

Oil Discoveries in West Africa: Managing the Ecological Risks



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Outline

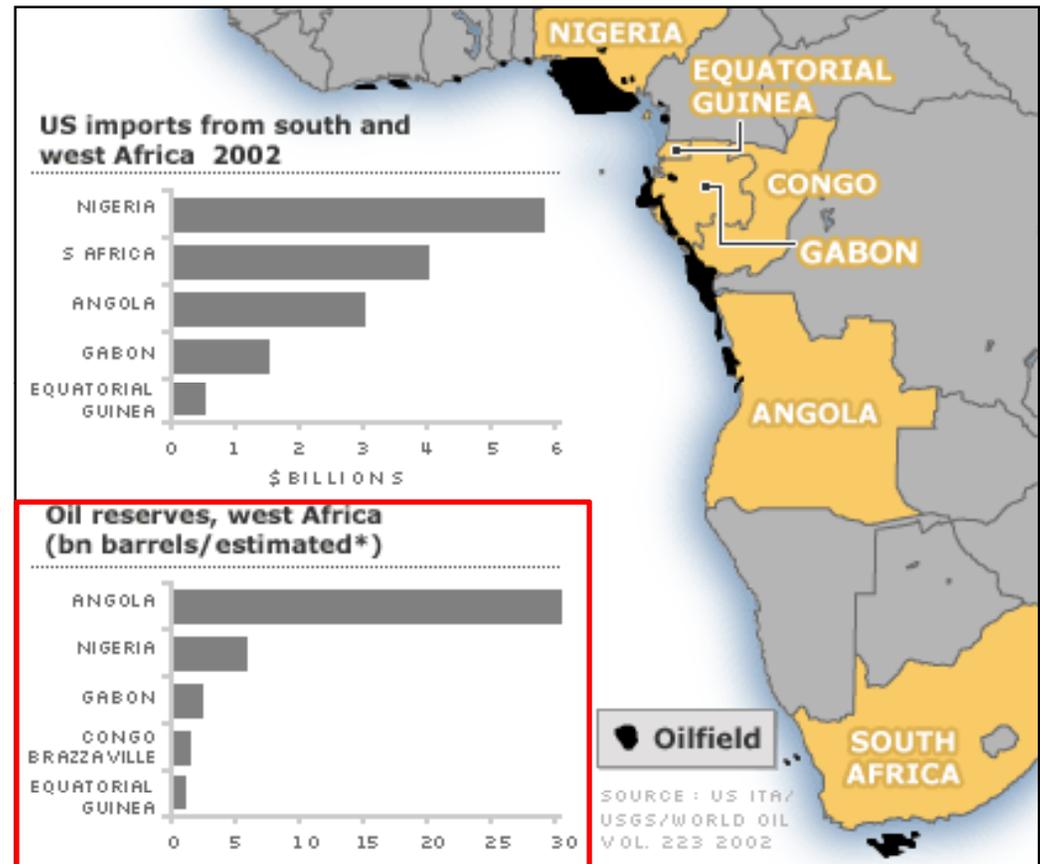
- Introduction
- Stages in Oil and Gas Discovery
- Activities and Operational Requirements
- Environmental Impacts
- Risk Management Mechanisms

Introduction- Global Oil Production

- Oil is a non-renewable resource.
- Consumption rate > 100 million barrels/day
- Majority of energy resources that runs our society is from oil and gas > 63%

Introduction-Oil in West Africa

- West Africa Crude oil has excellent quality.
- Major producing countries - Nigeria, Gabon, Equatorial Guinea, Angola, Congo.



Source: www.nogw.com/oilempires.htm

- Estimated production (2003-2012) > **20 billion barrels.**

Introduction-Oil in West Africa

Offshore



Source: www.ntis04.hgac.cog.tx.us

Onshore



Source: www.well-surveillance.com

- Oil & gas activities can be either offshore or onshore
- Most oil and gas production in West Africa are from offshore wells situated in sensitive marine environments.

Introduction-Oil in West Africa

Some marine and coastal ecosystems have been damaged by oil activities in the sub-region, notably the Niger Delta in Nigeria.



Oil spill fouls the water supply.
Source: <http://crossedcrocodiles.wordpress.com>



Source: www.hydrocarbon-technology.com

Introduction-Oil in West Africa

Though much has been achieved in terms of providing environmental protection in areas of operation, the industry still recognizes that more can be accomplished.



Polluted marine waters. Source: www.outboardmotoroilblog.com



Accident of an oil tanker. Source: Kloff & Wicks, 2004

Introduction- Global Oil Production

The challenge is to meet the world energy demands, whilst minimizing the adverse effect on the environment by conforming to current good practices

Petroleum Activities In Ghana – (Ackah, 2009)

- **Initial Phase: 1896-1967**

Exploration of oil and gas in Ghana started in 1896 in onshore Tano Basin

- **2nd Phase: 1968-1980**

Intense exploration activities offshore Cape Three Points, Saltpond, North & South Tano.

- **3rd Phase: 1981-1995**

Data retrieval and gathering, Blocking system reviewed, GNPC established, Enactment of new petroleum law, Model petroleum agreement.

- **Current Phase: 1996-to date**

The Oil & Gas Industry

The Industry has two main sectors:

(i) Upstream - exploration & production sector

(ii) Downstream - deals with refining and processing of crude oil, distribution and marketing of petroleum products.

The Oil & Gas Industry-Upstream Activities

- **Most environmental degradation associated with oil development comes from upstream activities.**
- **It is important to understand the upstream activities in the industry to better appreciate the origins of environmental degradation and their potential impact on the ecosystems.**

The Oil and Gas Industry-Stages & Activities

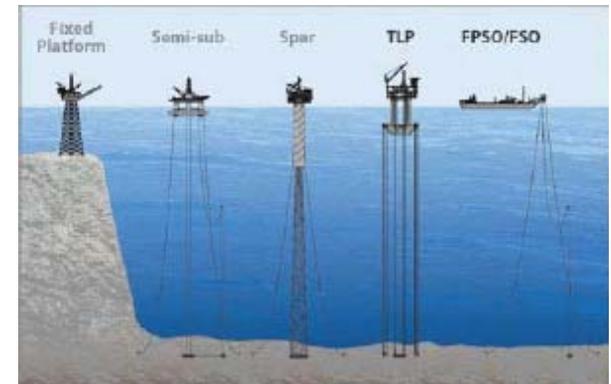
- Desk Study - Geological Maps/Aerial Photographs
- Aerial & Seismic Surveys
- Exploration Drilling
- Appraisal stage
- Development & Production
- Decommissioning & Rehabilitation



Exploration drilling. Source: www.engineerlive.com

Oil and Gas Production-Facilities Required

- Onshore sites and marine resources access
- Onshore extension of marine seismic lines and navigational beacons
- Seismic operation camp
- Drill sites
- Wellheads & flowlines
- Access for drilling and supply units
- Accommodation & Infrastructure
- Construction of storage & waste disposal facilities



Different offshore production facilities.
Source: Modec Inc. website.

Oil and Gas Production-Facilities Required

- **Separating & Treatment facilities**
- **Facilities to export products**
- **Oil storage facilities**
- **Flare facilities**
- **Gas production plant**
- **Transport equipment**
- **Equipments to plug wells**
- **Equipment to restore site**
- **Equipment to demolish and remove installation**



Source: jwilliams-flint.com

Environmental Impacts

- Human, Socio-economic & Cultural impacts
- Ecosystems impacts
 - (i) Atmospheric Impacts
 - (ii) Aquatic impacts
 - (iii) Terrestrial impacts

Ecological Impacts

Two broad categories of ecological impacts:

- ✓ Pollution
- ✓ Land Degradation

Pollution - Atmospheric Emissions

Sources:

- Flaring, venting and purging gases
- Combustions processes - diesel engines and gas turbines
- Fugitive gases from loading operations and tankage and losses from process equipments
- Airborne particulate from soil disturbance during construction, and from vehicular traffic
- Particulates from other burning sources, such as well testing

Aquatic Pollution

Sources:

- Production water
- Spills and leakages
- Cooling water
- Process, wash and drainage water
- Sewerage, sanitary and domestic wastes
- Drilling fluids, cuttings and well treatment chemicals



Oil pollution. Source: Kloff & Wicks, 2004



Blowout of exploration well.
Source: Kloff & Wicks, 2004

Terrestrial Pollution

Potential impact on vegetation & soils arises from:

- Deforestation
- Disturbance due to construction
- Indirect impact due to social change
- Contamination- spillage and leakage, or solid waste disposal

Ecosystem Impacts

Plant and animal communities are affected through variations in...

- Water
- Air
- Soil/sediment quality
- Disturbances by noise, extraneous light and changes in vegetative cover



Oiled Penguins. Source: UCT-a, 2005

Ecosystem Impacts

Such changes may directly affect the ecology through:

- Food and nutrient supplies
- Breeding areas/habitat
- Migration routes for animals
- Vulnerability to predators
- Changes in herbivore grazing patterns

How Do We Manage the Risk?

The described Activities and their impacts require mechanisms to prevent or minimize Ecological Risk

1. Conventions and Regulatory Frameworks
2. Strategic Approach to Environmental Management
 - ✓ Corporate Management Systems
 - ✓ Environmental Protection Measures On-site

Regulatory Frameworks

- International (Global and Regional)
- National

Notable Conventions subject to Gulf of Guinea

- London Dumping Convention 1972 (Global)
- MARPOL Convention 73/78 (Global)
- UN Convention of the Law of the Sea (Global)
- Abidjan Protocol (Regional)
- SOLAS and STCW
- Convention on Migratory Species
- Biodiversity Convention
- Basel Convention, etc.

These conventions usually serve as a baseline or guide in drafting national policies and regulations

National Regulatory Approach

- **Prescriptive** or '*command and control*' approach is based on specific requirements made by government, to be met by operators.
- **Performance based** approach: emphasises on setting an objective/goal to be reached by industry. Here, government involves industry in setting goals
 - ✓ E.g., Self Regulation - an agreement between the operator and government with specified environmental standards. It is the responsibility of the operators to define strategies on how they will achieve these standards & provide evidence to assure they are complying with the agreement

National Regulatory Approach (contd.)

- **Co-regulatory and Voluntary measures**
 - ✓ codes of practice
 - ✓ agreed actions plans
 - ✓ negotiated targets and limits

If voluntary action is effective, there is no need for regulation.

Problems with Regulatory Instruments

- Stumbling Blocks in Ratifying Conventions
- Duplication and Overlapping of Institutional Functions
- Inadequate Resources for Enforcements
- Absence of Effective Sanctions
- Economic Concerns
- Lack of Knowledge of Interdependent Linkages-
Development and Environmental Factors
- Community Dissatisfaction and Agitation

Strategic Business Processes

Both prescriptive and performance standards have substantial limitations.

They do not encourage continuous improvement or industry best practice. Nor do they directly encourage enterprises to develop an environmental culture or to "build in" environmental considerations at every stage of the production process. They are also demanding on regulatory resources.

Proactive Management Principles- *Instead of Rules*

- **Strategic Environmental Assessment Scoping- EU and World Bank**
 - A system of incorporating environmental consideration into policies, plans & programmes, by defining the boundaries for investigations, assessment and assumptions required.
- **Integration of Environmental Management Systems, in compliance with International Norms and Work Standards.**

Proactive Management Principles

Key Elements

- **Leadership and Commitment**

Senior management leadership and commitment has to be converted into action by the provision of adequate financial and human resources to ensure that environmental protection measures are incorporated on site

- **Policy and Strategic Objectives**

- **Organization, Resource and Documentation**

- **Evaluation and Risk Management**

- **Planning**

- **Implementation and Monitoring**

- **Auditing and Reviewing**

Site Environmental Protection Measures

Two Key Considerations

- **Operational Practices**
- **Innovative Technological Approaches**

Site Environmental Protection Measures

Operational Practices

- **Pollution Prevention**
 - Integration of environmental issues into engineering design
 - Application of on-site procedures aimed at reducing the risk of pollution
 - Engineering & operational techniques to avoid or reduce pollution
- **Waste Treatment/Disposal techniques**
 - waste management could be accomplished through application of measure such as; reduction, re-use, recycle, treatment, responsible disposal
- **Oil Spill Contingency Planning**
 - to identify and examine the risk, size and nature and potential consequences of oil spills
 - this should facilitate the rapid mobilization & effective of resources to carry out & support emergency response operations
 - the community should also be informed of the hazards involved in the spillage

Site Environmental Protection Measures

Operational Practices

- Decommissioning and Rehabilitation
 - removal of buildings and equipments
 - restoration of site to environmentally sound conditions
 - implementation of measures to encourage site -revegetation
 - continued monitoring of the site after closure
- Environmental Sensitive Areas
 - mangroves
 - tropical rain forests
 - coastal & fresh waters
 - coral reefs

Site Environmental Protection Measures

Innovative Technological Approaches

- **Atmospheric Emissions**
 - technology advances in valve design
 - flare facility design to improve combustion efficiency
- **Produced Water**
 - technology to remove dispersed oil.
- **Solid Waste**
 - screens/gravel pack can reduce sludge
- **Innovative Techniques**
 - other operational techniques to minimize pollution

Conclusion

The overall goal is to find the right mix of regulatory, co-regulatory, incentives and voluntary mechanisms to suit the context of a particular nation and the particular type of enterprise being regulated.

In this quest, EMSs are destined to play a central role.

THANK YOU