al *Environmental law in Nigeria- theory and practice* (2000) 51.
[258] Emeseh (n 170) at 21-22.

3.6 Conclusion

It is evident from all that has been discussed in this chapter that the regulation of offshore E&P waste management in Nigeria is not adequate. Although EGASPIN contains some provisions regulating E&P wastes, its provisions either lack standards for managing some wastes or are not at par with international standards. A cue should therefore be taken from the UK and a law should be enacted specifically to regulate offshore E&P waste management in Nigeria in line with contemporary standards. In the meantime, given the length of time it takes to enact laws in Nigeria, EGASPIN should be amended without delay to correct these deficiencies. Additionally, it is also imperative that a law should be enacted to protect offshore habitats from the impacts of offshore E&P activities.

CHAPTER FOUR

THE REGULATION OF OFFSHORE OIL AND GAS (E&P) WASTE MANAGEMENT IN THE UNITED KINGDOM

4.1 Introduction

The reduction of the adverse effects of offshore operations on the environment is one of the pressing issues facing the oil and gas industry in Europe today.[259] As such, many European Union (EU) environmental directives have influenced and have been implemented in the offshore oil and gas laws of the UK. Like Nigeria, the regulation of offshore oil and gas activities in the UK is centralised because offshore oil and gas matters are reserved matters. However, environmental regulation up to the 3 mile offshore limit is devolved.[260]

The UK offshore oil and gas regulatory regime is dynamic and constantly evolving to fit in environmental considerations. In fact, environmental regulation of the industry has become wider in scope and tougher in its implementation.[261] The industry is closely controlled by legislation and operators are also increasingly being held accountable for their operations through soft law concepts such as the precautionary principle, polluter pays and producer responsibility.[262] Consequently, companies exploring and developing UK's oil and gas resources are subject to a balanced regime of environmental regulation from national, European and international laws as well as self-regulation.[263] There are therefore statutory provisions for the management of offshore E&P wastes and for the protection of the offshore environment in the UK. The United Kingdom Offshore Operators Association (UKOOA) has also produced some voluntary codes and guidelines and

[259] Edward Salter and John Ford 'Environmental pollution challenges and associated planning and management issues facing offshore oil and gas field development in the UK' *(2000) 43(2) Journal of Environmental Planning and Management* 253.
[260] S Boyes et al 'Regulatory Responsibilities & Enforcement Mechanisms Relevant to Marine Nature Conservation in the UK'. Report to the Joint Nature Conservation Committee (JNCC) of 11 July 2003. Available at http://www.jncc.gov.uk/PDF/enforcement.pdf. [Accessed 5 September 2009]. Reserved matters are the matters still dealt with by the United Kingdom Parliament, and not devolved to the national governments of Scotland, Wales and Northern Ireland . See 'Definition of Reserved powers'. Available at http://dictionary.babylon.com/reserved%20powers. [Accessed 28 September 2009].
[261] Edward Salter and John Ford 'Holistic environmental assessment and offshore oil field exploration and production' (2001) 42 (1) *Marine Pollution Bulletin* 45.
[262] *Ibid*.
[263] Salter and Ford (n 259) at 256- 257.

negotiated agreements with appropriate government agencies to facilitate the regulation of the offshore activities.[264] So Nigeria ought to take a cue from the UK and strive for laws which are frequently developed to fit in environmental considerations.

This chapter examines the history and development of the oil and gas industry in the UK, the laws regulating offshore E&P wastes in the UK and offshore environmental protection in the UK.

4.2 Overview of the Oil and Gas Industry in the United Kingdom

The UK oil and gas reserves are located both onshore and offshore. The onshore oil reserves of the UK are mainly in the Wytch Farm in Dorset, which is the largest onshore oil field in Europe.[265] The UK Continental Shelf (UKCS), located in the North Sea off the eastern coast of the UK, contains the bulk of the country's offshore oil reserves.[266] There are also offshore oil reserves in the North of the Shetland Islands in the North Sea and in the North Atlantic. There are currently about 240 offshore fields in production in the UK. The largest concentration of natural gas production in the UK is the Shearwater-Elgin area of the Southern Gas Basin.[267]

The first commercial discovery of oil in the United Kingdom (UK) was made in 1918 in Nottinghamshire.[268] The first significant discovery of offshore gas was made by British Petroleum (BP) in 1965 in the West Sole Field in the Southern Basin of the North Sea and the first oil in UK waters was found by Amoco in the Arbroath Field in 1967.[269] The first major onshore oil field was discovered in Wytch Farm in Dorset in 1973.[270] The first UK offshore oil production was made in the Argyll field operated by Hamilton Brothers in June 1975.[271] In 1977, BP discovered

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[264] 'Environmental Regulations in United Kingdom offshore oil and gas industry'. Available at http://www.oilandgasforum.net/management/regula/ukprof.htm. [Accessed 5 September2009].
[265] 'Country analysis briefs-United Kingdom'. (2008 Estimates). Available at http://www.eia.doe.gov/cabs/United_Kingdom/Full.html. [Accessed 5 September 2009].
[266] *Ibid*.
[267] 'Oil and gas in United Kingdom- overview'. Available at http://www.mbendi.com/indy/oilg/gas_/eu/uk /p0005.htm. [Accessed 5 September 2009].
[268] *Ibid*.
[269] *Ibid*.
[270] *Ibid*.
[271] 'Key dates in UK offshore oil and gas production'. Available at http://www.ukooa.co.uk/education/dates/v0000091.cfm. [Accessed 5 September 2009].

oil in block 206/8 in the Clair field in the West of Shetlands-the first discovery in West Shetlands.[272]

The UK is the largest oil and gas producer in the European Union (EU) and one of the largest producers of natural gas in the world. However, its oil production has declined since peaking in 1999.[273] The UK has proven crude oil reserves of about 3,600 billion barrels and proven natural gas reserves of about 17,000 billion cubic feet.[274] The major importer of UK oil is the United States of America. The major oil producing companies in the UK are BP, Shell, ChevronTexaco, and Total and the major gas distribution companies are Centrica and British Gas (BG) Group.[275]

The major law regulating the oil and gas industry is the Petroleum Act 1998.[276] The Act vests on the Crown the exclusive right of searching and boring for and getting petroleum occurring in the UK and its continental shelf. [277] The power to grant licences to search and bore for and get petroleum under the Act is conferred on the Secretary of State, on behalf of the Crown.[278] The UK also has some offshore oil and gas laws that have prescribed standards for the management of E&P wastes and for environmental protection of marine habitats in the offshore areas of the UK.

The UK is also party to several global and regional environmental conventions such as the 1982 United Nations Convention on the Law of the Sea (UNCLOS),[279] International Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 (MARPOL 73/78),[280] the London Dumping Convention of 1972 and its Protocol of 1996[281] and the Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (OSPAR Convention). Of all these Conventions, the OSPAR Convention contains adequate provisions for the management of offshore E&P wastes.

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[272] *Ibid*.
[273] *Supra* (n265).
[274] 'United Kingdom energy profile'. (2008 Estimates). Available at http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=UK, [Accessed 5 September 2009].
[275] *Supra* (n265).
[276] C.17, United Kingdom Legislation- Act (June 1998).
[277] *Ibid*, section 2.
[278] *Ibid*, section 3.
[279] UNCLOS (n 82).
[280] MARPOL 73/78 (n 93).
[281] London Convention (n 194).

4.3 Regulation of Offshore E&P Wastes in the United Kingdom

The UK has enacted a number of laws to deal with offshore oil and gas activities and ultimately protect the marine environment. These laws contain provisions which set standards and procedures for the regulation of the different types of offshore E&P wastes. The laws regulating offshore oil and gas waste management in the UK include the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005;[282] Offshore Chemical Regulations 2002;[283] REACH Enforcement Regulations 2008;[284] Food and Environment Protection Act 1985 (as amended);[285] Merchant Shipping (Prevention of Oil Pollution) Regulations 1996[286] and the OSPAR Convention.[287] The Department of Energy and Climate Change (DECC) is in charge of administering and ensuring compliance with these laws.

The laws regulating the major offshore E&P wastes in the UK are discussed below.

4.3.1 Produced Water

The discharge of produced water is mainly regulated by the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (OPPC Regulations).[288] The OPPC Regulations are designed to encourage operators to reduce the quantities of hydrocarbons discharged during the course of offshore operations.[289]

Prior to the enactment of the OPPC Regulations, the discharge of oil-contaminated produced water from offshore installations was permitted by an

[282] The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005. Available at http://www.opsi.gov.uk/si/si2005/20052055.htm. [Accessed 5 September 2009].
[283] The Offshore Chemicals Regulations 2002. Available at http://www.opsi.gov.uk/si/si2002/20021355.htm. [Accessed 5 September 2009].
[284] The REACH Enforcement Regulations 2008. Available at http://www.opsi.gov.uk/si/si2008/pdf/uksi_20082852_en.pdf. [Accessed 5 September 2009].
[285] Food and Environment Protection Act 1985 (c. 48). Available at http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1985/cukpga_19850048_en_1. [Accessed 17 August 2009].
[286] The Merchant Shipping (Prevention of Oil Pollution) Regulations (POOP Regulations) 1996. Available at http://www.opsi.gov.uk/si/si1996/Uksi_19962154_en_1.htm. [Accessed 5 September 2009].
[287] OSPAR Convention (n 135).
[288] The OPPC came into effect on 20 August 2005 and replaced the Prevention of Oil Pollution Act.
[289] Section 1.2, guidance notes on the OPPC Regulations. Available at https://www.og.dti.gov.uk/environment/opaoppcr_guide.htm. [Accessed 5 September 2009].

exemption granted under the Prevention of Oil Pollution Act, 1971 (POPA).[290] However, POPA was considered to be out-of-date and lacking in flexibility to deal with the increasing demand on environmental performance.[291] So the exemption granted under POPA has been replaced by permitting obligations under the OPPC Regulations. This is an illustration of the evolving nature of the UK's offshore oil and gas laws.

The OPPC Regulations prohibit the discharge of oil into the sea unless a permit has been issued for the discharge.[292] Accordingly, a 'life' permit is required under the OPPC Regulations for overboard discharge into the sea and re-injection of produced water.[293] The discharge of produced water may only take place from those locations and at depths specified in the schedule attached to the life permit.[294] The current discharge standard included in permits for the discharge of produced water under the OPPC Regulations is 30 mg/l.[295] This standard has become the yardstick employed by many countries for the control of the discharge of produced water. It should therefore be incorporated into EGASPIN or an appropriately developed offshore oil and gas law to help limit the amount of the produced water discharged into offshore waters in Nigeria.

In addition to a life permit under the OPPC Regulations, a licence is also required under section 5 of the Food and Environment Protection Act 1985 (FEPA) for the transfer or export of produced water to another field for re-injection.[296] However, a FEPA licence is not required for the transfer of produced water to

[290] 'Oil Discharged with Produced Water 1992 – 2007'. Available at https://www.og.decc.gov.uk/information/bb_updates/chapters/Table3_2.htm. [Accessed 5 September 2009].
[291] Explanatory memorandum to the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 no. 2055 at 1. Available at http://www.opsi.gov.uk/si/em2005/uksiem_20052055_en.pdf. [Accessed 5 September 2009].
[292] Regulation 3, OPPC Regulations.
[293] Section 7.2, guidance notes on the OPPC Regulations. A life permit is a permit "issued for the life of an offshore installation, that is, for as long as it is involved in offshore activities for the duration of the activity to be covered by the permit." The schedules attached to a 'life' permit can either be valid indefinitely, or time limited for specific discharge activities. 'Life' permits are subject to a formal review as stipulated in the permit schedule. The minimum review period is once in three years.
[294] 'Produced water'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/Topic_Files/Offshore/Produced_water.htm. [Accessed 5 September 2009].
[295] Section 8.2.2. guidance notes on the OPPC Regulations.
[296] Annex A, section A1. 2.4, guidance notes on the OPPC Regulations.

another installation for separation, subsequent treatment and re-injection.[297] This is because an exemption will be issued for such activities.[298] A contingency oil discharge permit may also be required to cover the possibility of unplanned produced water injection or re-injection discharges during routine maintenance operations. It is also necessary to notify DECC of any such unplanned discharge.[299] These permitting requirements ensure that at all stages of production the discharge of produced water is controlled thereby preventing damage to the marine environment. EGASPIN has no provisions for contingency permits for unforeseen discharges of produced water and permits for the transfer of produced water to another field for re-injection. It is therefore advisable that permits for these situations should be included within the purview of EGASPIN to ensure control of produced water discharge during the various stages of oil and gas production.

Conditions may be attached to the schedule of life permits for the discharge or re-injection of produced water.[300] One of such conditions is the appropriate monitoring of discharges which may include varying degrees of sampling and analysis requirements.[301] For instance, there are reduced sampling and analysis requirements for installations discharging, injecting or re-injecting produced water containing less than 2,000000 kilograms of dispersed oils per annum to the sea.[302] On the other hand, installations discharging produced water containing more than 100,000 kilograms of dispersed oils per annum to the sea have more sampling and analysis requirements.[303] The procedure for undertaking sampling and analysis of produced water in Nigeria is not defined. As such, the UK's sampling and analysis procedure could be emulated and improved upon to ensure proper sampling and analysis of produced water with the aim of controlling the discharge of contaminated produced water in Nigeria.

There are also requirements for monthly reporting via the UKOOA/DECC environmental emissions monitoring system (EEMS) database, for environmental

[297] 'Produced water' (n 294).
[298] *Ibid*.
[299] Annex A, section A1.2.4, guidance notes on the OPPC Regulations.
[300] Regulation 4 (2), OPPC Regulations.
[301] Regulation 4 (2) (d) and section 8.2.1, guidance notes on the OPPC Regulations.
[302] Section 8.2.5, guidance notes on the OPPC Regulations.
[303] Section 8.2.6, guidance notes on the OPPC Regulations.

monitoring and for maintaining records of operations in the OPPC Regulations.[304] In addition, if the monthly average concentration of dispersed oil in produced water discharged by an installation exceeds 30 mg/l, DECC must be informed within 2 working days of the submission of the monthly returns.[305] DECC must also be notified within 6 hours if the maximum concentration of dispersed oil in produced water discharged exceeds 100 mg/l.[306] In both situations, DECC should be informed using an OPPC non-compliance notification form.[307] This notification requirement should be incorporated into EGASPIN to ensure that Department of Petroleum Resources (DPR) is kept abreast of instances where the produced water discharged exceeds the effluent limitation.

The OSPAR Commission has also set standards for the regulation of produced water. The discharge standard for dispersed oil in produced water as proposed by the OSPAR Recommendation 2001/1 (as amended by the OSPAR Recommendation 2006/4) is 30 mg/l standard.[308] The 30 mg/l limit is the performance standard for the UK under the OPPC Regulations. The recommendation also called for a 15% reduction in oil tonnage discharged in produced water by the end of 2006 (in comparison with discharges made in 2000).[309] The 2001/1 recommendation also proposes a zero harmful discharge limit by 2020.

4.3.2 Drilling Fluids/Mud and Drill Cuttings

The use, discharge and re-injection of drilling fluids/mud are mainly regulated by the Offshore Chemical Regulations 2002 (OCR).[310] A term permit is required for the use, discharge and re-injection of drilling fluids/mud under the Regulations.[311] The permit must be in place before commencement of operations. Application for use

[304] See sections 8.3.3, 8.3.4, 8.2.9 and 8.3.1, guidance notes on the OPPC Regulations for more details. The monthly report is to be submitted by the 16th of every month for each preceding calendar month.
[305] 'Produced water' (n 294).
[306] *Ibid*.
[307] *Ibid*.
[308] OSPAR Recommendation 2001/1 (n 206). The standard was initially 40 mg/l but was replaced with the 30 mg/l standard at the end of 2006. The 2001/1 recommendation revoked the PARCOM Recommendation of a 40 mg/l Emission Standard for Platforms of 1986 with regards to produced water only.
[309] *Ibid*.
[310] The Offshore Chemicals Regulations 2002. Available at http://www.opsi.gov.uk/si/si2002/20021355.htm#3. [Accessed 5 September 2009].
[311] Regulation 3 (1), OCR. A 'term' permit is issued for discharges that occur during the duration of a specific operation or for activities that are not undertaken on a regular basis.

and discharge of chemicals must be made using a Petroleum Operations Notice (PON) 15B even where there will be no overboard discharge.[312] Thus, the use of oil based fluids/mud (OBMs) andsynthetic based fluids or mud (SBMs) requires a permit even though no overboard discharge is prohibited.[313]

The discharge and re-injection of drill cuttings is also regulated by the Offshore Chemical Regulations 2002 (OCR).[314] The discharge or re-injection of cuttings contaminated with oil requires a permit under the OPPC Regulations.[315] However, the transfer of drill cuttings to another field for re-injection will require a licence under FEPA. A formal consent is not needed for re-injection of OBM/SBM cuttings onsite but DECC's approval must be obtained.[316]

The permitting requirements for the use, discharge and re-injection of drilling mud/fluids under the OCR is similar to those under EGASPIN. There is however no provision for licensing or permitting the transfer of drill cuttings to another field for re-injection in EGASPIN. The provision of the OCR in that regard should therefore be emulated and incorporated into EGASPIN.

There are sampling/monitoring requirements under the OCR. The use and discharge of drilling mud/fluids must be monitored, analysed and recorded. The components of oil based mud systems must be listed individually with their appropriate use and discharge.[317] However, there are no monitoring or sampling requirements for the re-injection of OBM/SBM cuttings contaminated with oil.[318] There are also reporting requirements under the OCR. Reports on all drilling fluids/mud used must be submitted to DECC using an EEMS Drill Fluids form available from the EEMS website.[319] Discharges of Organic-phase drilling fluid

[312] 'OBM and SBM use and discharge'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/OBM_SBM%20Consent.htm. [Accessed 5 September 2009].
[313] *Ibid*.
[314] 'WBM use and discharge'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/WBM.htm. [Accessed 5 September 2009].
[315] 'Re-injection of mud and cuttings'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/Re-injection.htm. [Accessed 5 September 2009].
[316] *Ibid*.
[317] *Supra* (n 312) and (n 314).
[318] *Supra* n (314).
[319] *Supra* (n 312) and (n 314).

(OPF) must be reported via the Condition 5 Return Form.[320] Reports on the use and discharge must be undertaken on a component basis of the whole mud.[321] Non-compliance with permit conditions under the OCR must be reported using the DECC Permit Condition Non-compliance Notification Form.[322] Non-compliance with the discharge or re-injection of cuttings contaminated with oil without an OPPC permit must be reported using the OPPC non-compliance notification form.[323]

The monitoring requirements under the OCR are similar to those under EGASPIN. However, the reporting requirements are more detailed than those under EGASPIN. This is because there are general reporting requirements as well as reporting for non compliance for the use and discharge of drilling mud/fluids via different forms. Accordingly, these detailed reporting requirements could be incorporated into EGASPIN to ensure adequate reporting of the use and discharge of drilling mud/fluids during offshore E&P operations in Nigeria.

Additionally, if there is a variation in the drilling mud/fluid used or the permitted volume of usage is exceeded, an application for a variation must be made to DECC using the PON15B.[324] There is no requirement like this in EGASPIN and it could be incorporated for effective management of the discharge of drilling fluids/mud.

The OSPAR Commission has also set standards for the regulation of drilling mud/fluids and drill cuttings. The OSPAR Decision 2000/3 prohibits the discharge of OBMs and organic phase fluids (OPF) (which includes SBMs) or cuttings contaminated with these mud/fluids .[325] The discharge of cuttings contaminated with WBM into offshore waters is permitted for ocean discharge in the OSPAR countries and so is allowed in the UK.[326] The discharge into the sea of cuttings contaminated

[320] *Supra* (n 312). OPF means an organic-phase drilling fluid, which is an emulsion of water and other additives in which the continuous phase is a water-immiscible organic fluid of animal, vegetable or mineral origin and includes SBMs.
[321] *Supra* (n 312) and (n 314).
[322] *Ibid*.
[323] *Ibid*.
[324] *Ibid*.
[325] OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings. Available at http://www.ospar.org/v_measures/browse.asp?menu=00510416000000_000000_000000. [Accessed 28 August 2009].
[326] Jerry M Neff 'Estimation of bioavailability of metals from drilling mud barite' (2008) 4(2) *Integrated Environmental Assessment and Management* 184.

with OBM is prohibited unless at concentration greater than 1% by weight on dry cuttings.[327] The use of diesel-oil-based drilling fluids is prohibited. The discharge of whole OPF or mixing of OPF with cuttings for the purpose of disposal is prohibited.[328] The use of OPF in the upper part of the well is also prohibited although exemptions may be granted by the national competent authority for geological or safety reasons.[329] The discharge of cuttings contaminated with SBMs into the sea will only be authorised in exceptional circumstances in line with the 'best available techniques' (BAT) or the 'best environmental practice' (BEP).[330] The provisions of the OSPAR Decision 2000/3 on the discharge of drill cuttings are similar to the provisions of EGASPIN except with regards to SBMs. The UK standard could therefore be adopted in Nigeria to protect the offshore marine environment from pollution and degradation.

The OSPAR Recommendation 2006/5 sets out measures to reduce pollution from oil or other chemicals from cuttings piles.[331] It calls for a cuttings pile management regime involving the initial screening of all cuttings piles completed within 2 years of the recommendation coming into effect.[332] This provision could be adopted into Nigerian law for the management of cutting piles so as to check pollution.

These abovementioned OSPAR measures are in place to prevent pollution and environmental degradation and ensure the protection of the marine environment.

It is noteworthy that DECC is seeking consultation views on government proposals to amend the OCR and the OPPC Regulations to enable enforcement actions to be taken against operators of offshore installations for unintentional

[327] *Ibid*.
[328] *Ibid*.
[329] *Ibid*.
[330] *Ibid*.
[331] OSPAR Recommendation 2006/5 on a management regime for cuttings piles. Available at http://www.ospar.org/v_measures/get_page.asp?v0=0605e_Rec%20drill%20cuttings%20regime.doc&v1=4.[Accessed 28 August 2009].
[332] *Ibid*.

releases of chemicals.[333] The proposed amendments will extend the scope of permits and extend the power to prosecute for unauthorised discharges.

4.3.3 Produced Sand and Scale

The discharge of produced sand and scale contaminated with oil is mainly regulated by the OPPC Regulations. The discharge of produced sand and scale can either be covered by a 'life' permit, or a 'term' permit.[334] Where an installation already has a life permit, the discharge of produced sand and scale can be covered within the permit or else a term permit can be applied for.[335] This permitting requirement should be incorporated into EGASPIN for the discharge of produced sand and should also include the discharge of produced scale.

The discharge of water used to fluidise or wash the sand/scale is normally routed via the produced water treatment plant or the drainage system. However, the direct discharge of water used to fluidise or wash the sand/scale will also require an oil discharge permit under the OPPC Regulations.[336] This helps control the discharge of water contaminated with produced sand/scale into offshore waters. There is however no provision in EGASPIN for the discharge of water used to fluidise or wash the sand/scale. It is therefore submitted that it should be included in EGASPIN to control the discharge of produced sand.

The discharge of sand/scale containing low specific activity or naturally occurring radioactive materials also requires authorisation under the Radioactive Substances Act.[337]

The performance standards for the discharge of produced sand/scale is specific to each case as agreed with DECC. The maximum concentration of oil and

[333] Consultation on amendments to: the Offshore Chemicals Regulations 2002 and the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005. Available at http://decc.gov.uk/Media/viewfile.ashx?FilePath=Consultations\amendmentsoffshorechemicalregs\120090723130421_e_@@_consoffshorechemregs.pdf&filetype=4. [Accessed 28 August 2009].
[334] Annex A, section A1.6.3, guidance notes on the OPPC Regulations.
[335] 'Summary of OPPC permit requirements'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/topic_files/offshore/OPPC_Summary_Table.htm. [Accessed 5 September 2009].
[336] Annex A, A1.6.2, guidance notes on the OPPC Regulations.
[337] Annex A, A1.6.4 , OPPC guidance notes on the OPPC regulations.

permitted location of produced sand/scale discharges will be detailed in the permit schedule in line with BAT.[338]

The monitoring/sampling requirements for the discharge of produced sand/scale are as agreed with DECC and will be detailed in the permit schedule. The quantity (kg) of oil on sand/scale discharged for on-line and off-line backwashing life permit operations is measured on a monthly and annual basis.[339]

There is also a requirement for the maintenance of accurate and correct records on the offshore installation.[340] The records must be reported to DECC on an annual basis (for life OPPC permits) or at the end of operation (for term permits).[341] Additionally, there are requirements for notification and reporting of the discharge of oil contaminated sand/scale under the OPPC Regulations. The reports on the total sand/scale discharged must be reported to DECC via the offshore inspectorate data mailbox.[342] If the monthly average concentration of dispersed oil discharged on sand/scale exceeds the limit specified in the OPPC permit schedule, DECC must be notified within 2 working days of submission of the monthly returns. The notification must be done using the OPPC non-compliance notification form.[343] DECC must also be notified via the PON1 form if oil contaminated sand/scale is accidentally spilt into the sea without a permit or outside the period authorised.[344] There are no requirements for the maintenance of records and notification for non-compliance with the effluent limitation for produced sand in EGASPIN. It is therefore submitted that these requirements should be included in EGASPIN for effective control of the discharge of produced sand in Nigeria.

4.3.4 Displacement Water and Cooling Water

The key legislation regulating the discharge of displacement water is the OPPC. A 'life' permit is required under the OPPC for the discharge of displacement water.

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[338] 'Produced sand and scale'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/topic_files/offshore/produced_sand.htm. [Accessed 5 September 2009].
[339] 'Summary of OPPC sampling requirements - process operations'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/topic_files/offshore/OPPC_Sampling_Table.htm. [Accessed 5 September 2009].
[340] 'Produced sand and scale' (n 338).
[341] The annual report for life permits must be submitted by 31st January while the reports for term permits must be submitted one calendar month after the end of the discharge operation.
[342] 'Produced sand and scale' (n338).
[343] *Ibid*.
[344] *Ibid*.

The permit covers all routine oil to sea discharges or re-injection of displacement water.[345]

The monitoring/sampling of displacement water discharges is required under the OPPC and will be detailed in the permit schedule. The sampling strategy to be used will also be specified in the permit schedule.[346]

Like in the case of produced water, there are also requirements for monthly reporting via the UKOOA/DECC environmental emissions monitoring system (EEMS) database and for maintaining records of operations.[347] There is also a requirement for confirmation that the discharge of displacement water meets the specified discharge standard (40 mg/l) and that safeguards are in place to ensure that highly contaminated displacement water is not discharged to sea.[348] Furthermore, DECC must be notified if the monthly average concentration of dispersed oil in displacement water discharged by an installation exceeds 40 mg/l.[349] Also, if the maximum concentration of dispersed oil in displacement water discharged exceeds 100 mg/l, DECC must be notified within six hours.[350]

The OSPAR Commission has also recommended performance standards for regulating the discharge of displacement water. The monthly discharge performance standard for dispersed oil in produced water as proposed by PARCOM 8/12/1 is 40 mg/l.[351] The 40 mg/l standard is the current performance standard included in permits for displacement water under the OPPC.

With regards to cooling water, there is no licence or permit requirement. The Deposits in the Sea (Exemption) Order 1985 provides a general exemption for the discharge of cooling water.[352] However, if the cooling water is contaminated with oil

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[345] Annex A, section A1.3, guidance notes on the OPPC Regulations.
[346] 'Displacement water'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/Topic_Files/Offshore/Displacement_water.htm. [Accessed 5 September 2009].
[347] *Ibid*.
[348] Annex A, section A1.3,.2, guidance notes on the OPPC Regulations.
[349] 'Displacement water' (n 346).
[350] *Ibid*.
[351] PARCOM Recommendation 86/1 of a 40mg/l emission standard for platforms. Available at http://www.ospar.org/documents/dbase/decrecs/recommendations/pr86-01e.doc. [Accessed 28 August 2009].
[352] Article 3 of the schedule to the Deposits in the Sea (Exemptions) Order 1985. Available at http://www.mceu.gov.uk/mceu_local/fepa/FEPA-Legal-controls.htm. [Accessed 5 September 2009]

or chemicals, the OPPC or OCR will apply depending on the nature of the contamination.

There is no provision for the discharge of displacement water and cooling water in EGASPIN or any other law in Nigeria. It is therefore imperative for the standards and requirements mentioned above to be included in EGASPIN for regulating the discharge of displacement water and cooling water.

4.3.5 Platform/Machinery Space Drainage

The Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 (POOP Regulations) regulate the discharge of oily drainage water in the UK.[353] However, the Regulations do not apply to hazardous and non-hazardous drainage, that is, oily drainage resulting from oil and gas operations because such drainage is covered by the OPPC Regulations.[354]The POOP Regulations and their amendments give effect to MARPOL 73/78 in the UK and the requirements applicable to ships of 400 tons gross tonnage (GT) and above apply to offshore installations under the Regulations.[355]

The effluent limitation of oil in water and oily mixtures for machinery space drainage from offshore installations in the UK is 15 ppm.[356] In addition, the offshore installation must have the appropriate machinery required under the Regulations and keep a record of all operations involving oil or oily mixture discharges.[357]

A UKOPP Certificate or IOPP Certificate (in the case of foreign flagship units) is required for the discharge of oily machinery space drainage water.[358] A temporary exemption from the requirements to have a UKOPP Certificate may be obtained under an informal agreement with Maritime and Coastguard Agency

[353] POOP Regulations (n 286).
[354] 'Drainage- machinery space'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/Oily_water.htm. [Accessed 5 September 2009].
[355] Regulation 32 (1), POOP Regulations.
[356] Regulation 32 (2), POOP Regulations. The POOP Regulations were amended by the Merchant Shipping (Prevention of Oil Pollution) (Amendment) Regulations 1997. The 1997 Regulations replaced the words 'platform drainage' with 'machinery space drainage'. See also Salter and Ford (n 259) at 262 and Rough Offshore Facilities Environmental Statement 2007 at 6. Available at https://www.og.dti.gov.uk/environment/ospar_docs/ospar_docs_2007/centricaSL_EMS.pdf. [Accessed 5 September 2009].
[357] Regulations 14, 25 (1) & (2) and 32 of POOP Regulations.
[358] Regulation 7, POOP Regulations. See also 'Drainage - machinery space' (n 354).

(MCA) pending a more formal and final arrangement.[359] The exemption is based on the grounds of cost and technical difficulties and that a small amount of machinery space drainage water is being discharged.[360] The drainage system of every offshore installation must be surveyed before a UKOPP Certificate or IOPP Certificate is issued to it for the first time. The certificate is subject to renewal every five years subject to a re-survey.[361] The first certificate is issued by the MCA and subsequent renewal is carried out by the Classification Societies.[362]

There is also a requirement under the POOP Regulations for the maintenance of an oil record book to record all oily discharges.[363] Inspections may also be undertaken to examine the oil record book or verify that there is a valid IOPP Certificate or UKOPP Certificate on board the offshore installation.[364]

There is no provision for the discharge of deck drainage in EGASPIN or any other law in Nigeria. As such, the effluent limitation standards and requirements mentioned above should be included into EGASPIN to ensure effective regulation of the discharge of displacement water and cooling water.

4.4 Protection of the Environment from the Effects of Offshore E&P Wastes in United Kingdom

The regulatory regime for the protection of the offshore environment in the UK is dynamic. Interestingly, NGOs such as Greenpeace have played a major role in influencing the development of laws that protect offshore habitats in the UK.[365] As a result of this, there are a number of laws that provide for the protection of offshore species and habitats from adverse effects of offshore oil and gas activities. These laws have impact assessment and conservation mechanisms which ensure that the offshore environment is not affected by offshore E&P activities.

[359] 'Drainage - machinery space' (n 354).
[360] *Ibid*.
[361] Regulation 4(1), POOP Regulations.
[362] 'Drainage - machinery space' (n 354).
[363] Regulation 10 (1), POOP Regulations.
[364] Regulations 10 (6) and 34, POOP Regulations.
[365] Greenpeace was instrumental to the development of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001because of its success in the judicial review action which extended the territory to which the EU Habitats Directive applies from 12 nautical miles to offshore areas.

The laws relating to environmental protection in the offshore oil and gas areas of the UK include the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999[366]; Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) (Amendment) Regulations 2007[367]; Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001[368] and Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007.[369]

The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (OPPPR) implement the 1985 Council Directive on the Assessment of the Effects of Certain Public and Private Activities on the Environment (85/337/EEC) as amended by Council Directive 97/11/EC.[370] The activities to which the OPPPR apply are field developments, the drilling of wells and the construction and installation of production facilities and pipelines in the UK Territorial Sea and the UKCS.[371] So the management of E&P wastes fall within the purview of the OPPPR. The OPPPR require the Secretary of State for Energy and Climate Change to take into consideration environmental information before making decisions on whether or not to consent to certain offshore activities.[372] Thus, any Operator who wishes to carry out such activities must first make an Environmental Assessment (EA) of the impact the activity would have on the environment and then summarise the conclusions of the EA in an Environmental Statement (ES). [373] Consent for such activities will not be given until the Secretary of State is satisfied

[366] The Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) Regulations 1999. Available at http://www.opsi.gov.uk/si/si1999/19990360.htm. [Accessed 5 September 2009].
[367] The Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) (Amendment) Regulations 2007. Available at http://www.opsi.gov.uk/si/si2007/uksi_20070933_en_1. [Accessed 5 September 2009].
[368] The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001. Available at http://www.opsi.gov.uk/si/si2001/20011754.htm. [Accessed 5 September 2009].
[369] The Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007. Available at http://www.opsi.gov.uk/si/si2007/uksi_20070077_en_1. [Accessed 5 September 2009].
[370] Section 1.2.1, guidance notes on OPPPR (as amended). Available at https://www.og.decc.gov.uk/environment/EIAGuidanceNote.pdf. [Accessed 5 September 2009]. The Regulations were amended in 2007 by the Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) (Amendment) Regulations 2007 to implement the Directive 2003/35/EC which provides for public participation for plans and programmes relating to the environment. The amended Regulations came into force on the 16 April 2007.
[371] Section 1.2.2, guidance notes on OPPPR (as amended).
[372] Section 1.3.1, guidance notes on OPPPR (as amended). See also regulations 4 and 5, OPPPR.
[373] *Ibid*. The EA and ES must be undertaken unless a PON15 application has been submitted seeking a Direction that an ES is not required and the Direction has been granted.

with the information provided and that there will be no significant impact on the environment.[374] If the activity would cause significant impact on the environment, consent might be refused or conditions to mitigate or remedy any adverse effects might be imposed in the consent.[375]

The OPPPR is very functional because it specifically applies to offshore E&P activities in the UK. It ensures that the adverse effects of offshore E&P activities such as the discharge and management (disposal) of E&P wastes on the environment are taken into consideration before such activities are consented to. Although Nigeria has similar provisions in its Environmental Impact Assessment Decree, the decree is too general and does not contain specific provisions for EA and ES. It is therefore submitted that like the OPPPR, an EIA law made specifically for offshore E&P activities should be enacted in Nigeria to accord environmental protection to the offshore environment.

The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (OPAR) as amended by the Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007 apply the requirements of the Habitats Directive and the Birds Directive[376] to oil and gas (E&P) activities carried out on the UKCS or in UK waters beyond low-water mark.[377] Under the OPAR, any oil and gas plan or project likely to have a significant effect on a relevant site must be subject to an appropriate assessment of its implications for the site's conservation objectives.[378] The Joint Nature Conservation Committee (JNCC) must also be consulted for the purposes of the assessment and the opinion of the general public may be taken where necessary.[379] The plan or project may only be consented to after ascertaining that it will not adversely affect the integrity of a special area of conservation (SAC) or special protection area (SPA) unless there are imperative reasons of overriding

[374] *Ibid*.
[375] Regulation 5, OPPPR. See also section 1.3.3, guidance notes on OPPPR (as amended).
[376] Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora and Council Directive 79/409/EEC on the Conservation of Wild Birds.
[377] 'Conservation '-UK Coastal Zone Law Notes. Available at http://www.coastlaw.uct.ac.za/iczm/notes/note16.htm#sect9. [Accessed 5 September 2009].See also Para 1.1, guidance notes on the OPAR. Available at https://www.og.dti.gov.uk/environment/habitatguidnote.doc. [Accessed 5 September 2009].
[378] Regulation 5 (1), OPAR and section 1.3, guidance notes on OPAR.
[379] Regulation 5 (2), OPAR and section 3.4, guidance notes on OPAR.

public interest.[380] In addition, investigation on the effects of UKCS oil and gas E&P activities on the conservation status of natural habitats and species may be carried out for the purposes of protecting such natural habitats or species.[381] Furthermore, where an activity has had, is having, or is likely to have an adverse effect on the integrity of a relevant site or has caused, is causing, or is likely to cause deterioration or disturbance of natural habitats or species in such a site, a written directive may be issued requiring the person engaged in such activity to refrain from such activity.[382]

The abovementioned provisions of OPAR ensure that natural habitats and species are not harmed or destroyed from offshore oil and gas E&P activities such as E&P waste discharge and disposal. Thus, Nigeria should take a cue from the UK and enact a similar law to protect the habitats and species in offshore areas where oil and gas E&P activities are carried out from the adverse effects of E&P wastes.

4.5 Conclusion

The UK apparently has laws with adequate provisions regulating the management of offshore E&P wastes. The standards prescribed in the laws are higher than the standards in some developed countries like the United States of America and Canada. This is because the OSPAR decisions and recommendations as well as EU directives relating to the management of E&P wastes are taken into consideration and are included in permit requirements in the UK's offshore E&P waste laws. Innovatively, the UK also has laws that ensure the protection of offshore habitats and species from the adverse effects of E&P activities. All these laws therefore ensure the protection of the marine environment and the prevention of environmental degradation. Accordingly, Nigeria should emulate the UK and incorporate the provisions of the laws into its laws.

[380] Regulations 5 and 6, OPAR and section 1.3, guidance notes on OPAR.
[381] Regulation 6 (4), OPAR.
[382] Regulation 7, OPAR.

CHAPTER FIVE

RECOMMENDATIONS AND CONCLUSION

5.1 The Way Forward

The offshore oil and gas industry has been immensely beneficial to the Nigerian economy. However, it is evident from all that has been discussed in the foregoing chapters that the regulation of offshore oil and gas (E&P) waste management in Nigeria is inadequate. Apart from UNCLOS and CBD which indirectly regulate offshore E&P waste management, there are no international conventions or initiatives regulating offshore E&P waste management to which Nigeria is a party. At the national level, there is no specific law dealing with offshore E&P waste management although EGASPIN has standards for the management of offshore E&P wastes. Nonetheless, the provisions of EGASPIN are either lacking or inadequate and are in need of amendment.

The current effluent limitation in EGASPIN for the discharge of produced water into offshore water bodies in Nigeria is low. Hence, the effluent limitation should be increased from 40mg/l to 30mg/l in line with the standard in the UK and other OSPAR countries. More over, activities such as unplanned discharges of produced water and the transfer of produced water which are not covered under EGASPIN should be made subject to a permit under EGASPIN. There are also no defined parameters for carrying out the sampling and analysis of produced water. So, a clearly defined system should be established for carrying out the sampling and analysis of produced water in Nigeria.

In addition, the transfer of drill cuttings to another field for treatment and re-injection is not covered by a permit under EGASPIN and needs to be addressed by DPR. The discharge standard for SBM's i.e. treatment to a residual oil content of less than 50g/kg, i.e. 5% of oil - on - cuttings should be also be revised. As such, the discharge of SBMs should only be authorised in exceptional circumstances like in the UK and other OSPAR countries. Measures such as the screening and BAT/BEP assessment should also be adopted for the management of cuttings piles in offshore waters of Nigeria as done in the UK and other OSPAR countries.

There is also no clear permitting requirement for the discharge of produced sand into offshore waters in Nigeria. Thus, DPR needs to clarify the issue and establish permitting conditions for the discharge of produced sand.

The lack of effluent limitation for the discharge of displacement water and deck drainage also needs to be addressed by DPR. Accordingly, effluent limitations should be set out to regulate the discharge of displacement water and deck drainage in Nigeria. An effluent limitation of 40mg/l should therefore be established in EGASPIN for the discharge of displacement water in line with the standard in the UK and other OSPAR countries. Similarly, an effluent limitation of 15ppm should be set out in EGASPIN for the discharge of deck drainage in line with the international standard set by MARPOL 73/78.

It is therefore pertinent for DPR to address the inadequacies in EGASPIN so as to prevent pollution and environmental degradation and to ensure the protection of habitats and species located in areas where offshore E&P activities take place. Accordingly, it is recommended that an offshore oil and gas E&P waste management law with adequate provisions regulating the different E&P wastes should be developed in Nigeria. The provisions in all the oil and gas laws relating to offshore E&P waste management should also be harmonised to ensure better regulation of offshore E&P waste management. It is also imperative that while a law is being developed, the provisions of EGASPIN are amended to reflect areas that are lacking or inadequate. There is also a need for long term monitoring and surveillance with the aim of protecting and preserving the environment from pollution caused by offshore oil and gas operations particularly E&P waste discharge and disposal.[383] Thus, a comprehensive offshore monitoring programme should be initiated by DPR to monitor the discharge and management of offshore E&P wastes as well as ensure compliance with the provisions of EGASPIN. It is submitted that the United Kingdom's Department of Energy and Climate Change should be emulated in this regard.

[383] Adeyemi Oludare Tolulope 'Oil exploration and environmental degradation: the Nigerian experience' (2004) 2 *Environmental Informatics Archives* 387 at 391 -392. See also M K Ukoli 'Environmental factors in the management of the oil and gas industry in Nigeria' 1 at 24. Available at http://www.cenbank.org/out/annual/ACZRU/2001/Owe-01-2.pdf. [Accessed 5 September 2009].

There are also no laws to ensure the protection of habitats and species located in areas where offshore E&P activities are carried out from the impacts of E&P wastes. Thus, it is recommended that a law should be developed to that effect.

The other factors that contribute to the ineffective regulation of offshore E&P waste management in Nigeria such as the attitude of the government in enacting and amending oil and gas laws; lack of enforcement of oil and gas laws; corruption, financial, technical and capacity constraints of regulatory agencies; fragmentation and overlapping competencies of government regulatory agencies and absence of environmental non-governmental organisations (NGOs) should also be addressed.

With regards to the issue of enacting and amending oil and gas laws, the Nigerian government must shun its lackadaisical attitude and be more proactive in its lawmaking. The government should ensure that oil and gas laws are constantly enacted or amended to cover new areas in oil and gas operations especially with regard to offshore E&P activities and fit in environmental considerations. A cue should be taken from the evolving nature of the UK's offshore waste management laws.

The government's attitude to the enforcement of offshore oil and gas laws must also be addressed to ensure an effective offshore oil and gas enforcement regime. There must be no room for political considerations in this regard.[384] Rather than favour oil companies to the detriment of the environment, the government must find ways to balance economic growth from the oil and gas industry with environmental considerations. This can be achieved by strict implementation of the provisions of such laws especially in the area of non-compliance. In addition, all offshore oil and gas E&P activities should be subjected to environmental impact statement (EIS) and EIA at every stage of exploration and production.[385] The government should also require all oil companies operating in Nigeria to ensure that their staff are trained in environmental issues and compliance awareness. This will ensure that problems of improper E&P waste management in the offshore oil and gas industry are tackled.

[384] Ukoli (n 383) at 24.
[385] *Ibid*.

The government should also ensure that mechanisms are put in place for checking bribery and corruption of officials in DPR. The mechanisms should ensure that such officials are held accountable for corrupt practices with regards to the regulation of all oil and gas activities including offshore E&P activities.

Additionally, the Nigerian government should also increase the budgetary allocation of DPR with regards to oil and gas matters particularly offshore E&P activities. This would enable DPR to carry out its duties effectively especially with regards to the control of discharge and management of offshore E&P wastes. The government should also employ more staff at DPR provide the manpower and capacity to enforce compliance with offshore oil and gas laws. The government should also ensure that the DPR staff charged with enforcing compliance with EGASPIN are adequately trained especially in the area of waste management in order to facilitate the proper management of such wastes so as to prevent pollution and degradation.

The government should also establish an offshore environmental protection unit within DPR for the purpose of monitoring the discharge of E&P wastes into offshore waters in Nigeria and ensuring compliance with offshore oil and gas laws.

Furthermore, the government should endeavour to minimize the changes in the structure and leadership of oil and gas agencies particularly DPR so as to prevent the disruption of existing regulatory mechanisms and maintain a stable offshore regulatory system.

There is also the need for NGO presence in Nigeria to aid in the enforcement of offshore oil and gas laws particularly EGASPIN. Thus, all political obstacles that can hinder NGOs and the public from participating in oil and gas environmental decision-making and implementation in Nigeria must be removed.[386] This is necessary because all over the world, NGOs have become important watch-dogs of governments and business environmental behaviour which has helped serve as a deterrent to oil and gas operators who might otherwise violate the law.[387] As such,

[386] Tayo Akeem Yusuf 'The status of environmental governance in the Nigerian oil & gas industry'. Available at http://www.nigeriansinamerica.com/authors/404/Tayo-Akeem-Yusuf. [Accessed 5 September 2009].
[387] *Ibid*.

NGO presence in Nigeria could help put pressure on the government to enforce the provisions of EGASPIN and develop an appropriate offshore E&P waste management law.

5.2 Conclusion

There is an overriding need for the effective regulation of offshore E&P waste management in Nigeria. Evidently, Nigeria has to enact laws and adopt measures to ensure the adequate regulation of offshore oil and gas E&P waste management. The implementation of such laws and measures will help control the discharge of E&P wastes from offshore installations and assist in the prevention of operational pollution, the reduction of environmental degradation and the protection of offshore habitats and species. It is therefore recommended that a law with standards and measures for adequately regulating the discharge and disposal of offshore E&P wastes is enacted in Nigeria.

BIBILOGRAPHY

PRIMARY SOURCES

Cases

R v Secretary of State for Trade and Industry ex parte Greenpeace Ltd (QBD) CO/1336/1999 5 November 1999, unreported.

Statutes

Nigerian Statutes

Constitution of the Federal Republic of Nigeria 1999, Cap C 34, LFN 2004.

Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) 1991 as revised in 2002.

Environmental Impact Assessment (EIA) Decree No. 86 of 1992.

Petroleum Act 1969, CAP 350 LFN 1990.

Petroleum (Drilling and Production) Regulations 1969, Cap 350 LFN 1990.

National Effluent Limitation Regulations of 1991, Cap 131 LFN 1990.

National Environmental Standards and Regulations Enforcement Agency (Establishment) Act (2007) 94 FRN Official Gazette A635 to 655.

National Policy on the Environment of 1989 (FEPA 1989).

Nigerian National Petroleum Corporation Act Cap 320 LFN 1990.

Oil in Navigable Waters Act 1968, Cap 337 LFN 1990.

United Kingdom Statutes

Environmental Protection Act 1990. Available at http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900043_en_1.htm.

[Accessed 5 September 2009].

Deposits in the Sea (Exemptions) Order 1985. Available at http://www.mceu.gov.uk/mceu_local/fepa/FEPA-Legal-controls.htm.

[Accessed 5 September 2009].

Food and Environment Protection Act 1985. Available at http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1985/cukpga_19850048_en_1.

[Accessed 17 August 2009].

Merchant Shipping (Prevention of Oil Pollution) Regulations 1996. Available at http://www.opsi.gov.uk/si/si1996/Uksi_19962154_en_1.htm.

[Accessed 5 September 2009].

Offshore Chemical Regulations 2002. Available at http://www.opsi.gov.uk/si/si2002/20021355.htm. [Accessed 5 September 2009].

Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001. Available at http://www.opsi.gov.uk/si/si2001/20011754.htm. [Accessed 5 September 2009].

The Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007. Available at http://www.opsi.gov.uk/si/si2007/uksi_20070077_en_1.

[Accessed 5 September 2009].

Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005. Available at http://www.opsi.gov.uk/si/si2005/20052055.htm.

[Accessed 5 September 2009].

The Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) (Amendment) Regulations 2007. Available at

http://www.opsi.gov.uk/si/si2007/uksi_20070933_en_1.

[Accessed 5 September 2009].

Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999. Available at http://www.opsi.gov.uk/si/si1999/19990360.htm.

[Accessed 5 September 2009].

Petroleum Act 1998, C.17, United Kingdom Legislation- Act (June 1998).

Treaties

Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention) 1981, (1981) 20 ILM 746.

Convention for the Protection of the Marine Environment and Coastal Region of the Mediterranean of 1995 (Barcelona Convention). Available at http://www.unep.ch/regionalseas/main/med/medconvi.html.

[Accessed 5 September 2009].

Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter (London Dumping Convention) 1972, (1972)11 ILM 1294.

Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) 1992, (1993) 32 ILM 1072.

Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention) 1992. Available at

http://www.helcom.fi/Convention/en_GB/annexes/#top. [Accessed 5 September 2009].

The European Union Waste Framework Directive 2006/12/EC as amended by the European Directive 2008/98/EC. Available at http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0012:EN:NOT. [Accessed 28 August 2009].

International Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 (MARPOL 73/78). http://www.imo.org/conventions/contents.asp?doc_id=678&topic_id=2583.

[Accessed 29 August 2009].

Kuwait Protocol Concerning Marine Pollution Resulting from Exploration and Exploitation of the Continental Shelf 1989. Available at http://sedac.ciesin.columbia.edu/entri/texts/acrc/ProtKuwait.txt.html.

[Accessed 5 September 2009].

Kuwait Regional Convention for Co-operation in the Protection of the Marine Environment from Pollution (Kuwait Convention) of 1978, (1978) 17 ILM 511.

Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil 1994. Available at http://www.unep.ch/regionalseas/main/med/medoffsh.html.

[Accessed 5 September 2009].

Protocol to the Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1996, (1997) 36 ILM 7.

United Nations Convention on Biological Diversity 1992, (1992) 31 ILM 822.

United Nations Convention on the Law of the Sea 1982, (1982) 21 ILM 1261.

SECONDARY SOURCES

'2000 Environmental protection and offshore oil' 1 at 21. Available at http://wwww.dieselduck.net/library/05environmental/2000EnvironmentalProtectionandoffshoreoil.pdf. [Accessed 28 August 2009].

Adegoke, Adegoroye 'The challenges of environmental enforcement in Africa: the Nigerian experience' (1994) 1 Proceedings of the Third International Conference on Environmental Enforcement 43. Available at http://www.inece.org/3rdvol1/pdf/adegoro.pdf. [Accessed 29 August 2009].

Adewale, Omobolaji 'The Right of the Individual io Environmental Protection: A Case Study of Nigeria' (1991) l2 (4) *Rivista Giuridica DeIl' Ambiente* 649.

Agenda 21. Available at http://www.un.org/esa/dsd/agenda21/res_agenda21_00.shtml.

[Accessed 30 August 2009].

Agyebeng, Kisi 'Disappearing acts- toward a global liability regime for pollution damage resulting from offshore oil and gas exploration' (2006) Paper 11 *Cornell Law School LL.M Paper Series* 1.

Arctic offshore oil and gas guidelines, 2002. Available at *http*://old.pame.is/sidur/uploads/ArcticGuidelines.pdf. [Accessed 30 August 2009].

Arctic offshore oil and gas guidelines, 2009. http://arcticcouncil.org/filearchive/Arctic%20Offhsore%20Oil%20and%20Gas%20Guidelines%202009.pdf. [Accessed 30 August 2009].

Atsegbua et al *Environmental law in Nigeria- theory and practice* (2000) Ababa Press, Lagos.

Awogbade, Soji 'What is the Place of Practice of Environmental Law in Africa's Development?' Available at http://www.aelex.com/files/Africas-Development.doc.doc. [Accessed 30 August 2009].

Ayotamuno et al 'Effluent quality and wastes from petroleum drilling operations in the Niger Delta, Nigeria' (2002) 13 (2) *Journal of Environmental Management and Health* 207 at 208.

Bashat, H 'Managing waste in exploration and production activities of the petroleum industry' 1. Available at http://www.eeaa.gov.eg/english/main/Env2003/Day1/mOil/bashat.aeec.pdf. [Accessed 28 August 2009].

'Basic concepts'- Radiation-related consulting and services from Integrated Environmental Management, Inc. Available at http://www.iem-inc.com/primrite.html. [Accessed 22 September 2009].

'Basic Documents and Guidelines Concerning Environmental Practices in Offshore Oil and Gas Activities'. Available at http://www.oilandgasforum.net/education/Guidelines/Relevant_guidelines.htm. [Accessed 30 August 2009].

Bentley, Chris et al 'The oil crisis in the Niger River Delta'. Available at http://www.dnr.cornell.edu/saw44/NTRES331/Products/Spring%202008/Papers/Oil_Crisis_in_Niger_River_Delta.doc. [Accessed 28 August 2000].

Boyes, S et al 'Regulatory Responsibilities & Enforcement Mechanisms Relevant to Marine Nature Conservation in the UK'. Report to the Joint Nature Conservation Committee (JNCC) of 11 July 2003. Available at http://www.jncc.gov.uk/PDF/enforcement.pdf. [Accessed 5 September 2000].

Brown, Chester 'International environmental law in the regulation of offshore installations and seabed activities: the case for a South Pacific Regional protocol' (1998)17 *Australian Mining & Petroleum Law Journal* 109.

Chitra, A 'Role of Ngo's In Protecting Environment And Health' in Martin J Bunch et al (eds*) Proceedings of the Third International Conference on Environment and Health* (2003) 105.

Chronological lists of ratifications of, accessions and successions to the Convention and the related agreements as 2008. Available at http://www.un.org/Depts/los/reference_files/status2008.pdf.

[Accessed 28 August 2009].

Churchill, RR and Lowe, AV *The law of the Sea* 3ed (1999) Manchester University Press, Manchester.

'Conservation' -UK Coastal Zone Law Notes. Available at http://www.coastlaw.uct.ac.za/iczm/notes/note16.htm#sect9.

[Accessed 5 September 1999].

Consultation on amendments to: the Offshore Chemicals Regulations 2002 and the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005. Available at http://decc.gov.uk/Media/viewfile.ashx?FilePath=Consultations\amendmentsoffshorechemicalregs\1_20090723130421_e_@@_consoffshorechemregs.pdf&filetype=4. [Accessed 28 August 2009].

'Country analysis briefs-United Kingdom'. (2008 Estimates). Available at http://www.eia.doe.gov/cabs/United_Kingdom/Full.html.

[Accessed 5 September 2009].

CSD Decision 4/15- Report of the 4th Session of the CSD. Available at http://www.un.org/esa/dsd/susdevtopics/sdt_oceaseas_documents.shtml.

[Accessed 29 August 2009].

Decision iO/l4/VI of the Governing Council of UNEP, of 31 May 1982. Available at www.unep.org/.../UNEPEnv-LawGuide&PrincN04.pdf. [Accessed 30 August 2009].

'Definition of reserved powers'. Available at http://dictionary.babylon.com/reserved%20powers. [Accessed 28 September 2009].

'Definition of waste'. http://www.aggregain.org.uk/wastemanagementregulations/background/definition of html. [Accessed 15 February 2009].

'Displacement water'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/Topic_Files/Offshore/Displacement_water.htm. [Accessed 5 September 2009].

Dixon, Martin *Textbook on international law* 6ed (2007) Oxford University Press, USA.

Drainage - machinery space. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/Oily_water.htm. [Accessed 5 September 2009].

Emeseh, Engobo 'The limitations of law in promoting synergy between environment and development policies in developing countries: a case study of the petroleum industry in Nigeria' at 2. Available at http://userpage.fuberlin.de/ffu/akumwelt/bc2004/download/emeseh_f.pdf.

[Accessed 30 August 2009].

'Environmental laws governing petroleum and other related operations in Nigeria offshore from mobilization to decommissioning of such operations (including seismic and fishing activities) in the areas of waste and hazardous materials toxic chemicals including carriage and disposal'. Available at www.standard.digibooks.cn/Download.asp?ID=226309. [Accessed 30 August 2009].

'Environmental Regulations in United Kingdom offshore oil and gas industry'. Available at http://www.oilandgasforum.net/management/regula/ukprof.htm. [Accessed 5 September 2009].

Explanatory memorandum to the offshore petroleum activities (oil pollution prevention and control) Regulations 2005 no. 2055 at 1. Available at http://www.opsi.gov.uk/si/em2005/uksiem_20052055_en.pdf.

[Accessed 5 September 2009].

'Exploration and production in the marine environment'. Available at http://www.aip.com. au/ industry/fact_exploration_marine.htm. [Accessed 13 February 2009].

'Fact sheet and supplemental information for the proposed re-issuance of the NPDES general permit for new and existing sources in the offshore subcategory of the oil and gas extraction point source category for the western portion of the outer continental shelf of the gulf of Mexico' (GMG290000) (December 2006) 1 at 9. Available at www.epa.gov/EPA-IMPACT/2006/December/Day-21/i21890.htm. [Accessed 19 February 2009].

'Fact Sheet- discharge to ocean' Available at http://web.ead.anl.gov/dwm/techdesc/discharge/index.cfm.

[Accessed 29 August 2009].

Gao, Zhiguo 'Environmental Regulation Oil and Gas in the twentieth century and beyond: an introduction and overview' in Zhiguo Gao (ed) *Environmental regulation of oil and* gas (1998) 3.

Gavouneli, Maria *Pollution from Offshore Installations* (1995) Graham & TrotmanMartinus Nijhoff, London.

Glowka, L et al *A guide to the Convention on Biological Diversity* (1994) IUCN and Gland, Switzerland.

Guidance notes on the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001. Available at https://www.og.dti.gov.uk/environment/habitatguidnote.doc.

[Accessed 5 September 2009].

Guidance notes on the Offshore Petroleum Activities (Oil pollution Prevention and Control) Regulations 2005. Available at https://www.og.dti.gov.uk/environment/opaoppcr_guide.htm.

[Accessed 5 September 2009].

Guidance notes on the Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) Regulations 1999 (as amended). Available at

https://www.og.decc.gov.uk/environment/EIAGuidanceNote.pdf.

[Accessed 5 September 2009].

Haut et al 'Minimizing waste during drilling operations' presented at the American Association of Drilling Engineers National Technical Conference and Exhibition, 2007. Available at www.files.harc.edu/Projects/OurWork/**MinimizingWastesDrilling**.pdf.

[Accessed 29 August 2009].

Heberer, Marina and Prentis, Peter 'Environmental consequences of offshore oil drilling' (2008) available at http://www.docstoc.com/docs/3571113/Environmental-Consequences-of-Offshore-Oil-Drilling. [Accessed 29 August 2009].

'History of the Nigerian petroleum industry'. Available at http://www.nnpcgroup.com/history.html. [Accessed 30 August 2009].

'History of the Nigerian oil and gas industry'. Available at http://moneyplanets.blogspot. com/2008/12 /history-of- nigeria-oil-and-gas-industry.html. [Accessed 13 February 2009].

Holdway, Douglas A 'The acute and chronic effects of wastes associated with offshore oil and gas production on temperate and tropical marine ecological processes' (2002) 44 *Marine Pollution Bulletin* 185.

Hydrostatic test water. Available at http://www.epa.state.oh.us/dsw/permits/GP HydrostaticTestWater.html. [Accessed 24 February 2009].

'Injection wells'. Available at http://www.purdee.edu/envirosoft/groundwater/src/epa.5.htm.

[Accessed 23 March 2009].

International Finance Corporation Environmental, Health and Safety Guidelines- Oil and Gas Development (Offshore), December 2002. Available at http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_offshoreOG/$FILE/offshoreoil.pdf. [Accessed 30 August 2009].

International Finance Corporation Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development, 2007. Available at http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_OffshoreOilandGas/$FILE/Final+-+Offshore+Oil+and+Gas+Development.pdf. [Accessed 30 August 2009].

'Key dates in UK offshore oil and gas production'. Available at http://www.ukooa.co.uk/education/dates/v0000091.cfm.

[Accessed 5 September 2009].

Kloff, Sandra and Wicks, Clive 'Environmental management of offshore oil development and maritime oil transport' (2004) 1. Available at www.cmsdata.iucn.org /downloads/ offshore_ oil_ eng.pdf.

[Accessed 28 August 2009].

LC 24/14-Future objectives for the London Convention 1972 and the 1996 Protocol thereto submitted by the Netherlands. Available at http://www.sjofartsverket.se/upload/4945/24-14.pdf. [Accessed 30 August 2009].

Lethbridge, John R 'MARPOL 73/78 (International Convention for the prevention of Pollution)' (2005) 1. Available at http://sitesources.worldbank.org/INTTRANSPORT/ Resources/336291-1119275973157/td-ps4.pdf. [Accessed 30 August 2009].

List of parties to the Convention on Biological Diversity. Available at http://www.cbd.int/information/parties.shtml. [Accessed 15 September 2009].

'London convention 1972'. Available at http://www.imo.org/home.asp?topic_id=1488. [Accessed 30 August 2009].

Nediljika, Gaurina-Medimuree et al 'Offshore drilling and environmental protection'. Available at http://bib.irb.hr/datoteka/274894.lanakOFFSHORE_DRILLING_AND_ENVIRONMENTAL_PROTECTION.doc. [Accessed 28 August 2009].

Neff, Jerry M 'Estimation of bioavailability of metals from drilling mud barite' (2008) 4(2) *Integrated Environmental Assessment and Management* 184.

'Nigeria energy profile'. (2008 Estimates). Available at http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=NI.

[Accessed 30 August 2009].

'Nigeria- exploration history'. Available at http://www.allbusiness.com/mining/oil-gas-extraction-crude-petroleum-natural/288169-1.html. [Accessed 30 August 2009].

'NLNG'. Available at http://www.nlng.com/NR/exeres/547F159C-1544-45DD-8D7F-92FF61E19E3 C%2 C frameless.htm. [Accessed 24 April 2009].

'OBM and SBM use and discharge'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/OBM_SBM%20Consent.htm. [Accessed 5 September 2009].

Obi, C I 'Political and Social Considerations in the Enforcement of Environmental Law" in M A Ajomo & O Adewale (eds) *Environmental Law and Sustainable Development in Nigeria* 1st ed *(1994)* 67.

Ogri, Onah R 'A review of the Nigerian petroleum industry and the associated environmental problems' (2001) 21 (1) *The Environmentalist* at 11.

Offshore waste management guidelines for Canada (August 2002) 1 at 7. Available at www.cnlopb.ni.ca/pdfs/guidelines/owtgo208.pdf. [Accessed 24 February 2009].

'Oil Discharged with Produced Water 1992 – 2007'. Available at https://www.og.decc.gov.uk/information/bb_updates/chapters/Table3_2.htm. [Accessed 5 September 2009].

'Oil and gas in United Kingdom- overview'. Available at http://www.mbendi.com/indy/oilg/gas_/eu/uk /p0005.htm.

[Accessed 5 September 2009].

Onwukwe, S I and Izuwa, N C 'Drilling wastes generation and management strategy in the oil industry' (2004) 34 *Nigerian Society of Chemical Engineers Proceedings* 1.

OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings. Available at http://www.ospar.org/v_measures/browse.asp?menu=00510416000000_000000_000000. [Accessed 28 August 2009].

OSPAR Recommendation 2001/1for the Management of Produced Water from Offshore Installations (Consolidated text). Available at http://www.ospar.org/v_measures/get_page.asp?v0=0101e_consol%20Produced%20water.doc&v1=4. [Accessed 28 August 2009].

OSPAR Recommendation 2006/5 on a management regime for cuttings pile. Available at http://www.ospar.org/v_measures/get_page.asp?v0=0605e_Rec%20drill%20cuttings%20regime.doc&v1=4. [Accessed 28 August 2009].

PARCOM Recommendation 86/1 of a 40mg/l emission standard for platforms. Available at http://www.ospar.org/documents/dbase/decrecs/recommendations/pr86-01e.doc. [Accessed 28 August 2009].

Patin, Stanislav 'Waste discharges during offshore oil and gas activity'. Available at http://www.offshore-environment.com/discharges.html. [Accessed 29 August 2009].

Pollution Prevention and Abatement Handbook. Available at http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_genenv_WB/$FILE/genenv_PPAH.pdf. [Accessed 30 August 2009].

'Produced sand and scale'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/topic_files/offshore/produced_sand.htm. [Accessed 5 September 2009].

'Produced water'. Available at http://www.oilandgasukenvironmentallegislation.co.uk/Contents/Topic_Files/Offshore/Produced_water.htm. [Accessed 5 September 2009].

'Re-injection of mud and cuttings'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/Re-injection.htm. [Accessed 5 September 2009].

Revised Annex I of MARPOL 73/78. Available at http://www.amsa.gov.au/Marine_Environment_Protection/Revision_of_Annexes_I_and_II_of_L_73-MARPOL78/117-52.pdf. [Accessed 30 August 2009].

Rough offshore facilities environmental statement 2007 at 6. Available at https://www.og.dti.gov.uk/environment/ospar_docs/ospar_docs_2007/centricaSL_EMS.pdf. [Accessed 5 September 2009].

Salter, Edward and Ford, John 'Environmental pollution challenges and associated planning and management issues facing offshore oil and gas field development in the UK' *(2000) 43(2) Journal of Environmental Planning and Management* 253.

Salter, Edward and Ford, John 'Holistic environmental assessment and offshore oil field exploration and production' (2001) 42 (1) *Marine Pollution Bulletin* 45.

'Summary of OPPC permit requirements'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/topic_files/offshore/OPPC_Summary_Table.htm. [Accessed 5 September 2009].

'Summary of OPPC sampling requirements - process operations'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/topic_files/offshore/OPPC_Sampling_Table.htm. [Accessed 5 September 2009].

The Application of EIA in Relation to Offshore Oil and Gas Exploitation (1998). Available at http://www.oilandgasforum.net/education/Guidelines/ Relevant _guidelines.htm. [Accessed 30 August 2009].

Tolulope, Adeyemi Oludare 'Oil exploration and environmental degradation: the Nigerian experience' (2004) 2 *Environmental Informatics Archives* 387.

'Types of injection wells: Fact sheet for the underground injection program in Arkansas'. Available at http://www.adeq.state.ar.us/water/branch_permits/pdfs forms/uic_fact_sheet.pdf. [Accessed 29 August 2009].

'United Kingdom energy profile'. (2008 Estimates). Available at http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=UK.

[Accessed 5 September 2009].

Ukoli, M K 'Environmental factors in the management of the oil and gas industry in Nigeria' 1 at 24. Available at www.cenbank.org/out/annual/ACZRU/2001/Owe-01-2.pdf. [Accessed 5 September 2009].

Veil, JA 'Offshore waste management: discharge, inject or haul to shore'. Available at www.ipec.utulsa.edu/conf2001/veil_2.pdf. [Accessed 28 August 2009].

Vinogradov, SV and Wagner, JP 'Combating operational pollution from offshore petroleum activities: International regime' 1. Available at http://www.dundee.ac.uk/cepmlp/infoserv/Downloads_Free/CP1-97.pdf.

[Accessed 28 August 2009].

'Waste management'. Available at http://www.absoluteastronomy.com/topics/waste_management.

[Accessed 11 February 2009].

'WBM use and discharge'. Available at http://www.ukooaenvironmentallegislation.co.uk/contents/Topic_Files/Offshore/WBM.htm. [Accessed 5 September 2009].

'What is an injection well?' Available at http://h2o.enr.state.nc.us/aps/gpu/uic/index.htm. [Accessed 29 August 2009].

Wills, Jonathan 'Muddied Waters A Survey of Offshore Oilfield Drilling Wastes and Disposal Techniques to Reduce the Ecological Impact of Sea Dumping' (2000) at 15. Available at http://www.alaskaforum.org/other/muddiedwaters.pdf.

[Accessed 29 August 2009].

Yusuf, Tayo Akeem 'The status of environmental governance in the Nigerian oil & gas industry'. Available at http://www.nigeriansinamerica.com/authors/404/Tayo-Akeem-Yusuf. [Accessed 5 September 2009].

Zhao, Lin et al 'A risk assessment model for produced water discharge from offshore petroleum platforms-development and validation'*(*2008) 56 (11) *Marine Pollution Bulletin* at 1890.