EXECUTIVE SUMMARY (ENGLISH)

ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DRILLING OF EXPLORATORY WELLS (26 NOS.) IN PML BLOCKS OF CACHAR FORWARD BASE, IN ASSAM

ONGC LIMITED
CINNAMARA, JORHAT, ASSAM

PROJECT REFERENCE NUMBER:
IN/ES-EIA/2014-161
(VERSİON 2.0)

CONTRACT NO: 5010094119
TENDER NO: L26BC14015

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

M/s Oil and Natural Gas Corporation Limited (hereinafter referred as ONGC) has been awarded onshore Blocks within Adamtila PML, North Patharia PML, Cachar Dist. PML and Sector-VC PML blocks in Cachar and Karimgunge district of Assam state for exploration of hydrocarbons. Exploratory drilling of wells at 26 locations has been proposed in these three PML blocks.

As per notification dated 14th September 2006, proposed exploratory drilling of 26 no.s of wells is designated as “Category A” project and requires Environment Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC), Govt. of India, Delhi.

Ministry of Environment and Forest & Climate Change (MoEF&CC) issued Terms of Reference (TOR) for carrying out the EIA/EMP study vide letter No. J-11011/229/2012- IA II (I) Dated 11th September 2013 based on the duly filled Form I along with pre feasibility report submitted and subsequent presentation made to Expert Appraisal Committee (EAC).

Location and Accessibility

The identified blocks Cachar Dist. PML, Karimganj Dist. PML, Sector-VC PML, Banaskandi PML, Adamtila PML, North Patharia PML lies in the proven petroliferous Assam-Arakan Basin. The coordinates of the same is given in Table 1.1:

Table 1.1: Location coordinates of Block area

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of block</th>
<th>Name of Wells</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cachar Dist. PML</td>
<td>N/L 7</td>
<td>24°54'13.55&quot;N 92°35'6.669&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>TNAA</td>
<td>24°33'35.53&quot;N 92°53'14.31&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>HRAB</td>
<td>24°53'18.73&quot;N 92°34'51.14&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>N/L 10</td>
<td>24°59'23.02&quot;N 92°28'22.39&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>NTAB</td>
<td>24°59'45.15&quot;N 92°26'23.38&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>N/L 12</td>
<td>24°34'13.15&quot;N 92°51'3.459&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>RPAA</td>
<td>24°48'21.55&quot;N 93°02'57.85&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>BKAD</td>
<td>24°42'45.53&quot;N 92°50'3.668&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>N/L 15</td>
<td>24°38'29.88&quot;N 92°48'45.45&quot;E</td>
</tr>
<tr>
<td></td>
<td>N/L 7</td>
<td>N/L 16</td>
<td>24°37'39.59&quot;N 92°49'54.22&quot;E</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Name of block</td>
<td>Name of Wells</td>
<td>Coordinates</td>
</tr>
<tr>
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<td>---------------</td>
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<td>------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Latitude</td>
</tr>
<tr>
<td>2</td>
<td>Sector-VC PML</td>
<td>N/L 17</td>
<td>24°35′42.2″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 22</td>
<td>24°54′58.6″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 23</td>
<td>24°51′25.5″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PMAC</td>
<td>24°52′19.65″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPM</td>
<td>24°53′58.58″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TKAD</td>
<td>24°54′50.17″N</td>
</tr>
<tr>
<td>3</td>
<td>Banaskandi PML</td>
<td>BK3(Sub)</td>
<td>24°43′40.67″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BKAC</td>
<td>24°45′33.04″N</td>
</tr>
<tr>
<td>4</td>
<td>Adamtila PML &amp; EXtn</td>
<td>TIAA</td>
<td>24°32′14.25″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 2</td>
<td>24°30′8.517″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 3</td>
<td>24°32′54.17″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 4</td>
<td>24°21′58.0″N</td>
</tr>
<tr>
<td>5</td>
<td>North Patharia PML</td>
<td>PTAC</td>
<td>24°48′14.06″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 19</td>
<td>24°49′49.73″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/L 20</td>
<td>24°46′41.35″N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PTAB</td>
<td>24°45′45.37″N</td>
</tr>
</tbody>
</table>

### 2.0 Project Description

The identified blocks Cachar Dist. PML, Adamtila PML & EXtn., North Patharia PML, Sector-VC PML, Banaskandi PML lies in the proven petrolierous Assam-Arakan basin. All blocks primarily fall within the depositional plains of the River Brahmaputra and its tributaries; whilst the southern boundary of the Block is close to the Naga Hills.

Project activity involves

- ✔ Well site preparation, construction of access roads,
- ✔ Well drilling and testing,
- ✔ Site closure and decommissioning of wells not indicative of potential hydrocarbon reserves.

The other details are described in brief as per given hereunder:

**i) Well kick situation**

While drilling, if the formation pressure exceeds the hydrostatic pressure exerted by the drilling fluid, formation fluids break out in to the well bore.
ii) Blowout
Uncontrolled “well control situation” eventually leads to a blowout. Blow out can cause a partial or total destruction of drilling rig. Blowouts are often associated with hydrocarbon spill followed by fire.

iii) Well control
This set of equipment is called “Blowout Preventers (BOP)”.
Blow Out Preventer consists of, “Annular Preventer”, which can generally close on any size or shape of tubular in the well bore and closes the annular space between drill string and casing.

Drilling Fluids (Mud)
If the drill bit penetrates a formation containing oil, gas or water under pressure, drilling mud are prevented from flowing into the borehole by ensuring that the drilling mud is of sufficient density to the natural formation pressures. The density of the mud can be increased by the addition of barite weighting material. Bentonite is employed to improve the theological properties and enable the drill cuttings to be transported from the hole while drilling and also be suspended in the fluid while the drill bit is being changed. The barite used in the drilling mud would be as per API standard specifications. Water Based Mud (WBM) will be used for all the wells considering environmental constraints and hazards.

Drill Cutting
The drill cuttings, cut by the bit, shall be removed from the mud by the shale shakers and centrifuges and transferred to the mud tank. Once the mud shall be cleaned, it is pumped down the drill string again.

i) Drill-stem testing
If the geologist detects the presence of oil or gas in the drill cuttings, a drill-stem test is frequently performed to evaluate the formation or zone from which the oil show was observed.

ii) Surface Testing & Flaring
In case hydrocarbons are detected in the well, the quantity and quality will be tested. The fluids & gases coming out from the well will be flared.

iii) Well logging
Drilling operations continue until the predetermined total depth of the well is reached. The drill string is removed from the well bore to allow the insertion of logging tools, which are lowered all the way to the bottom of the hole by means of a special cable.

iv) Completing the well
When drill-stem testing and well-logging operations have been completed and the results have been analyzed, the company management must decide whether to complete the well as a producing well or to plug it as a dry hole.
v) **Restoration of Cutting Containment Area**

At the conclusion of well testing at each drilling site, solar drying will dewater the waste pits. All residual solids and liner will be covered with thick column of native soil. The cutting mud is inert and with HDPE (High Density Poly-Ethylene) linings of the pit in place.

### 2.1 Project Cost and Implementation Details

The proposed exploratory drilling period is expected to be about 60 Days and testing period of 30 days.

The estimated cost of the project is INR 780 Crores.

### 2.2 Utilities

**Water Requirements and Source:** The water consumption for each well will be 25 kilolitres per day (KLD) for 75-90 days per well. The camp will normally operate with around 50 personnel and will consume water @ 5 KLD for domestic purpose only.

**Power Requirement:** There will be Four (04) x 1430 KVA DG sets with a diesel consumption of about 6 KL/day. At a time, Maximum three during drilling, 01 standby. During well testing/flaring one auxiliary 250 KVA DG Set.

**Waste Disposal:** Conduits will be laid to collect wastewater from kitchens, toilets, bathing and washing areas. Wastewater from toilets shall be sent to soak pit after passing through Septic tank while same from other sources shall be sent to soak pit for final disposal.

### 3.0 Description of Environment

The proposed activities shall be confined to block only. The environmental monitoring was carried out for ambient air quality, water quality, soil and sediments quality, noise levels, traffic density and meteorology. No Reserved Forest, Protected forest and Wildlife Sanctuary/ National Park are present within the Block area.

### 3.1 Baseline Environmental Conditions

Baseline environmental studies for various environmental attributes were carried out during the months, from 26th January 2015 to 17th April 2015 covering summer season.

#### 3.1.1 Ambient Air Quality

The ambient air quality monitoring for PM10, Sulphur Dioxide, Nitrogen Dioxide, VOC, Carbon Monoxide (as CO), Methane, Non-Methane were carried out at 8 locations in order to assess the present air quality of the study area and its conformity to standards specified by MoEF&CC. Monitoring was conducted at a frequency of twice a week at each station for 24 hours for three months. The baseline air quality found to be as follows;
Out of the 8 locations, maximum concentration for PM10 of 92.2 $\mu$g/m$^3$ was recorded at Kaligara village (AAQ5) & minimum of 35.8 $\mu$g/m$^3$ at Gougrakona (AAQ8). Oxide of Nitrogen (NOx) varies between 19.0$\mu$g/m$^3$ to 32.2 $\mu$g/m$^3$ & AAQ5 had maximum 32.2 $\mu$g/m$^3$ and AAQ8 had minimum 19.0 $\mu$g/m$^3$. Sulphur Dioxide (SO2) varies between 5.0 to 11.9 $\mu$g/m$^3$ & AAQ5 have maximum 11.9$\mu$g/m$^3$. The VOCs of all the location are Below Detection Level.

3.1.2 Noise Level
Ambient noise monitoring was carried at residential zone of 15 locations around the well sites. Out of 15 locations, highest values of noise level observed at Katigara (N5) and lowest value recorded at Ghukrakona (N11).

3.1.3 Water Quality
Out of 5 locations of Ground water, pH varied from 5.43 to 7.4. TDS varied between 116 and 350 mg/l. Total Hardness varied from 50 to 110 mg/. Chloride varied from 10 to 100 mg/l and Nitrate varied from 2.6 to 5.7 mg/l. Heavy metals like Arsenic, Manganese, Chromium, Lead, Mercury, Cadmium were found to be below detection limit at all locations. Groundwater quality of the samples conforms to the IS 10500:2012 standards for Drinking Water Quality at almost all locations. Out of 5 locations of Surface Water, pH varied from 6.86 to 7.62. TSS varied between 8 and 14 mg/l. TDS varied from 68 to 120 mg/l. BOD found to be higher in SW3 (12 mg/l) and minimum at SW2 (5 mg/l). Dissolved Oxygen varied from 5.2 mg/l to 5.5 mg/l. Heavy metals like Chromium, Mercury and Lead were found to be below detection limit at all locations. Total Coliform count varies between 1536 to 2325 cfu/100ml and maximum at SW3.

3.1.4 Soil Quality
Out of 9 locations, pH varied from 6.84 to 7.35. Electrical conductivity found within a range from 168 $\mu$mhos/ cm to 250 $\mu$mhos/ cm. The texture of soil is Sandy clay to clay. Available Nitrogen ranged from 246 kg/ha to 310 kg/ha, Potassium ranged from 165 kg/ha to 215 kg/ha, Available Phosphorus ranged from 65 kg/ha to 106 kg/ha.

3.1.5 Ecology & Biodiversity
Study conducted around 1 km radius of each well and some important tree species are Alistonia scholaris, Anthrocephalus sinensis, Azadirchta indica, Acacia auriculoformis, Artocarpus heterophyllus, Delonix regia, Phyllanthus emblica, Ficus religiosa, Mangifera indica, Lagerstroemia speciosa, Dalberjia siso, Terminalia arjuna, Salix tetrasperma, Terminalia belerica, Ficus cunia, Azadirachta indica, Acacia nilotica, Anthocephalus
kadamba, *Saraca indica, Tamarindus indica*. About 27 mammalian species, 79 avifauna, 15 reptiles were recorded within the study area.

### 3.1.6 Baseline Socio-economic Conditions

The study conducted within 1 km from the centre of each proposed well. Total population in the study area is 67827 comprise 46416 people (from 10052 households) of Cachar district and 21411 people (from 4380 households) of Karimganj district. The majority of scheduled caste and scheduled tribe population exist in the Cachar district i.e. 20% and 10.6% respectively. The scheduled tribe population was found to be insignificant in Karimganj district. Sex ratio in the study area is 943 females per 1000 male, which is below sex ratio of Cachar and Karimganj district (Rural) as per the latest reports of Census Directorate 2011. The literacy rate of Cachar and Karimganj district (rural) is 77.1% and 76.1%.

### 4.0 Anticipated Environmental Impact and Management Plan

The proposed project activity will have impact on soil, water resources & water quality, ambient air quality, noise, ecology and socio-economic environment in surrounding area due to the generation, handling and disposal of stack emissions, liquid effluents and solid wastes during construction as well as operation phase and various related industrial activities.

#### 4.1 Impact Assessment

The impact assessment is given in below Table 3.

<table>
<thead>
<tr>
<th>Source</th>
<th>Potential impact</th>
<th>Component affected</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>Access</td>
<td>H/At/B/Aq/T</td>
<td>Vegetation cleared, possible erosion and changes in surface hydrology; emissions, vibration and (onshore) noise from earth moving equipment; disturbance to local population. Secondary impacts related to influx and settlement through new access routes. Mainly short-term, transient impacts. Potential long-term impacts from access construction.</td>
</tr>
<tr>
<td>Site preparation</td>
<td>Footprint</td>
<td>H/At/B/Aq/T</td>
<td>Requirement for proper site selection to minimize possible impact. Removal of vegetation and topsoil; possible erosion and changes in surface hydrology; drainage and soil contamination; land use conflict; loss of habitat; construction noise, vibration and emissions from vehicles; disturbance to local population, aesthetic visual intrusion. Short term provided adequate decommissioning and rehabilitation.</td>
</tr>
<tr>
<td>Source</td>
<td>Potential impact</td>
<td>Component affected</td>
<td>Comments</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------</td>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Camp and operations</td>
<td>Discharges, Emissions, Waste</td>
<td>H/At/B/Aq/T</td>
<td>Water supply requirements; noise, vibration and emissions from plant equipment and transport; extraneous light; liquid discharges—muds and cuttings; wash water; drainage; soil contamination—mud pits, spillages, leakages; solid waste disposal; sanitary waste disposal, sewage, camp grey water; emissions and discharges from well test operations; additional noise and light from burning/flare. Nature: Short-term, transient. Land-use conflicts, disturbance and interference to local population, special considerations required for native and indigenous population; interactions between workforce and local population; immigration; potential effects on local infrastructure—employment, education, roads, services; hunting, fishing, poaching. Nature: Short-term, transient.</td>
</tr>
<tr>
<td>Decommissioning and aftercare</td>
<td>Footprint</td>
<td>H/B/Aq/T</td>
<td>Proper controls during construction and Operations and careful decommissioning and aftercare should effectively remove risk of long term impacts. Improper controls can result in soil and water contamination; erosion and changes in surface hydrology; wildlife disturbance; loss of habitat; impacts to biodiversity; human and cultural disturbance; secondary impacts to socio-economic infrastructure, immigration, changes in land and resource use.</td>
</tr>
</tbody>
</table>

**H- Human, socio-economic, culture; Aq-Aquatic; B- Biosphere; T- Terrestrial; At- Atmospheric**

### 5.0 Risk Analysis

#### MINOR OIL SPILL

A minor oil spill is confined within the well plinth area. The conditions which can result in minor oil spill are as follows:

- **Diesel Fuel Storage System:** Oil spillage from tanker unloading, leaking valves, lines and storage tank.

- **Exploration or Testing Well Site:** Drill stem testing leading to an oil spillage from lines, valves, separator and tank failure.

#### MAJOR OIL SPILL

Significant hydrocarbon inventories are not maintained at a well drilling site. A major spill can, therefore, only arise as a result of an uncontrolled flow from a well either during drilling resulting from a failure of the surface equipment.

#### BLOWOUT

Blowout means uncontrolled violent escape of hydrocarbon fluids from a well. Blowout followed by ignition, which prevents access to the wellhead is a major hazard.
OTHER HAZARDS AT DRILLING RIG OPERATIONS

- Setting up the substructure
- Hazards during setting up the Rig floor and Mast or Derrick
- Hazards in Rigging up the Circulation system
- Hazards during installing the Auxiliary equipments.

6.0 CONSEQUENCE ANALYSIS

The consequence of igniting a hydrocarbon release during blowout depends on the type of material released, the mass release rate, the timing of the ignition, and the environment into which the hydrocarbon is released. Briefly, typical outcomes are:

- Jet fires: produced by an ignited jet of gas or liquid spray released under pressure;
- Pool fires: produced by ignition of a liquid release that accumulates on the surface and ignites;
- Flash fires: produced by igniting a gas cloud so that a fire propagates through the gas cloud (without generating a significant overpressure);
- Explosions: produced by igniting a gas cloud in conditions where the resultant accelerating flame front produces a significant overpressure.

7.0 RISK MITIGATION TO CONTROL HAZARDS

BLOWOUT

- A pit level indicator registering increase or reduction in the drilling mud volume and shall include a visual and audio –warning device near the driller stand.
- A device to accurately measure the volume of mud required to keep the well filled at the all times.
- A gas detector or explosimeter at the primary shale shaker and connected to audible or visual alarm near the driller stand.
- A device to ensure filling of well with mud when the string is being pulled out.
- A control device near driller stand to close the mud pump when well kicks.
- Blowout prevention drill shall be carried out once every week near the well during drilling.
- Suitable control valves shall be kept available near the well which can be used in case of emergency to control the well.
- When running in or pulling out tubing, gate valve and tubing hanger shall be pre-assembled and kept readily available at the well.
CONTROL MEASURES FOR H2S DURING DRILLING

H2S Detection System: A four channels H2S gas detection system should be provided. Sensors should be positioned at optimum points for detection, actual locations being decided on site but likely to be:

- Well Nipple
- Rig Floor
- Shaker header tank
- Substructure cellar

SAFETY SYSTEM FOR DRILLING RIGS

- Twin stop safety device (crown-o-matic and floor-o-matic)
- Fall prevention device on mast ladder with safety belt.
- Emergency Escape device for top man.
- First aid box with Stretcher and Blanket.
- Fire bell /siren.
- Emergency vehicle.
- Fire extinguishers
- Flame proof portable hand lamp /safety torch
- Railling with toe board
- Guards on all moving parts.
- Breathing apparatus (wherever required)
- Gas detector for hydrocarbon gas & H2S gas (if required)
- Safety lines for power tongs
- Rotary brake
- Hoisting brake lever with safety chain
- Emergency shutoff system for draw works
- Safety chain for inclined ramp (To prevent fall of any person)
- Safety belt for top-man with lane yard
- Railling on stair case at mud tank/walkways and derrick floor

8.0 ENVIRONMENTAL MONITORING PROGRAM

Prior to exploratory drilling of 26 wells, the following aspects shall be identified and information used in consultation with the relevant parties (e.g., Administrative authorities, Department of Archaeological Survey, Divisional & local Forest and Irrigation Departments, and all concerned State government agencies) for logistical and planning purposes with respect to affected area.
- Ecological details;
- Land use pattern;
- Details of land ownership;
- Details of habitat and other infrastructure;
- Pollution and waste management;
- Safe working practices;
- Rehabilitation (when applicable);
- Employment;
- Compensation; and
- Cultural heritage

9.0 **Environmental Management Plan (EMP)**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Component</th>
<th>Mitigation measures</th>
</tr>
</thead>
</table>
| 1 | Land Use | - Consult local authorities and other stakeholders regarding preferred location for drilling sites, camps and access/maximize use of existing infrastructure.  
- Where possible use existing road/water infrastructure.  
- All necessary protocols shall be followed and legal requirements shall be implemented with respect to local regulation pertaining to use of land;  
- Mark out the site boundaries to ensure that land taken is restricted to pre-agreed area;  
- Minimize the disturbance of vegetation present in and around area proposed to be used, if any;  
- Minimum utilization of land and clearing of site;  
- In-house audit before and after exploratory drilling; etc |
| 2 | Ecology | - Siting to minimize impacts on water resources, conservation interests, settlement, agriculture, sites of historical and archaeological interest and landscape. Consider using site that has been cleared/disturbed previously or of low ecological value, or which may be more easily restored, e.g., agricultural land;  
- Choose site to encourage natural rehabilitation by indigenous flora/avoid removal of vegetation and topsoil/preserve topsoil, and seed source for decommissioning.  
- Mark out site boundaries;  
- Avoid uprooting vegetation to the possible extent;  
- Take account of topography, natural drainage and site runoff. Ensure adequate and proper drainage.  
- Ensure proper handling and storage of fuels and hazardous materials  
- For cleared areas, retain top soil in stockpile where possible on boundary of drilling site for subsequent re-spreading onsite during restoration;  
- Retain vegetation on edge of site to serve as seed bank for future site re-vegetation during restoration;  
- Minimize cleared area and size of site/maximize perimeter to area ratio to aid natural re-vegetation. |
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>• Use hand cutting to clear vegetation initially—where necessary be selective in using machinery.</td>
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<tr>
<td></td>
<td>• All bulldozer operators involved in site preparation shall be trained to observe the defined site boundaries;</td>
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<td>• Kerosene oil/LPG shall be used for domestic purpose;</td>
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<td>• Distance in case of test flaring as suggested in Chapter-6 shall be maintained;</td>
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<td></td>
<td>• Initially land shall be taken on temporary basis and shall be returned back to owner after restoration, in case no economic findings of petroleum hydrocarbons otherwise shall be acquired for development and production activities;</td>
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<tr>
<td></td>
<td>• In-house audit before and after exploratory drilling operation: etc</td>
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<tr>
<td>3</td>
<td><strong>Water Resources</strong></td>
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<tr>
<td></td>
<td>• Siting to minimize impacts on water resources;</td>
<td></td>
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<td></td>
<td>• Avoid areas prone to flooding;</td>
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<tr>
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<td>• Where water courses and aquifers are deemed sensitive, consider a fully sealed site, avoid use of mud pits, preferentially use steel tanks, but if used must be lined. Pits if used must be lined;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Consider aquifer protection and proper plugging;</td>
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<tr>
<td></td>
<td>• Adequate water supply arrangement shall be made at drilling site and camp site;</td>
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<tr>
<td></td>
<td>• Continuous attempt shall be made to avoid wastage and leakage of water;</td>
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<tr>
<td></td>
<td>• Continuous attempt shall be made to optimize/reduce the use of water;</td>
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<td>• Drilling shall not be carried out during monsoon season;</td>
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<td>• If an aquifer is breached, the drilling crew can cement the hole to prevent leakage.</td>
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<td>• Toilets and bathrooms on temporary basis shall be provided at camp site; and</td>
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<td>• In-house audit before and after exploratory drilling: etc</td>
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<td>4</td>
<td><strong>Air Emissions (Dust and gaseous emission)</strong></td>
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<td>• Emission from flaring of petroleum hydrocarbons, DG sets and other machinery shall confirm the standards as prescribed;</td>
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<td>• Well testing (flaring) to be undertaken so as to minimize impacts of emissions:</td>
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<td>• duration of testing minimized by careful planning; and</td>
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<td>• high combustion efficiency, smokeless flare/burner to be used</td>
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<td>• Any dry, dusty materials (chemicals, construction materials etc) shall be stored in sealed containers and fenced storage yard;</td>
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<td>• Detectors for CH4 and H2S shall be placed at adequate locations;</td>
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<td>• Arrangement of water spray at drilling site and access road to the possible extent shall be made;</td>
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<td>• Preventive maintenance of vehicles and machinery;</td>
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<td>• Regular testing of the combustion efficiency of the vehicles/machinery;</td>
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<td>5</td>
<td><strong>Noise and Vibration</strong></td>
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<td></td>
<td>• Selection of low noise generating machinery/equipment;</td>
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<td>• Engineering specifications for machinery/equipment shall be stipulated during tendering as a condition for contractor to maintain noise level not more than 85 dB(A) at 1 m from each source;</td>
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<td>• Provision of rubber padding/noise isolators/silencers to modulate</td>
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the noise generated by machinery/equipment, wherever possible;
- Use experienced and skilled personnel;
- Train personnel of standard operating procedures for handling and shooting of explosives;
- The high noise zones within ROW shall be demarcated and temporary enclosures & barriers, if required shall be provided;
- Provision of protective devices like ear muffs/plugs to the workers;
- Preventive maintenance of machinery/equipment and vehicles;
- All employees shall be encouraged to cooperate in using agreed safe work practices;
- Information on noise, the risks of exposure to noise and the appropriate control measures shall be disseminated in a manner appropriate to the workplace;
- All employees shall receive appropriate training and education as and when required;
- In no case, workers shall be exposed more than 85 dB (A) at 1m from source;
- Regular monitoring and In-house audit as per details given in this chapter; etc.

### Soil and Solid wastes

#### Soil Erosion
- Minimize area and extent of site clearance, by staying within defined boundaries;
- Stockpile of topsoil wherever possible at the edge of site;
- Limit erosion potential/avoid steep slope and drainage courses/avoid cut and fill techniques/ incorporate proper drainage, culverting and bridging techniques;
- Avoid removing undergrowth where possible so as to retain land stability;

#### Fuel, Lubricants and Chemical Management
- All fuels, lubricants, surface treatment materials, welding rods/gases, chemicals etc to be placed in controlled storage i.e. properly fenced area and in clearly marked vessels and containers;
- Storage and liquid impoundment areas for fuels, construction materials, solvents, chemicals and waste should be designed with secondary containment (e.g., dykes and berms) to prevent spills and the contamination of soil, groundwater, and surface waters;
- Impervious liners shall be in place for fuel, lubricants and chemicals storage area;
- Impervious liners shall be in place for pits for storage of drill cutting and mud;
- Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials to be used for fuel lubricants and chemicals storage area;
- Non-contaminated and potentially contaminated run-off shall be kept separate. Non-contaminated run-off will be routed to off-site areas via silt traps. Potentially contaminated surface run-off shall be routed through oil traps.
| 7 | Employment and Socioeconomic | • In-house audit shall be carried out before and after exploratory drilling operation.  
• Preference shall be given to locals for temporary direct and indirect employment;  
• Local employment (unskilled) should be provided in a manner, giving fair representation to all section;  
• Where ever local skilled labour is available, should be preferred to be hired for the respective job;  
• Local suppliers for machineries and construction materials shall be given preference;  
• Local transporters shall be preferred for transportation of machinery/materials.  
• Close monitoring on the type of loss to local habitats, if any. In case of any loss to locals, adequate compensation shall be provided as per the law or on mutually agreed terms;  
• Third part audit after completion of activities; |
| 8 | Occupational Health & Safety | • Due care shall be taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated during drilling operation to the possible extent;  
• Any worker found to develop symptoms of dust related diseases will be changed over to other activities in cleaner areas;  
• General Safety Measures  
• Employees shall be provided with helmets, safety boots, eye and ear protection, and snug fitting gloves as appropriate;  
• Masks and dust-proof clothing shall be provided to personnel; and  
• Procedures shall be strictly enforced for the drilling, storage, handling, and transport of explosives, flammable and hazardous materials.  
• General Health Measures  
• Sanitary facilities shall be well equipped with supplies and employees shall be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens;  
• Personnel required to work in areas with high humidity shall be allowed to take frequent breaks away from these areas; and  
• Pre-employment medical examinations of all personnel shall be made mandatory for contractor. |
| 9 | House keeping | • The facilities should be kept clean, maintained, and operated in a safe and environmentally sound manner;  
• Facilities should be cordoned off in a manner to prevent access to the facility by the general public, livestock, where appropriate.  
• Signs should be posted in conspicuous locations to notify employees and the public of any dangerous situations such as, flammable conditions, high voltage, and toxic.  
• All equipment should be painted and/or kept clean to present an acceptable appearance and to provide protection from external corrosion.  
• Waste receptacles should be provided at appropriate locations for collecting discarded paper, rags, etc. and emptied on a regular basis. |