EXECUTIVE SUMMARY

INTRODUCTION

Mobil Producing Nigeria Unlimited (MPN), in a joint venture with the Nigerian National Petroleum Corporation (NNPC), proposes to further develop its Yoho Field. The Yoho Area (Yoho, Awawa, and Isuo fields) lies in oil mining Lease (OML) 104, offshore Nigeria in water depths of 302ft. When completed the proposed project will recover an estimated 0.4 billion barrels of oil from the Yoho and Awawa reservoirs.

MPN has carried out and presents this Environmental Impact Assessment (EIA) of the proposed Development Wells Drilling in Yoho Area project in compliance with Federal Ministry of Environment (FMENV) Environmental Impact Assessment (EIA) Act No. 86 of 1992 and the requirements of the Department of Petroleum Resources (DPR) Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (Part VIII, Section 3.1.2, EGASPIN, 2002).

In line with Mobil Producing Nigeria Unlimited (MPN) Safety Health and Environment policy, Fugro Nigeria Limited (FNL) was commissioned to carry out the EIA of Development wells Drilling in Yoho Area Project

The objectives of this EIA study are to:

* provide necessary data / evidence that will form the Environmental Impact Statement (EIS) of the proposed exploratory drilling project;
* establish the existing environmental baseline status of the project area;
* critically review the proposed project facilities and activities thereby identifying the potential impacts and associated effects of any hazards posed by the pursuit of the project;
* recommend control measures to prevent and/or mitigate identified potential/associated adverse impacts of the project;
* develop and document cost effective Environmental Management Plan (EMP) that recommends plans and procedures to manage the consequences and recover from exceptional events throughout the lifetime of the project; and
* keep a record of consultation with communities, regulatory authorities, the public and other stakeholders.

Project Location

The Yoho Area lies in Oil Mining Lease (OML) 104, offshore Nigeria in water depths of 92 meters (302 feet). And 38 miles south west Qua Iboe TERMINAL IN Akwa Ibom state Nigeria. The approximate total acreage of the Yoho Development Area is -35126.44 acres (approx.143km2 and is located at 40 1’N and 70 28”E.

**Legal, Regulatory and Administrative Frameworks)**

The legal, regulatory and administrative frameworks upon which this EIA study was carried out include:

* The various national statutes, regulations and standards on environmental protection in Nigeria;
* The EIA Act No. 86 of 1992;
* The DPR (EGASPIN), 1991 (revised 2002) provisions;
* Oil in Navigable Waters Act and Regulations of 1968;
* Petroleum (Drilling and Production) Regulations of 1969;
* Mineral Oils (Safety) Regulations of 1963 as amended in 1997;
* Akwa Ibom State Ministry of Environment and Mineral Resources (AKSMEMR)
* MPN policies on safety health and environment (SHE);
* National Environmental Standards and Regulations Enforcement Agency (NESREA) Act, 2007
* National Oil Spill and Detection and Response Agency (NOSDRA) Act, 2006
* Nigerian Maritime Administration and Safety Agency (NIMASA) Act, 2007
* Applicable international agreements, guidelines and conventions to which Nigeria is signatory;
* World Bank / IFC Performance Standard on Social, Environmental Assessment;
* United Nations Guiding Principles on the Human Environment, 1972; and
* Oil Pollution and Exploitation of the Continental Shelf of 1958.

**PROJECT JUSTIFICATION**

The proposed Development Wells Drilling project in Yoho Area is justified since it will contribute to meeting the local and global energy demand. Above all, the project will lead to addition of value to Nigeria’s total hydrocarbon reserve and hence increase production capacity ultimately enhancing the overall export earnings for the nation.

**Benefits of the Proposed Project**

The benefits of the proposed Development Wells Drilling Project are:

* Direct economic benefits accruing to the Government of Nigeria (via the NNPC), the Government of Akwa Ibom State (allocation related to the production of a natural resource), and MPN. Revenues going to Nigeria would be derived from:
* NNPC’s joint venture participation in the project;
* taxes on MPN’s revenues from the project; and
* taxes on other economic activity generated by the project.
* Gainful utilisation of associated gas by re-injection into reservoirs for pressure maintenance to increase ultimate recovery and allows for gas production in the future.
* Creation of employment opportunities directly and indirectly for Nigerians.
* Secure economic benefits and growth through MPN’S commitment to increase local business development and capacity, consequently:
* the Yoho project will boasts significant Nigerian content contribution - about one-third of direct project costs, covering engineering, procurement, construction and installation of various facilities and drilling will be handled in the country, this will make a substantial contribution to the Nigerian economy and fabrication infrastructure; and
* many Nigerians will also be trained in modern oilfield technology.
* Support MPN's and Nigeria’s long term oil growth targets.

**Economic, Technical and Environmental Sustainability of the Proposed Project**

Reservoir studies with well data indicate large recoverable oil reserves of an estimate 0.4 billion barrels from Yoho and Awawa reservoirs. The project is therefore envisaged to be economically and commercially sustainable. In order to ensure the technical sustainability of the project, MPN and its contractors will develop operation manuals and appropriate documentation regarding the proper operation and maintenance of the facilities prior to start-up. The environmental sustainability of the project is assured since the developed EMP will ensure that prescribed mitigation measures are strictly implemented. However, MPN in consultation with the coastal communities will determine mutually agreeable and achievable community assistance projects to be executed in relation to the project. This will also ensure the project achieves its desired objectives in terms of diversified employment creation, sustainable community development which will ensure all stakeholders satisfaction throughout the duration of the project.

**Project Development options**

The project alternatives considered include the overall Well Drilling techniques and the suitable rig for use in deep offshore environment. The considerations were based mainly on Safety, Health, and Environment (SHE) requirements as well as economic and technical feasibilities.

***The No Project Option***

This means the non-implementation of the proposed Yoho Development wells Drilling Project. The implications of this is that impacts associated with oil and gas exploitation and production will remain as it is in the area, while the over 400 million barrels of oil would remain unexploited. This also implies that all the envisaged benefits derivable from the implementation of the project will not be realised .This option was therefore rejected

### **Do something option (Undertake Development Wells Drilling)**

This option entails the drilling of proposed development wells in Yoho area in order to increase crude oil production in the area. This shall be be carried out using the most up to date and proven offshore drilling technology. Also, International HSE Guidelines and standards and acceptable best practices shall be adopted in all phases of the drilling project. This option which assures the realisation of the aspiration of the Federal Government of Nigeria and the stakeholders with its various benefits has been selected for implementation.

**PROJECT DESCRIPTION**

The planned 2009 - 2011 MPN drilling campaign in the Yoho Area (Yoho, Awawa and Isuo Fields) located offshore in OML 104 will comprise a total of 14 wells (13 producers and 1 gas source well) and 9 workovers this will be implemented over the three year period as follows:

* 10 ‘new drill’ wells (i.e., drilled from existing open slots, slot additions, and new wellhead platforms);
* 4 ‘redrill’ wells (i. e. wells developed by drilling a sidetrack from an already existing well that will be plugged and abandoned); and
* The 9 workovers comprise 1 oil producer recompletion, and 8 workovers to install gas lift mandrels.

**Development Overview**

The current estimate of drilling and workover activities within the demarcated acreage is summarised below.

**Proposed Well Drilling and Workovers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Field / Platform** | **Location Coordinates (x, y)** | **New Drills** | **Redrills** | **Recomplete Workovers** | **GL Mandrell Workover** | **Total No. of Wells** |
| Yoho A | 558472, 1800 | - | 4 | - | 6 | 10 |
| Yoho B | 557440, -234 | 6 | - | - | - | 6 |
| Awawa A | 555422, -8026 | 4 | - | 1 | 2 | 7 |

**Single vs. Dual Completions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Completion Type** | **New Drills** | **Redrills** | **Recompletions** | **GL Mandrel WOs** | **Total No. of Wells** |
| Single String | 10 | 4 | 1 | 8 | 23 |
| Dual String | 0 | 0 | 0 | 0 | 0 |
| Total | 10 | 4 | 1 | 8 | 23 |

The Yoho Area development project involves rig activity on 23 drill wells (22 producers and 1 gas source well) from fields in OML 104. Full well-stream (FWS) fluids will be brought together in manifolds via flowlines in a wellhead platform. The FWS will then be routed from the WHP to Yoho YP Production Platform by way of pipelines (Awawa ZBA, Yoho YB) and piping connection for Yoho YA wellhead platform.

**Drilling Rig and Facilities**

The proposed Yoho Development wells Drilling Project shall be implemented using Jack-Up drilling rigs that are fully registered in Nigeria for drilling. These rigs will be used for well drilling and workover purposes. In general, these jack–up rigs will have the ability to cantilever the drilling rig out over a platform to access well slots.

**Logistics Support**

*Marine Support Vessels*

A variety of marine vessels will support the drilling operations. For example, supply boats will bring supplies to and remove wastes from the drilling rig. Tugboats will assist in jack–up rigs movements. Most of the supply boats, trips will often be shared with other facilities, so only minor incremental traffic and emissions would result from supply vessels servicing the drilling rig.

*Helicopters and Air Travel*

Helicopters will be the principal means of transporting personnel to the drilling rig and back to shore. Helicopters will also be used to move certain supplies. Passenger requirements will likely be met with a 10-passenger capacity P001 helicopter from MPN’s fleet.

**Control and safeguarding systems**

The goal of the safeguarding system is to protect against unsafe operation of the process and to perform corrective or suppressive actions in case of hazardous conditions on the rig. The drilling rig safeguarding system consists of the emergency shutdown switches for the complete power systems which are located on the rig floor and Barge Masters office, other safety systems avaliabe in the rig include Safety and Personnel Protection Systems, Fire and Gas Detection, Firewater and Deluge Systems, Foam System, Lifeboats, and Life Rafts etc.

**Quarters and Helideck**

The accommodation is designed for maximum personnel on board (POB) of 98–106 (including 15 temporary beds) to ensure that there is sufficient capacity.

The helicopter deck is located above the stern of the vessel aft of the accommodation. The location of the helicopter deck has been carefully selected taking into account the constraints of the existing accommodation and funnel structures and the envisaged helicopter operations.

**Control and Safeguarding Systems**

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**Well Drilling Design**

MPN will develop the various JV reservoirs with additional drill wells from multiple existing platforms and future new build development platforms. The maximum drilling radius anticipated for the shallower reservoirs (+/-6000ft TVD) is 8,000ft while the deeper reservoirs (> 6000ft TVD) can expect a maximum drilling radius of up to 10,000ft.

The anticipated wells include a mixture of both new wells from existing / future slots along with sidetracks from existing wells. Various gas and water injectors will be drilled to provide reservoir pressure maintenance as outlined in current field development plans. The current plan allows flexibility to increase the number of wells dependant on future available sidetrack candidates and slot recovery techniques as deemed appropriate in the future.

**Directional Design**

The following constraints were used to develop the directional plans:

* Directional Profile - Build-Hold or Build-Hold-Drop;
* Kick-off point - 400 m to 1400 m (BML);
* Max. inclination - 50 - 80°;
* Max. Build Rate - 2-1/2o - 3°/30m; and
* Max Drop Rate - 2° - 3o/30m.

However, these parameters are for planning purposes only and will be optimized on a well-by-well basis.

**Drilling Fluids**

The choice of drilling fluids is based on the challenges associated with drilling in the MPN fields:

**Typical Drilling Fluids Programme for Yoho Development Wells**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Hole Size (in)** | **Casing Size (in)** | **MD (ft)** | **TVD (ft)** | **Fluid Type** | **MW (ppg)** |
| Driven | 36 | 400 | 400 | Seawater & Sweeps | 8.6 – 8.7 |
| 17-1/2 | 13-3/8 | 3800 | 3640 | KCl Polymer | 8.8 - 9.5 |
| 12-1/4 | 9-5/8 | 7408 | 5860 | NAF | 10.5 - 11.0 |
| 8-1/2 | 7 | 8401 | 5860 | NAF | 10.0 – 10.5 |

**Well Casing Design**

Design and analysis of “Surface”, “Intermediate” and “Production” Casings will be performed using the in-house proprietary Load and Resistance Factor Design (EMLRFD) Computer Program.

**Summary of Yoho Development Wells Casing Program**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **String** | **Nom. OD** | **Weight** | **Grade** | **Conn.** | **Conn. OD** | **Nom. ID** | **Drift ID** |
| Structural/DP | 30” | 1.5” / 1.0” W.T. | X-52 | RL-4R | 30.234” | 29.250`" | − |
| Surface | 13-3/8” | 68.0 ppf | N-80 | BTC | 14.375” | 12.415” | 12.259” |
| Prod. 2 | 9-5/8” | 47 ppf | L-80 | BTC | 10.625” | 8.681” | 8.525” |
| Liner | 7” | 33.7 ppf | L-80 | SLX | 7.721” | 6.094” | 5.969” |

**Inflow and Tubing Performance**

The production wells will typically have 3 ½” or 4 ½” ” L-80 tubing. There are the special cases where the rates expected may dictate the use of 5 ½” or even 7” L-80 tubing. The use of alloy steels like 13% Cr, etc. will be dictated by the well condition elements for example erosion/corrosion, CO2, etc.

**Completion, Well Cleanup and Testing**

Wells are normally cleaned up of completion fluid and tested on the rig prior to rig move off. This will typically involve the creating an under-balance in the well normally through the use of Coiled Tubing with Nitrogen. The preferred method is to use rig based testing equipment with this test spread tied in to the platform production manifold facilities. The completion and well hook up process will be coordinated such that the delay in getting the wells on production prior to hand over is short (within hours).

**Project Schedule**

The notional field development schedule for the proposed project is between 20011 and 2015. MPN drilling campaign in the Yoho Area has been planned for a three period. 6 wells from Yoho B location and 5 Awawa wells are listed on the schedule below.

4 drill wells and 6 GL workover in Yoho A and 3 workover in Awawa A are not firmed on the schedule but will be drilled during the period covered by the EIA

**THE EXISTING ENVIRONMENT DESCRIPTION**

The existing environmental baseline milieu of Yoho Field in OML 104, within which MPN plans to carry out development Well Drilling activities is described based on information from literature research, two-season field sampling/measurements/observation, and results of laboratory analyses of collected seawater column and sediment samples.

**Regional Meteorological / Metocean Features**

The Yoho Field Area is in equatorial West Africa (commonly known as Gulf of Guinea), which comprises the region lying within 50N of the equator on the Atlantic coast of Africa. Air temperature within the project area indicated little variation with a mean of 26OC. Relative humidity is generally high (around 80%) throughout the year, while the atmospheric pressure varies between 1010mB in the dry season and 1014mB in wet season. Rainfall data collected over a period of 15 years (1991 – 2005), from Nigerian Meteorological Agency (NIMET) QIT Eket which is the nearest meteorological station to the project area, shows that the annual rainfall in the area is in excess of 2,800mm. The two major wind regimes in the study area are the North-East and the South-West Trade Winds, while currents are mainly the Guinea current and South Equatorial (Gabon – Congo) undercurrents.

**Air Quality Characteristics / Noise Levels**

The mean SPM levels recorded in the study were 10.8μg/m3 and 19.4μg/m3 in the wet and dry seasons respectively. These values were well below the FMENV guideline (daily mean of hourly values) concentration of 250μg/m3 and the DPR guideline (1-hour mean) range of 150 - 230μg/m3. Air pollutant gases measurements in Yoho Field showed that the concentrations of NO2, CO, SO2 and CxHx were below method detection limits of 1ppm (for NO2, CO, SO2) and 0.01% for hydrocarbon gases (CxHx) in both wet and dry seasons.

The mean noise level in the study area were 66dB (A) and 78.2dB (A) in the wet and dry seasons respectively. The observed levels are attributable to the ocean wave actions and power generators in the survey vessel. The recorded levels were below the 90dB (A), FMENV maximum permissible limit for 8-hour working period.

***Regional Geological Synopsis***

The Yoho Field area falls within compressional fold of the Niger Delta. The continental margin of West Africa evolved when the African plate separated from the South American plate during the Jurassic period. In a rift-like setting that developed into an “RRR” triple junction, two of the arms developed into collapsed continental margins, while the third, a failed arm (aulacogen), formed the Benue Trough. This rifting was followed by subsidence of the African continental margin (Stacher, 1995).

Generally, the Niger Delta was developed by the accumulation of fine-grained sediments eroded and transported by the River Niger and its tributaries. The geology of the Niger Delta (including the seabed sediment of the study area) is comprised of lithostratigraphic units known as the Akata, Agbada and Benin formations.

The geology of the deeper section shows a thick sequence of lower slope clays, silts and sands, mostly well layered in the shallow section. These have been displaced by numerous faults and also disturbed by presumed gas migration/accumulation and presumed mud mounds “diapirism”.

**Physical Characteristics of Seawater & Sediment**

Continuous surface to bottom measurements for project area seawater column temperature indicated regions of discontinuity (or thermocline) in the temperature gradient, consistent across profiled seawater stations and with trend in tropical ocean waters. Salinity and density as well as other physical characteristics (pH, total suspended solids and turbidity) were generally consistent with reported levels in tropical ocean waters and similar water environments offshore Nigeria.

Summary of the seawater characteristics is presented below.

**Summary of Yoho Field Seawater Samples Characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters (mg/l)** | **Wet Season** | | **Dry season** | |
| **Range** | **Mean** | **Range** | **Mean** |
|
| pH | 7.16 – 8.79 | 8.3 | 7.03 – 7.8 | 7.4 |
| Temperature (oC) | 26.6 - 29.1 | 27.5 | 19 – 29.7 | 28.2 |
| Conductivity (mS/cm) | 45.4 – 51.4 | 48.5 | 42.1 – 52.9 | 44.4 |
| Salinity (ppt) | 27.2 – 32.1 | 30.1 | 25 – 29.5 | 26.9 |
| DO (mg/l) | 4.2 - 6.3 | 5.1 | 7.1 – 8.4 | 7.7 |
| Turbidity (NTU) | <1.00 | <1.00 | <1.00 | <1.00 |
| TSS (mg/l) | <1.00 – 16 | 10.5 | 5 – 11 | 7.9 |
| TDS (mg/l) | 28.1 – 33.5 | 31.4 | 25.3 – 31.7 | 28.8 |
| BOD (mg/l) | <0.5 – 3.4 | 1.2 | <0.5 – 3.5 | 1.2 |
| COD (mg/l) | <0.8 – 5.1 | 1.8 | <0.8 – 5.2 | 1.8 |
| Phenols (µg/l) | 0.62 – 0.81 | 0.69 | 0.25 – 0.52 | 0.38 |
| TPH (mg/l) | <1.00 | <1.00 | <1.00 | <1.00 |
| Oil & Grease (mg/l) | <1.00 | <1.00 | <1.00 | <1.00 |
| Chloride (mg/l) | 15,550 – 18,543 | 17,251 | 13,834 – 16,478 | 16,078 |
| Nitrate (mg/l) | 0.63 – 0.76 | 0.68 | 0.65 – 0.91 | 0.76 |
| Phosphate (mg/l) | 0.46 – 0.72 | 0.56 | 0.48 – 0.84 | 0.57 |
| Sulphate (mg/l) | 2,180 – 2,615 | 2,419 | 1,451 – 2,514 | 1,622 |
| Sodium (mg/l) | 10,010 – 17,130 | 13,329 | 5,986 – 16,077 | 10,640 |
| Calcium (mg/l) | 347 – 387 | 368 | 216 – 400 | 344 |
| Magnesium (mg/l) | 1,623 – 1,926 | 1,728 | 1,048 – 1,875 | 1,546 |
| Potassium (mg/l) | 357 – 398 | 379 | 201 – 386 | 286 |
| Cadmium (mg/l) | <0.02 | <0.02 | <0.02 | <0.02 |
| Total Chromium (mg/l) | <0.10 | <0.10 | <0.10 | <0.10 |
| Copper (mg/l) | <0.05 | <0.05 | <0.05 | <0.05 |
| Total Iron (mg/l) | <0.05 | <0.05 | <0.05 | <0.05 |
| Lead (mg/l) | <0.20 | <0.20 | <0.20 | <0.20 |
| Cobalt (mg/l) | <0.10 | <0.10 | <0.10 | <0.10 |
| Silver (mg/l) | <0.10 | <0.10 | <0.10 | <0.10 |
| Nickel (mg/l) | <0.10 | <0.10 | <0.10 | <0.10 |
| Zinc (mg/l) | <0.05 | <0.05 | <0.05 | <0.05 |
| Manganese (mg/l) | <0.10 | <0.10 | <0.10 | <0.10 |
| Vanadium (mg/l) | <0.20 | <0.20 | - | - |

The sediments of the area were generally gray in colour, soft and with visible shell fragments in some stations and predominantly silty clay in texture. These were consistent in all collected samples.

**Summary of Yoho Field Sediment Samples Characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters (mg/kg)** | **Wet season** | | **Dry season** | |
| **Range** | **Mean** | **Range** | **Mean** |
|
| pH (H2O) | 7.01 – 7.99 | 7.5 | 8.04 – 8.46 | 8.2 |
| Temperature (oC) | 18.1 – 21.1 | 19.3 | 18.1 – 21.8 | 19.6 |
| Elect Conductivity (mS/cm) | 1.23 – 20.9 | 11.04 | 13.0 – 45.0 | 25.8 |
| TPH (mg/kg) | <10.0 – 83 | 16.9 | <10.0 – 106 | 17.43 |
| TOC (g/kg) | 6.85 – 17.9 | 11.85 | 8.78 – 27.9 | 17.4 |
| Redox Potential (mV) | -130 - -68.5 | -110.13 | -146 – -79.5 | -115.8 |
| Clay (%) | 12 - 31 | 20.1 | 10 - 31 | 19.8 |
| Silt (%) | 21 - 83 | 52.9 | 20 - 80 | 51.29 |
| Sand (%) | 5 - 60 | 26.94 | 5 - 61 | 28.9 |
| Magnesium (mg/kg) | 2,672 – 56,929 | 8,213 | 2,801 – 12,358 | 6,815 |
| Potassium (mg/kg) | 1,232 – 5,420 | 3,582 | 2,014 – 5,869 | 3,721 |
| Sodium (mg/kg) | 4,069 – 13,110 | 7,502 | 4,240 – 15,350 | 8,515 |
| Calcium (mg/kg) | 8,676 – 27,780 | 13,917 | 9,940 – 28,300 | 14,857 |
| Cadmium (mg/kg) | 0.03 – 0.72 | 0.35 | 0.20 – 0.88 | 0.44 |
| Total Chromium (mg/kg) | 7.5 – 30.1 | 19.5 | 12.3 – 35.7 | 22.6 |
| Copper ((mg/kg) | 2.3 – 12.6 | 7.4 | 3.73 – 14.5 | 8.15 |
| Total Iron (mg/kg) | 8,993 – 25,170 | 16,356 | 10,110 – 26,680 | 17,456 |
| Lead (mg/kg) | 3.5 – 16.9 | 11.2 | 5.8 – 28.3 | 14.2 |
| Cobalt (mg/kg) | 3.0 – 15.5 | 10.7 | 7.6 – 19.4 | 12.1 |
| Silver (mg/kg) | 0.6 – 1.1 | 0.8 | 0.4 – 1.4 | 0.7 |
| Nickel (mg/kg) | 6.2 – 25.9 | 17.0 | 9.1 – 21.7 | 13.9 |
| Zinc (mg/kg) | 14.2 – 64.1 | 37.8 | 18.2 – 77.2 | 42.3 |
| Manganese (mg/kg) | 106.0 – 515.0 | 330.8 | 196 – 562 | 367.7 |
| Barium (mg/kg) | 29.5 – 186.0 | 73.7 | 32.9 – 232 | 85.8 |

**Chemical Characteristics of Seawater & Sediment**

Analytical data obtained indicated that the concentrations of phenol (in seawater), polyaromatic and aliphatic hydrocarbons (in sediments) were within background / natural levels, indicating that the seawater and sediments were uncontaminated by these substances at the time of survey. The heavy metals (Pb, Cd, Cr, Cu, Fe, Ni, As, Hg & Zn) were below detectable levels in the surface seawater samples while their levels in the sediment samples were generally consistent across sampling stations and well within toxic limits for bottom dwelling organisms.

The levels of essential nutrients (nitrate, phosphate & sulphate) in the surface seawater of the area compared well with ranges recorded in the seawater of similar environments, offshore Nigeria and were consistent across sampling stations.

**Microbiological Characteristics of Seawater & Sediment**

Analytical results of surface seawater and sediment samples indicated a generally low microbial load, and *Pseudomonas* as the only bacteria specie observed (fungal species; *Candida*, *Mucor*, and *Penicillium.*  Also, *Pseudomonas,* (bacteria) and *Candida*, *Mucor* (fungi) were the only hydrocarbon degrading species in both the seawater and sediment.

**Plankton and Macro Benthic Abundance and Diversity**

*Phytoplankton*

The major divisions of phytoplankton observed in the area were Diatoms which accounts for 80.3% and 65.5% for the wet and dry seasons respectively. This is followed by the Dinoflagellates with 18.2% in the wet season and 34.0% in the dry season. Other encountered divisions include Blue green algae, Marine flagellates and Tintinnid. The dominance of Diatoms in the two seasons is in conformity with previous findings, which indicate that Diatoms dominate the phytoplankton population in marine ecosystem.

*Zooplankton*

A total number of 816 and 1158 species were counted for Yoho Field during the wet and dry seasons respectively. Out of these, the Copepoda/Calanoida was the most abundant with a percentage of 65.5% and 73.5% for the wet and dry seasons respectively. The Copepoda larvae also have a percentage count of 11.0% and 2.9% for the wet and dry season respectively. Copepods are known to constitute three-quarter of the zooplankton population of tropical marine ecosystem.

*Macro Benthic Organisms*

In the wet season, a total of 1,693 species of benthic macrofauna were encountered of which 430 belongs to Annelida/Polychaeta, 839 to the Mollusca family and Arthropoda was 253. Others were Echinodermata, Sipunculida, Chordata, Nermetea and Hemichodata. Similarly, during the dry season, about 1,805 species were encountered. Annelida, Arthropoda, Mollusca, and Echinodermata were also identified. The most abundant phylum in terms of total number of organisms was the mollusca having 49.6% and 56.2% for the wet and dry season respectively.

**Fisheries Resources, Seabirds and Marine Mammals of Project Area**

*Fisheries Resources*

The study area supports a substantial artisanal and trawl fishery. The common fisheries resources within the study area include fin fishery (pelagic and demersal), and shellfishes (shrimps, crabs, lobsters, and molluscs).

*Seabirds*

More than 30,000 seabirds belonging to 13 species breed along the coast of West Africa. However the only recorded large concentrations of seabirds on the coast of West Africa are in Mauritania and Senegambia to the north of the Gulf of Guinea. The most commonly identified Nigerian coastal birds include pelicans (*Pelecanus rufescens*) and egret (*Egretta gularis*).

*Marine Mammals*

About 27 species of marine mammals, all of which are either dolphins or whales, are commonly known to inhabit or migrate through Nigerian offshore waters.

**SOCIO-ECONOMIC PROFILE AND CONSULTATION**

The consultation exercise within the Akwa Ibom State LGA for the proposed EIA of Development wells Drilling project in Yoho Area was scheduled between June 22, 2009 and July 2, 2009. However the consultation activity had to be extended to July 3, 2009 in order to accommodate the rescheduled LGAs. The exercise was successfully completed in the scheduled 16 LGAs.

Akwa Ibom State is the 15th most populous state in Nigeria with a high population density, ranging between 333.2 persons per square kilometre (Federal Republic of Nigeria Official Gazzet-No 2, 2nd February 2009 Vol. 96). The State is inhabited by a total population of 3,902,051 people made of up of 1,983,202 males and 1,918,849 females. The people of Akwa Ibom State are believed to have originated from one ancestral Ibibio stock. Present day Akwa-Ibom is made up of three distinct ethnic groups of Ibibio, Annang and Oron. Ibibio is however spoken and understood among all linguistic groups. The local traditional political organisation consists of five tiers of authority, consisting of the Nuclear Family Heads; extended (lineage) Family Heads (Obong Ekpuk) and Village Heads (Ete Idung) who superintend over various families.

The literacy rate in Akwa Ibom State is 75.8% which is quite higher. About 49.4% of dwelling houses in Akwa Ibom state are made of cement/concrete mixture while 32.96% are made up of mud materials. Food and education account for over 50% of the mean monthly household expenditure. Majority of the people in the study area source their drinking water from untreated water sources like river, streams, and ponds. Only 4% households obtain drinking water from public tap system. The Federal Office of Statistics [FOS] (2004) revealed that poverty level in Akwa Ibom State decreased from 72.3% in 1996 to 39.86% in 2004. However, unemployment is also relatively high (80%) in the 15 - 34 years age group. On infrastructural development a lot still has to be done in order to revamp the socio-economic/infrastructure base of the State. Interactions with inhabitants reveal that common diseases in the study area include malaria, typhoid, cholera, pneumonia, tetanus and whooping cough etc.

**POTENTIAL IMPACT ASSESSMENT AND MITIGATION**

The potential and associated impacts of the proposed Yoho Development Wells Drilling Project have been identified and evaluated using standard procedures. Various source references including past project experience, professional judgment and knowledge of the project environment and project activities as well as the FMENV sectoral guidelines on oil and gas industry have been used in the assessment. A summary of the significant impacts that would result from the proposed project and proffered mitigation measures are presented below.

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| --- | --- | --- | --- | --- | --- | --- |
| **Project Activities** | | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| **Logistics (Mobilisation/ Demobilisation** | Vessel Movement to Site | Interference with marine transport and fishing activities | Medium | Formal, Informal and Avoidance | MPN shall:   * ensure that routine procedures to notify other vessels * ensure all communications equipment are in good working condition * consult the Nigerian Navy and Nigerian Maritime Authority | Low |
| Accidental collision with existing infrastructure (platform) | Medium | Formal, Informal, Physical and Avoidance | MPN shall:   * Conduct reconnaissance visit in the area to assess all existing infrastructure before commencing drilling activity * use trained and competent personnel etc | Low |
| Collision with other vessels and smaller boats | High | Physical, Informal and Avoidance | MPN shall:   * consider the weather condition before start of work * make use of competent staff, * avoid periods of intense activities | Low |
| Risk of pirate /militant attack/kidnap | High | Formal and Avoidance | MPN shall:   * carry out security assessment of mobilization route prior to mobilization * educating indigenes on tolerance * ensure well equipped security operatives (navy/mopol/army) accompany survey vessel | Medium |
| Exhaust emissions from vessel engines | Low | Formal and Informal | MPN shall:   * properly maintain and monitor performance of equipment * conduct pre-mobilisation checks on vessel | Low |
| Injury/loss of life from helicopter accidents/ crash during support services | Medium | Formal, Avoidance and Physical | MPN shall:   * Support/ shuttle/ crew change helicopters shall be maintained in optimal conditions * Pre-flight checks shall be carried out at all times * ensure that all operational flight crew are competent | Low |
| Loss of employment/disengagement of casual workers | High | Formal and Informal Control | MPN shall:   * ensure workers are integrated into other available jobs * encourage workers on how best to make use of income generated | Low |

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| --- | --- | --- | --- | --- | --- | --- |
| **Project Activities** | | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| **Logistics (Mobilisation/ Demobilisation** | Hazardous Material Handling | Risk of injury /death of personnel | High | Formal, Informal and Physical | MPN shall:   * provide and enforce use of appropriate PPE by worksite personnel at all times * use chemicals with lowest toxicity levels in all its operations * ensure material safety data sheets (MSDS) are provided for chemicals on site * ensure adequate onsite first aid facility | Medium |
| Acute and chronic health conditions resulting from over exposure to adverse conditions | High |
| Increase in biological and chemical toxicity of seawater column/ increased bioaccumulation in marine flora and fauna from discharge of pigging waste | High | Formal, Informal and Avoidance | MPN shall:   * develop an appropriate Waste Management Plan * ensure operational waste are separated at source * treat and discharge all effluents (spent mud, cement, cuttings, etc.) in accordance with regulatory (FME and DPR) requirements * ensure zero discharge of spent Oil Based Mud.. | Low |
| **Exploratory Drilling** | Well Drilling and Installation of casings | Temporary re-suspension of sediments and consequent degradation of water quality during rig positioning | Low | Formal and Avoidance | MPN shall:   * specifically deal with borehole instability, the down hole sections of the proposed well shall be drilled using water based mud * employ standard blow out preventers (BOPs) to forestall well bow outs * activate existing oil spill contingency plan | Low |
| Borehole instability resulting in well blowout and subsequent release of oil and gas, | High |
| Disturbance of bottom sediments and loss of benthic organisms | Low | Formal and Avoidance | MPN shall:   * design the sequence of drilling operations to minimise such hazard and allow for contingency solutions to be assessed while drilling | Low |
| Localised increase in ambient noise levels from rig operations. | Medium | Formal and Avoidance | MPN shall:   * ensure persons working in areas with high noise level are provided with ear protecting gargets | Low |
| Well Completion and Development Prognosis | Liability to MPN due to damage to subsea cables or pipelines | Medium | Formal and Avoidance | MPN shall:   * carry out appropriate seabed surveys of the Yoho Field area prior to mobilisation | Low |
| Localised increase in the ambient concentration of air pollutants due to flaring from well testing | High | Formal | Flaring during well testing operation is expected to be short term | Low |

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| **Project Activities** | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| Health, Safety and Environment (HSE) | Work place accidents/ incidents | High | Formal, Informal and Physical | MPN shall:   * use trained and competent personnel * ensure job hazard analysis are conducted * ensure the mandatory use of PPE for all jobs * ensure all potential hazards are identified before start of work * ensure adequate onsite first aid/clinic facility | Low |
| Risk of communicable and other diseases | High | Formal, Informal and Physical | MPN shall:   * train personnel safe sex practice (use of condoms) * health awareness on mode of prevention/treatment of the diseases, * ensure medical examinations are carried out * ensure use of treated mosquito nets and prompt treatment of malaria at site Clinic | Low |
| Waste Management | Degradation of water quality from discharge of untreated sanitary wastes, grey waters etc | Medium | Formal and Avoidance | MPN shall:   * treat and discharge all sewage, grey waters etc. in accordance with DPR and FME guidelines | Low |
| Degradation of water quality from accidental oil spills during fuelling/ handling activities | High | Formal, Informal and Physical | MPN shall:   * implement leak prevention, inspection and maintenance, and repair programmes * activate spill contingency plan in an event of oil spill * monitoring seawater quality as well as marine flora and fauna diversity and abundance | Medium |
| Reduction in diversity and abundance of marine flora and fauna resulting from oil spill due to pipeline rupture | High |
| Alteration of seawater column baseline quality | High | Formal, Informal and Avoidance | MPN shall:   * make sure all operational waste must be separated at source * ensure project site personnel are trained on good waste management practice * ensure effluent waste are treated to regulatory standards (FME and DPR) * ensure that there is zero discharge of spent oil based mud. | Low |
| Increased bioaccumulation in marine | High |

**ENVIRONMENTAL MANAGEMENT PLAN**

The environmental management plan (EMP) is essentially a management tool and standalone component of the EIA report. It provides the assurance that the mitigation measures developed for the significant impacts of a proposed project will be implemented and maintained throughout the project lifecycle. The EMP also outlines MPN’s management strategies for safety health and environment (SHE) stewardship in the proposed Yoho field development project.

This EMP is a dynamic working tool and its scope may be reviewed periodically to effect changes in regulatory regimes, guidelines and standards as well as operator’s corporate SHE policies. It shall be made a green document throughout the project duration so as to ensure that lesson learnt, new environmental findings and sustainable technology are incorporated to guarantee continuous mitigating measures to reduce the project potential impacts. The documented EMP has been developed in accordance with the general requirements of ISO 14000: 2004 - Environmental Management System.

The main elements of the EMP are:

* resourcing and responsibilities for implementing specific mitigation measures;
* guidelines for waste management;
* guidelines for training programmes
* emergency response / contingency plan;
* environmental monitoring plan;
* guidelines for audit and review; and
* guidelines for decommissioning and abandonment.

**CONCLUSION**

The EIA of the proposed Development Wells Drilling Project in Yoho has been carried out using data obtained from a two seasons (wet and dry) sampling and measurement in the area as well as research / literature survey on regional studies offshore Nigeria. The overall goal of the EIA is to ensure that potential environmental and social impacts of the proposed project are identified and evaluated and adequate mitigation proffered for significant impacts.

The field analysis result showed that the physical, chemical and biological characteristics of the seawater column, surface seawater and surficial sediments, were consistent across the concession. The composition of plankton and benthic macro fauna species indicated unique assemblages with abundance that relate to the nutrients and chemical composition of the ecosystem.

The impact assessment of the proposed drilling project indicated would beneficially and significantly impact on the national economy and the overall well being of the Nigerian people. This would be by way of adding value to Nigeria’s total hydrocarbon reserve; increased production capacity and ultimately, enhancement of the overall export earnings for the nation. It would also result in provision of direct and indirect employment opportunities for Nigerians as well as increased derivation fund to local and state governments and other government mandated development agencies / commissions. The identified significant adverse impacts can be prevented, reduced or ameliorated by implementing the recommended mitigation measures. Consequently, adherence to the established EMP will ensure proactive and effective implementation of the proffered mitigations throughout the project duration.