**CHAPTER SIX**

**POTENTIAL IMPACT MITIGATION MEASURES**

**6.1 General**

This chapter presents the approach and mitigation measures for the identified impacts of the proposed Yoho development well drilling project. The classification of the mitigation controls (formal control, informal control, physical control, training and avoidance) are ranked from low to high in the matrix (**Figure 6.1**). This was used to determine the mitigation requirements for each impact taking into cognisance the scale, frequency and potential severity of impact; environmental sensitivities as well as political and economic concerns.

|  |  |  |
| --- | --- | --- |
| Formal Control | Physical Control | Avoidance |
| Training | Formal Control | Physical Control |
| Informal Control | Training | Formal Control |

# Impact Significance

High

HIG

Medium

Low

Low

High

Medium

Likelihood of Occurrence

**Figure 6.1: Matrix for determination of Mitigation Measures**

*Informal Control*

This involves the application of sound judgment and best practice in mitigating the impacts of the seismic and drilling project activities.

*Formal control*

This involves the application of documented policy, process or procedure in mitigating the impacts of the project activities. It ensures that residual associated impacts are reduced to an acceptable level.

*Physical control*

This involves the application of physical processes, barriers or instruments (pegs, fence, gates, sign post etc), not necessarily requiring any special technology, in order to mitigate the impacts of the project.

*Avoidance*

This involves the modification of plans, designs or schedules in order to prevent the occurrence of an impact or impacts.

The specific mitigation measures satisfying the mitigation requirement were established putting the following into consideration.

* Best available techniques (BAT)
* On-site conditions; and
* Public concerns

**6.2 Mitigation Measures**

EIA has as its principal and most important objective the development and establishment of suitable procedures (mitigation measures) for the identified significant and adverse impacts of a proposed project.

The mitigation measures proffered are to prevent, eliminate or minimize the impacts and their effects to levels that are considered as low as reasonably practicable (ALARP).

In proffering mitigation measures, the primary objectives were:

* ***Prevention*** – ensuring that significant and adverse potential impacts and risks do not occur.
* ***Reduction*** – ensuring that the effects or consequences of those significant associated and potential impacts that cannot be prevented are reduced to as low as reasonably practicable. Reasonable practicability was determined in reference to best industry practice and to economic, environmental, technical, health and safety considerations.
* ***Control*** – ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

**6.3 Management Procedure for Mitigation Measures**

The management procedures employed for the establishment of mitigation measures for the identified impacts is presented in **Figure 5.3**. Mitigation measures were subsequently proffered for adverse significant potential impacts. These measures (prevention, reduction, control strategies) were developed for the adverse impacts through review of industry experience (past project experience), consultations and expert discussions with multi-disciplinary team of engineers and scientists.

**Impact Assessment/Evaluation**

Is the impact significant?

Considering:

* Health & safety of the people
* Pollution / deterioration of the environment
* Damage to asset / property
* Proponent’s Image & reputation

**Mitigation / Ameliorative Requirements**

* Eliminate barriers to prevent adverse effect
* Control of escalation factors
* Recovery preparedness measures
* Lessons from past project experience
* Consultations with experts

**Impact Mitigation**

* Prevention strategy
* Reduction strategy
* Control strategy

**Management Plan**

* Management resourcing & responsibilities
* Monitoring plan
* Auditing & review

**Figure 5.3: Management Procedure for Mitigation Measures**

**6.4 Proffered Mitigation Measures**

Accordingly, this section presents the mitigation measures proffered for the significant (medium and high) adverse impacts of the proposed Yoho development wells drilling project. These cost effective measures have been proffered with reference to best industry practice and SHE considerations.

Based on the impact assessment matrix in the previous chapter, the overall ratings of impact significance **High** or **Medium** or **Low** was established for each identified impact. The proffered mitigation measures and the expected final residual impact rating for the identified potential significant impacts are presented in the **Table 6.1** below.

**Table 6.1: Mitigation Measures for Significant Impacts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 within project area and along project route | Medium | Formal, Informal and Avoidance | MPN shall:   * ensure that routine procedures to notify other vessels by appropriate signals in accordance with International Maritime Law which include communications via radio and flags are adhered to * ensure all communications equipment are in good working condition (including back ups) before mobilisation * ensure trained and competent vessel captain and crew members are used for all operations * use appropriate markings, signals and lights on seismic, supply and security vessels to alert other sea users of their presence * consult the Nigerian Navy and Nigerian Maritime Authority to clarify any protocols or requirements for the seismic survey | Low |
| Accidental collision of survey vessel with existing infrastructure (platform) leading to asset damage injury/death to/of personnel | 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 with requisite offshore work certifications, BOSIET, etc | Low |
| Collision with other vessels and smaller boats during adverse weather conditions resulting in injury/death of personnel and assets | High | Physical, Informal and Avoidance | MPN shall:   * ensure the weather condition of the day is considered before start of work * make use of competent staff, who are safety conscious and adequately trained * avoid periods of intense activities | Low |
| Risk of pirate /militant attack/kidnap leading to trauma/injury or death of personnel and loss of revenue | 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 throughout the seismic data acquisition period * activate emergency response plan in the event of threat | Medium |

**Table 6.1: Mitigation Measures for Significant Impacts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project Activities** | | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| **Logistics (Mobilisation/ Demobilisation** | Vessel Movement to Site | Exhaust emissions from vessel engines contributing to greenhouse gas global warming agents | Low | Formal and Informal | MPN shall:   * properly maintain and monitor performance of equipment (to minimise downtime and associated emissions * conduct pre-mobilisation checks on vessel prior to movement * ensure that all gaseous emissions are consistent with international standards and will comply with FMENV and DPR regulatory limits | 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 |
| Rig Movement | Interference with vessels/ boat traffic and fishing activities along mobilisation route | Medium | Formal and Avoidance | MPN shall:   * ensure the rig is mobilised after due consultation with relevant maritime authorities and other stakeholders to minimise interference along the water ways | Low |
| Disturbance of aquatic organisms along mobilisation route | Low |
| Collision and damage to existing offshore oil/ gas facilities | Medium | Formal and Avoidance | MPN shall   * Conduct reconnaissance visit in the area to assess all existing infrastructure before commencing drilling activity | Low |
| Risks of pirates /militant attack leading to personnel injury/death | 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 throughout the seismic data acquisition period * activate emergency response plan in the event of threat | Medium |

**Table 6.1: Mitigation Measures for Significant Impacts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project Activities** | | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| **Logistics (Mobilisation/ Demobilisation** | Rig Movement | Exhaust emissions from rig engine contributing to greenhouse gas global warming agents | Low | Formal and Informal | MPN shall:   * properly maintain and monitor performance of equipment (to minimise downtime and associated emissions * conduct pre-mobilisation checks on vessel prior to movement * ensure that all gaseous emissions are consistent with international standards and will comply with FMENV and DPR regulatory limits | Low |
| Supply Vessels and Helicopter Support Services | Injury /loss of life from collision of supply vessels with other vessels and existing structures during adverse weather conditions | High | Formal, Informal and Physical | MPN shall:   * Conduct reconnaissance visit in the area before using source vessels * use trained and competent personnel   with requisite offshore work certifications, BOSIET, etc | 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 prior to each journey * Pre-flight checks shall be carried out at all times per each flight * ensure that all operational flight crew are competent * activate emergency procedures on the event of an accident/ crash | Low |
| Exhaust emissions from vessel/ helicopter engines contributing to greenhouse gas global warming agents | Low | Formal and Informal | MPN shall:   * properly maintain and monitor performance of equipment (to minimise downtime and associated emissions * conduct pre-mobilisation checks on vessel prior to movement * ensure that all gaseous emissions are consistent with international standards and will comply with FMENV and DPR regulatory limits | Low |

**Table 6.1: Mitigation Measures for Significant Impacts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 * employ only competent personnel for the drilling exercise * use chemicals with lowest toxicity levels in all its operations * ensure that material safety data sheets (MSDS) are provided for chemicals on site * conduct awareness and training exercise for all personnel working with hazardous/corrosive chemicals | Medium |
| Acute and chronic health conditions resulting from over exposure to adverse conditions and handling of toxic chemicals/materials at work place | 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 before project commencement * ensure all operational waste are separated at source to enhance efficiency in waste handling and disposal * treat and discharge all effluents (spent mud, cement, cuttings, etc.) in accordance with regulatory (FMENV and DPR) requirements * ensure zero discharge of spent Oil Based Mud. This shall be recovered, reconditioned and reused or taken to offsite facility for treatment. | Low |

**Table 6.1: Mitigation Measures for Significant Impacts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project Activities** | | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| **Exploratory Drilling** | Well Drilling and Installation of casings | Temporary re-suspension of sediments especially within shallow waters and consequent degradation of water quality during rig positioning | 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 * 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 to effect clean up and forestall wide spread pollution in the event of a blow out | Low |
| Borehole instability resulting in well blowout and subsequent release of oil and gas, leading to environmental pollution, injury/death of personnel and reduction in biodiversity of marine flora and fauna | High |
| Disturbance of bottom sediments and loss of benthic organisms during the drilling process | 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. Leading to loss/ scare for fishes, seabirds and marine mammals | 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 Ufon 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 |
| Health, Safety and Environment (HSE) | | Work place accidents/ incidents (trip and fall, man overboard, etc) during seismic and drilling sequence. Leading to injury/death of personnel | High | Formal, Informal and Physical | MPN shall:   * use trained and competent personnel * prior to daily start of work, ensure job hazard analysis are conducted and all personnel properly briefed of inherent hazards as pertain to their jobs * 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 such as Sexually Transmitted Infections (STIs), Human Immunodeficiency Virus (HIV), Malaria etc. | 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 prior to mobilisation * ensure use of treated mosquito nets and prompt treatment of malaria at site Clinic | Low |

**Table 6.1: Mitigation Measures for Identified Impacts**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Project Activities** | **Associated and Potential Impact** | **Rating before Mitigation** | **Mitigation**  **Control** | **Mitigation Measures** | **Residual Impact after Mitigation** |
| 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 FMENV 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 to ensure equipment perform to industrial standards * activate spill contingency plan in an event of oil spill * manage these potential impact by monitoring seawater column quality as well as marine flora and fauna diversity and abundance in the event of any spill | 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 resulting from routine discharge of drilling wastes (deck drains, spent mud, cement, cuttings etc.) | High | Formal, Informal and Avoidance | MPN shall:   * make sure all operational waste must be separated at source to enhance efficiency in waste handling and disposal * ensure project site personnel are trained on proper waste management practices * treat and discharge all effluents (spent mud, cement, cuttings, etc.) in accordance with regulatory (FMENV and DPR) requirements * ensure that there is zero discharge of spent oil based mud. This shall be recovered, reconditioned and reused or taken to offsite facility for treatment | Low |
| Increased bioaccumulation in marine flora and fauna from discharge of chemicals, spent mud, cuttings, cement, oily waste waters, etc | High |
| Mortality /reduction in benthic species abundance and diversity through smothering resulting from drilling operations and discharge of mud, cement, cuttings, etc. to sea bottom | High | Formal and Avoidance | MPN shall:   * manage these potential impact by monitoring seawater column quality as well as marine flora and fauna diversity and abundance * treat and discharge all effluents (spent mud, cement, cuttings, etc.) in accordance with regulatory (FMENV and DPR) requirements | Low |