Executive Summary

ONGC Limited

Drilling of Development wells in Oil Fields of Area II and IV of Ahmedabad Asset in Gandhinagar, Ahmedabad and Kheda Districts of Gujarat
Introduction and Background

About ONGC

Founded on August 14, 1956, Oil and Natural Gas Corporation Limited (ONGC) is the largest Indian public sector company. It is also the second largest Indian company in terms of net profit and the third largest Indian company by market capitalization. It has been ranked at 413th position as per Fortune Global 500 - 2011 list, based on revenues. ONGC has been conferred the Maharatna status by the Central Government.

ONGC is engaged in hydrocarbon exploration and production activities. Major functions of ONGC are to plan, promote, organize and implement programs for exploration, development of petroleum resources and the production. It is involved in exploring and exploiting hydrocarbons in about 26 sedimentary basins of India. ONGC produces crude oil which is 64% of India's crude oil production. It owns and operates more than 11,000 kilometers of pipelines in India.

About the Ahmedabad Asset

Ahmedabad Asset is one of the major onshore Asset of ONGC operating in four revenue districts of Gujarat. Operation area of Ahmedabad Asset is divided four areas, area I to area IV. Area I and area III are geographically located in Mehsana and Gandhinagar Districts, while area II and area IV are falling within Kheda, Ahmedabad and Gandhinagar Districts.

Operational areas for the Ahmedabad Asset include a Mining Lease (ML) area of ~1649.917 Km². The Asset currently produces approximately 3725 TPD of crude oil and 5.8 Lakh m³ of natural gas on a daily basis.

Mining Leases of Area II & IV of the Ahmedabad Asset are spread over three districts covers:

- Four Taluka of Ahmedabad District
- Three Taluka in Gandhinagar District
- Seven Taluka of Kheda District

Regulatory Framework

As per the Schedule attached to the EIA Notification 2006, as amended till date, the proposed project is covered under Project or Activity, 1(b), namely Offshore and Onshore Oil and Gas Exploration, Development and Production. Such activities are also listed as Category A under the said Notification, requiring prior Environment Clearance (EC) from the Impact Assessment Authority (IAA), i.e. the Ministry of Environment and Forests (MoEF), New Delhi.

Project Chronology till Date

1. As part of its EC process, ONGC submitted relevant documents, namely Form-1 (as per the EIA Notification 2006, as amended till date) along with a Pre-feasibility Report and proposed Terms of References (ToRs) for carrying out environmental studies, to the Expert Appraisal Committee (Industrial Projects-2) MoEF (‘EAC, Industry-2’), vide letter No ONGC/CHSE/EC/12 dated 27th February 2012

2. A presentation to the EAC, Industry-2, to finalize the ToR for the EIA study was held during 34th EAC (Industry-2) meeting held during 13th – 14th April 2012 at New Delhi. The EAC, Industry-2 prescribed ToR vide its letter F. No. J-11011/92/2012-IA II (I) dated 13th July 2012.

3. Thereafter ONGC awarded the work of undertaking relevant environmental and other studies required as part of the EC process to Kadam Environmental Consultants (‘Kadam’). Kadam is accredited by the National Accreditation Board for Education and Training (NABET) to undertake EIA and related studies in the onshore oil and gas, exploration, development and production sector, a mandatory requirement for agencies submitting such studies to regulators for the purpose of seeking EC.
4. Kadam undertook the study during the summer season 2013, in accordance with the ToR issued by the EAC-Industry 2 / MoEF and presented the preliminary study findings in its draft report released for the purpose of public consultation as per the EIA Notification.

5. ONGC has applied for extension of validity of TOR and EAC, MoEF has approved the extension in vide their letter dated 1st December 2014

6. Meanwhile, ONGC updated reservoir data in the Gamij field, which comes under Area IV of Ahmedabad Asset. Owing to this updation, Gamij Field which has excellent potential needs to be monetized at the earliest. Due to this fast tracked development, in addition to 52 wells for which ToR has already been received from the MoEF&CC, an additional 268 wells need to be drilled in Gamij field in the foreseeable future. Consequently, total wells in all the fields constituting the proposed project will increase from 138 to 406 wells, hence ONGC has applied for TOR amendment to MoEF and submitted revised Form 1, PFR

Presentation for amendment in TOR was held on 1st December 2014, EAC, MoEF approved the inclusion of additional wells in present study, as they will be drilled in same area and issued ToR amendment vide its letter dated 8/5/2015

Project Description

Location of the Project

Location details are as follows:

- Taluka: Daskroi, Ahmedabad city, Sanand, Dholka, Mansa, Dehgam, Gandhinagar, Kheda, Kathalal, Mehmdbad, Matar, Kapadvanj, Mahudha, Nadiad
- District: Ahmedabad, Gandhinagar and Kheda
- State: Gujarat

The Drilling Process

Drilling operations shall be conducted round-the-clock for 24 hrs. The time taken to drill a well depends on the depth of the hydrocarbon bearing formation and the geological conditions. ONGC intends to drill wells to a depth range from 1200 to 2000 m. This would typically take ~30 - 35 days for each well – however drilling period may increase depending on well depth.

In general, a 17 ½” hole is drilled from the surface up to a predetermined depth and 13 3/8” surface casing is done to cover fresh water sands, prevent caving, to cover weak zones & to provide means for attaching well head & the blowout preventer (BOP). This is followed by drilling of 12 ¼” hole and lowering of 9 5/8” intermediate casing depending upon the depth of the well and anticipated problems in drilling the well. The 8 ½” holes is drilled up to the target depth of the well cased with 5 ½” or 7” production casing to isolate the producing zone from the other formations

In the process of drilling, drilling fluid is used to lift the cutting from the hole to the surface. Drilling fluid is formulated by earth clay and barites. Various types of bio-degradable polymers are also added to maintain the specific parameters of the mud. After completion of production casing the well is tested to determine & analyze various parameters of producing fluid.

Water based mud, that is ecologically sensitive, will be used and all drilling activities will be conducted as per the requirements of the Oilfield and Mineral Development Rules, 1984 as amended till date. Guidelines issued by the Oil Mines Regulation (OMR) will be followed throughout the drilling process.

Workforce Management

There will be no permanent workers camp required for drilling of wells. During the drilling operations, about 15 to 16 persons may be working in 8/12 hour shifts at site. No camping is required at or near the well site. Once drilling is over, no person is required at site, except security cover through a contractor.
Power Requirement

The power requirement for drilling operation, shall be generated by DG sets of 1250 KVA (four nos. out of one which is stand by). Each DG set will consume ~290 liters/hours high speed, low sulphur diesel conforming to Bharat stage IV norms including a sulphur content of <50 mg/kg (0.005%).

Water Requirement

The drilling operation and maintenance of the drill site facilities have various water requirements. The most significant of these requirements in terms of quantity is that for mud preparation. The other requirements would be for engine cooling, floor / equipment / string washing, sanitation, fire-fighting storage / make-up and drinking. Water for emergency firefighting would be stored in a pit of 200 m³ capacity and make-up of the same will have to be made on a regular basis.

The requirement of water expected for sanitation and drinking purposes of the workers shall be insignificantly low in terms of quantity. ONGC will meet the requirement of water at the drilling site through water supplied by tankers and sourced from nearest ONGC installation.

It is anticipated that ~35m³/day water will be required for drilling purposes, out of which 8 m³/day will be recycled during the drilling process. Thus a fresh water requirement of ~27 m³/day.

Waste Water Generation

The drilling operation would generate waste water in the form of wash water due to washing of equipment, string etc. This waste water along with spill over mud will be diverted to waste water mud pit whose bottom would be lined with HDPE sheet so as to avoid percolation of water contaminants in the soil. Approximately 3 m³ per day of waste water will be discharged in HDPE lined evaporation pit. The domestic sewage generated from the drill site operations will be treated in a septic tank–soak pit system. The septic tank is adequately sized to cater to a volumetric capacity of 4–5 m³ per day.

Air Emissions

The emissions to the atmosphere from the drilling operations shall be from the DG set. D.G set will run round the clock during the entire drilling operation.

Solid and Hazardous Waste Management

The drilling rig system to be employed for drilling will be equipped for the separation of drill cuttings and solid materials from the drilling fluid. The drill cuttings, cut by the drill bit, will be removed from the fluid by the shale shakers (vibrating screens) and centrifuges and transferred to the cuttings containment area. Once the drilling fluid / mud have been cleaned it will be returned to the fluid tank and pumped down the drill string again.

It is estimated that 104 MT of formation cuttings and 650 m³ of drilling mud will be generated in the form of solid waste, during the drilling operation.

Drill cuttings and drilling mud will be disposed off in accordance with the Gazette Notification dated 30th August 2005 - G.S.R 546 (E), Section C ‘Guidelines for Disposal of Solid Waste, Drill Cuttings and Drilling Fluids for Offshore and Onshore Drilling Operation’. Under these guidelines:

- Drill cuttings separated from Water Based Mud (WBM) will be properly washed and unusable drilling fluids will be allowed to evaporate in a HDPE lined pit. In case the drill cuttings have oil and grease level in excess of 10 grams/kg, these will be sent to a GPCB authorized Treatment, Storage and Disposal Facility (TSDF).
- WBM will be re-used at the next drill site where feasible. If this is not feasible, the WBM will be disposed off in a HDPE lined pit or sent to a GPCB authorized TSDF for disposal.
- Waste oils generated during the drilling process, if any, will be sent to authorized reprocessors or incinerated at a GPCB authorized TSDF.
Description of the Environment
Baseline environmental studies were carried out during summer season 2013, during the non-monsoon season, as per the TOR received from the EAC-Industry 2 / MoEF.

Study Area
The study area covers a distance equal to 10 km from the nearest field boundary for each field (as prescribed by the ToR).

Landuse of the Study Area
A recent satellite image for the study area was collected using Google Earth Pro. The image was interpreted through manual supervised classification based on National Remote Sensing Agency (NRSA) classifications. Ground truthing was done to confirm and edit the interpreted landuse / land cover classes.

The key landuse land cover classes identified during the study have been provided in the report and are reproduced in Table 1.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Primary Classification</th>
<th>Secondary Classification</th>
<th>Area, Secondary Class (Ha.)</th>
<th>Area, Secondary Class (~km²)</th>
<th>Area, Primary Class (Ha.)</th>
<th>Area, Primary Class (~km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Built-up Land or Habitation</td>
<td>Residential / Commercial</td>
<td>43920.68 439.21 7.30</td>
<td>53531.5 535.32 8.89</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industrial</td>
<td>9610.82 96.11 1.60</td>
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<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>Agricultural Land</td>
<td>Crop Land/Fallow Land</td>
<td>435257 4352.57 72.31</td>
<td>441803.64 4418.04 73.4</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plantations</td>
<td>6546.64 65.47 1.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Wastelands</td>
<td>Land without Scrub</td>
<td>9296.6 92.97 1.54</td>
<td>10775.08 107.75 1.79</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Muddy Area</td>
<td>142 1.42 0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sandy Area</td>
<td>1336.48 13.36 0.222</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Water Bodies</td>
<td>Reservoir / Lakes / Ponds / Tanks</td>
<td>5395.68 53.96 0.90</td>
<td>13260.68 132.61 2.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rivers</td>
<td>7865 78.65 1.31</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Scrub</td>
<td>42334.06 423.34 7.03</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td>Vegetation Cover</td>
<td>Open Vegetation</td>
<td>38020.5 380.21 6.32</td>
<td>82586.85 825.87 13.72</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Close Vegetation</td>
<td>2232.29 22.32 0.37</td>
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</tbody>
</table>

The main landuse / land cover class in the area is Agricultural Land, with a ~73.4% component of the total landuse. Others (due to Vegetation Cover) come next with ~26.6% followed by Built-up Land or Habitation, Water Bodies and Wastelands.

Climatology
The climate of the study area is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season from March to middle of June. The period from middle of June to September is the southwest monsoon season. October and November constitute the post-monsoon or retreating monsoon season1.

- Mean average temperature recorded during study period was 31.5 °C with mean maximum temperature of 39.3°C and mean minimum of 25.1°C.
- Predominant wind direction during study period is observed to be from West direction.

1 District Gazetteer,
- Mean average wind speed was observed to be 9.9 km/hr.
- The mean average relative humidity recorded was 39.3% with mean maximum humidity of 58.2% and mean minimum of 21.1%.
- There was no rainfall recorded during the study period

**Ambient Air**

Ambient air quality monitoring was carried out during summer season 2013. The ambient air quality monitoring stations were set up at 10 different locations.

- The average concentration of PM$_{2.5}$ recorded at 10 locations ranged from 34 µg/m$^3$ (Vansoli & Naika villages) to 43 µg/m$^3$ (Visat Village). All these values are within the specified limit of CPCB (60 µg/m$^3$).
- The average concentration of PM$_{10}$ recorded at 10 locations ranged from 63 (Vansoli & Naika villages) to 82 µg/m$^3$ (Visat Village). All these values are within the specified limit of CPCB (100 µg/m$^3$).
- The average concentration of SO$_2$ were found in range from 8.0 µg/m$^3$ (Khanpur, Itadara and Manipur Villages) to 9.6 µg/m$^3$ (Sarkhej Village) All these values are within the specified limit of CPCB (80 µg/m$^3$).
- The average concentration of NO$_X$ were found in range from 11.3 µg/m$^3$ (Vanch and Manipur Villages) to 21.5 µg/m$^3$ (Visat Village) All these values are within the specified limit of CPCB (80 µg/m$^3$)

**Noise**

Noise levels were recorded at 45 different locations within the study area.

- Noise level during day time was observed to be in range of 49.6 dBA (Vinjhol & Nenpur village) to 58.50 dBA (Koba Village). Noise level during day time at most of the locations was observed within the CPCB standards for residential area (55 dBA).
- Night time Noise level was in range of 45.2 dBA (Kathwada Village) to 50.3 dBA (Randheja Village).

**Soil**

Soil samples were collected from 18 locations within the study area.

- The soil analysis data reveal that porosity ranged from 39 % (Devkaran na Muvada village) to 56% (Vasna Rathod villages), water holding capacity varied from 39.33% (Sarkhej-16 villages) to 70.72% (Matarvillage) and permeability ranged from 6.96 ×10$^{-5}$ cm/sec (Matar village) to 3.61×10$^{-4}$ cm/sec (Navagam village). These physical parameter of soil indicate that soils of Ahmedabad, Gandhinagar are having good physical conditions, while that of Kheda District though have high water holding capacity the permeability is minimum due to high salinity and Sodicity.
- The Electrical Conductivity of soils ranged from 0.156 ds/m (Khanpur village) to 1.9 ds/m (Halisha village) indicating that soil are normal to highly saline, whereas crop quality is greatly hampered.
- From the soil analysis results it is observed that majority of the area soils are normal but in Kheda District soils are highly saline which need a meliorating measure of providing drainage facility. In case of laying out pipe-line for carrying Oil and gas precaution need to be kept aside and filled last after laying out pipe line, which will help in restoring original soil fertility.
Surface Water Quality
Surface water samples were collected from 13 different locations within the study area and analyzed for parameters mentioned in IS 10500:1991:

- pH of sample was found to vary from 6.84 (Nayaka) to 8.41 (Unarsad). All samples were within the permissible limit (6.5 to 8.5).
- TDS of sample was found to vary from 512 mg/l (Mahudha Village) to 2836 mg/l (Nayaka Village). TDS in all samples were below the permissible limit (2000 mg/l) except Unarvasad and Nayaka.
- Electrical conductivity in all samples was found to vary from 828 µmoh/cm (Kalol) to 4000 µmoh/cm (Nayaka Village).
- Total Hardness of all samples was found to vary from 180 mg/l (Mahudha Village) to 680 mg/l (Nayaka Village). Total Hardness of all samples was below the permissible limit (600 mg/l) except at Nayaka.
- Total Alkalinity of all samples was found to vary from 20 mg/l (Nayaka Village) to 310 mg/l (Unarvasad Village). Total Alkalinity of all samples was below the permissible limit (600 mg/l).
- Magnesium content of samples was found to vary from 54 mg/l (Navagam Villages) to 344 mg/l (Nayaka Village). Magnesium in all samples was below the permissible limit (100 mg/l) except Unarvasad, Nardipur, Kalol, Nayaka, Khanpur and Mahudha.
- Iron in all samples was below the permissible limit (1.0 mg/l).
- Total coliforms and fecal coliforms are exceeding the permissible limit at all locations.

Based on the analyzed parameters, it is recommended that water of these ponds should not be used for drinking purpose.

Ground Water Quality
Analysis of collected samples revealed that all other parameters are within the permissible limit except TDS which is exceeding the permissible limit at Nayka and Vatva which may be due to formation salinity.

Biological Environment
The list of floral species is prepared based on visual observation during site visit and through review of site literatures and secondary data available with various government offices is referred for identifying rare or endangered species in the region.

No rare or threatened faunal species are present at the proposed site and surrounding area except Pavo cristatus (Indian peafowl) (Schedule I) was observed in study area.

Ahmedabad District
Total 5 genera of phytoplankton were observed in the study area in which Navicula sp. was recorded in maximum stations (4) and Merismopedia sp. was present only in one station. Maximum cell counts of phytoplankton were recorded at Bidaj Village River (Khari – Down Stream) whereas lowest cell counts of phytoplankton were recorded at Bareja Village Pond.

Total 6 genera of zooplankton were observed in entire sampling locations. The highest population of zooplankton was recorded at Barejadi Village pond whereas lowest at Bareja Village Pond. Among fresh water benthos, 6 major groups were observed in entire sampling locations. Oligochaetes were more dominant and present in all stations. Maximum populations were recorded in Virdi Village River (Sabarmati – Down Stream) and minimum were recorded in Barejadi Village pond. As in population, the same result was reflected in biomass estimation.

Among fish community Guppy fish (Poecilia reticulata) was observed in this the pond.

Kheda District
Total 4 genera of phytoplankton were observed in the study area in which Navicula sp. was recorded in maximum (4) stations and Scenedesmus sp. was recorded only in station 3. Maximum cell counts...
of phytoplankton were recorded at Mahudha Village Pond whereas lowest cell counts of phytoplankton were recorded at Salun Village Pond. 

Total 4 genera of zooplankton were observed in entire sampling locations in which Daphnia sp. was present in maximum (4) stations and Branchionus sp. was present in minimum (1) station. The highest population of zooplankton was recorded at Nani Khadol Village River whereas lowest at Salun Village Pond. 

Among fresh water benthos, 3 major groups were observed in entire sampling locations. Oligochaetes were more dominant and present in all stations except Station 1. Maximum populations were recorded in Nani Khadol Village River and minimum were recorded in Salun village pond. Maximum biomass was recorded in Navgam village pond and minimum biomass was recorded in Salun village pond.

**Gandhinagar District**

Total 5 genera of phytoplankton were observed in the study area in which Navicula sp. was recorded in maximum (4) stations and Tetraedron sp. was recorded only in one station. Maximum cell counts of phytoplankton were recorded at Naridpur Village Pond whereas lowest cell counts of phytoplankton were recorded at Uvarsad Village Pond. 

Total 4 genera of zooplankton were observed in all sampling locations in which Cyclops sp. was major dominant groups in four locations and Trichocerca sp. was recorded only in one station. The highest population of zooplankton was recorded at Lavad Village pond whereas lowest at Near Bahiyal Village Pond. 

Among fresh water benthos, 4 major groups were observed in entire sampling locations. Oligochaetes were more dominant and present in all stations. Maximum populations were recorded in Uvarsad village pond and minimum were recorded in Mirapur village pond. In contrary, maximum biomass was recorded in Near Bahiyal village (Narmada main canal) and minimum biomass was recorded in lavad village pond.

**Anticipated Environmental Impact Identification, Prediction and Mitigation**

**Ambient Air**

A number of sources are there to cause potential impacts on air quality, which are as follows:

- Emissions from DG sets used as part of the drilling rig;
- Flaring of gases primarily during the testing phase will contribute to additional air pollution;
- Fugitive emissions during site preparation and closure phases;
- Emissions from vehicular movement;

Impacts of emissions from DG sets on the GLC at various distances were predicted using the AERMOD software based on type of fuel (HSD). Maximum 24 hourly average GLC's are observed to be 0.5433 µg/m³, 58.4 µg/m³ and 0.5433 µg/m³ for SO₂, NOₓ and Particulate matter respectively at distance of 100 m from the source in ENE Direction.

The predicted impact level due to the operation of DG set is within the limit prescribed in National Ambient Air Quality Standards.

The mitigation measures for air quality impacts are:

- Blow out preventer of sufficient capacity will be installed at well head during drilling operation;
- The exhaust of the DG set will be at sufficient height to allow dispersion of the pollutants and DG sets will be properly maintained so that emissions will be under statutory limits;
- The flaring system will be properly managed at all times;
- Location of the flare stack will be decided in accordance with the Oil Mines Regulation Rules, 1984 (Chapter 9, Section 96 – Protection against Pollution of Environment), a flare stack of minimum 9
m height will be provided at the site taking into consideration nearest habitations, campsite location and prevailing wind direction;

- Water spraying will be done on the access roads to control re-entrained dust during dry season (if required);
- The engines and exhaust systems of all vehicles and equipment used in this project will be maintained as such, that exhaust emissions are low and do not breach statutory limits set for the concerned vehicle/equipment type;
- Ensuring the availability of valid Pollution Under Control Certificates (PUCC) for all vehicles used on site.

Noise Environment

The proposed drilling operations and related activities will lead to emission of noise that may have significant impact on the surrounding communities in terms of increase in noise levels and associated disturbances.

Following activities would result in increase in noise level

- Noise from rig and associated machinery
- Noise from vehicular movement
- Noise from DG sets

Mitigation measures for noise will include the following:

- Sufficient engineering control during installation of equipments and machineries (like mufflers in DG sets) is to be ensured to reduce noise levels at source;
- Proper and timely maintenance of machineries and preventive maintenance of vehicles is to be adopted to reduce noise levels;
- All noise generating operations, except drilling is to be restricted to daytime only to the extent possible;
- Personnel Protective Equipments (PPE) like ear plugs/muffs is to be given to all the workers at site and it will be ensured that the same are wore by everybody during their shift;

Surface Water /Ground water

Quantity

It is estimated that a total of ~35m3/day water will be required for drilling purposes at start of the drilling, out of which 8 m3/day will be recycled back. Thus a fresh water requirement of ~27 m3/day. The water requirement is on a short term basis i.e each well will required water during drilling phase only, for drilling and domestic consumption which would be for a month.

\[
(406 \text{ wells} \times 27 \text{ KLD per well } \times 30 \text{ Days}) + (406 \text{ wells} \times 8 \text{ KL recycled water required first time}) = 332108 \text{ KL (for total program)}
\]

Quality

Wastewater discharged from the drilling/other operations shall be collected in HDPE lined pit for evaporation. Waste water generated from domestic activities will be treated in a septic tank–soak pit system. The septic tank is adequately sized to cater to a volumetric capacity of 4–5 m³ per day.

Following mitigation measures will be implemented for water pollution control:

- Efforts will be made to reduce water requirement;
- Proper treatment of discharged wastewater will be made by disposing waste water in an impervious HDPE lined pit for evaporation;
- The domestic waste water will be discharged into the soak pits;
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- All chemical and fuel storage areas will have proper bunds so that contaminated run-off cannot meet the storm-water drainage system;
- ONGC will ensure proper spill control at site
- ONGC will use best engineering technique during drilling operation and also during the cementing job and installation of casing so that drilling mud does not contaminate the ground water

Land

Impact on land environment, due to site preparation shall be loss of vegetation or change in land use from agriculture/scrub land/open vegetation/plantation to industrial land use for total 406 wells.

Mitigation measures

- Necessary efforts will be made during selection of drill site to minimize disruption of current land use to the extent possible;
- On completion of works (in phases), all temporary structures, surplus materials and wastes will be completely removed;
- Temporary new approach roads can be constructed and existing roads may be improved, if required, for smooth and hassle free movement of personnel as well as materials and machineries;

Soil

- During site preparation the topsoil will be removal of from the project site and the approach road, which contains most of the nutrients and organisms that give soil productivity. This will in turn result in minor changes of topsoil structure
- Soil quality may be affected by setting up of rig and associated machinery and will continue till the site is restored to its original condition
- Contamination of soil can result from the project activities if certain operations like storage of chemicals and fuels, cement and mud preparation, spent oil and lubricants are not managed efficiently
- Improper storage of drilling waste and return/unused drilling mud at the on-site waste disposal facility can also result in contamination of the soil

Mitigation measures

- Store, preserve and protect topsoil separately to use it during restoration period; and domestic waste
- Carry out adequate restoration of soil at the drilling site, to the extent possible using the soil stored from piling and excavation activities;
- Dispose drilling mud and drill cutting temporarily in an impervious HDPE lined pit for evaporation carefully so that there is no spillage.
- The drilling rig system to be employed for drilling will be equipped for the separation of drill cuttings and solid materials from the drilling fluid. The drill cuttings, cut by the drill bit, will be removed from the fluid by the shale shakers (vibrating screens) and centrifuges and transferred to the cuttings containment area and will be disposed off in accordance with Notification dated 30th August 2005 - G.S.R 546 (E);
- Management of spilling of contaminants such as oil from equipments, cement, drilling mud, and etc. on the soil;
- Proper arrangement of soak pits provided at the drilling site for disposal of ~1KLD water per well;

Socio Economic

The proposed drilling project will have positive impact on socio economic status of the area due to
• Generation of indirect employment in the region due to the requirement of workers, supply of raw material, auxiliary and ancillary works, which would marginally improve the economic status of the people.
• Result in an increase in local skill levels through exposure to activities.
• As the existing loose / soft surface roads, shall be upgraded to facilitate the movement of the heavy equipment required, the project in turn would lead to improvement in transport facilities.
• As well as CSR activities carried out by ONGC will improve facilities in the area.

Flora and Fauna

Possible Biological Impacts of proposed Project

• Impact on terrestrial fauna due to noise
• Project infrastructure and well development may disturb agriculture land near site.
• Drilling fluids, spillage, leakage and well treatment may produce chemical spillage which will disrupt agriculture of nearby farm
• Drilling activity may increase deposition of dust and dust settling on the vegetation may alter or limit plants’ abilities to photosynthesize and/or reproduce

Mitigation Measures

• Flaring will be done through a vent as per OMR standard to minimize effect on nocturnal avifauna.
• Acoustic enclosure shall be provided to D.G. set to reduce the noise intensity during the drilling operation
• Since, the activity is temporary wastewater discharged from the drilling operations shall be collected in HDPE lined collection pit
• There is no ecologically important area (e.g. National Park, Sanctuary) in the 1 km radius of well location so impact on such areas is not expected.
• ONGC will develop and implement a spill management plan if required.
• Use existing facilities (e.g. Access Roads) to the extent possible to minimize the amount of new disturbance
• Avoid use of unnecessary lighting at night to avoid attracting avifauna

Occupational Health and risk to surrounding community

• Site preparation, drilling and post drilling activities involve many occupational health hazards to the workers at site.
• Noise generated during drilling operation may affect the workers and staff members
• Handling of chemicals, fuel, may cause health hazard if not handled properly
• Uncontrolled flow of hydrocarbon or other fluids during blow out may cause serious health injuries including fatality of workers as well as surrounding communities

Mitigation measures

• As per ONGC policy period medical checkup would be carried out in two stages which include clinical examination and laboratory test if required
• During site preparation proper care would be taken by ONGC, proper PPE will be provided to site workers and staff members
• Site preparation work will be carried out during day time only
• Acoustic enclosures will be provided to DG sets and other noise generating equipment
• ONGC will develop and implement a spill management plan to prevent risk of spill which may cause health problem
• Blow out preventer of sufficient capacity will be used to mitigate risk of blow out
• Impervious HDPE lined pit of sufficient depth will be provided for storage of waste water to prevent risk of contamination of immediately surrounding area

Additional Studies

Hazard Identification and Consequence Assessment
Hazards are identified for release of HSD from storage tank at drilling site. Consequence analysis of all possible containment scenarios was carried out using DNV Technica Software (PHAST).

Result of Consequence Assessment
The result of consequence analysis indicates that the risk contours for fatality are confined within the drilling site only.

Disaster Management Plan

The development of a DMP is to ensure effective control of an emergency to minimize loss to human life and property. First objective of a DMP is to save human life and then comes minimizing damage to property. The DMP describes the role and responsibilities of various authorities under the emergency organization. Specifically, the DMP contains the following:

• Major emergencies likely to happen
• Prevention plan of an impending emergency by control of incidents;
• Internal emergency reporting and communication system;
• Offsite plan components;

It is recommended that the DMP be integrated into the actual operations prior to commencement of project work. Mock drills should be conducted at periodic intervals to check the efficacy of the DMP. ONGC has well developed DMP/ERP integrated with district and national level Disaster Management Plans.

Project Benefits

The project benefits are summarized as follows:

• New oil/gas finds in the asset will lead to reduction in India’s dependence on imported crude oil and thereby result in considerable savings in foreign exchange.
• There will be a beneficial effect of a flourishing production unit that will directly and indirectly boost the living standards of the people, save foreign exchange and with increase in industrial activities, create more jobs in the local economy.
• The activities would result in an increase in local skill levels through exposure to drilling technology.
• In the event of discovery of commercial quantity of hydrocarbon reserves, more long-term employment opportunities shall be created. Besides, the hydrocarbons brought to the surface shall help in contributing the ongoing efforts of the government to meet the national demand of petroleum resources.
• Development of ancillary activities resulting into indirect jobs and skills of local manpower.

Environmental Management Plan (EMP)
The EMP provides a delivery mechanism to address potential adverse impacts, to instruct contractors and to introduce standards of good practice to be adopted for all project works. For each stage of the programme, the EMP lists all the requirements to ensure effective mitigation of significant biophysical and socio-economic impacts identified in the EIA. The EMP covers the following:

- Role of ONGC and its contractors;
- A comprehensive listing of the mitigation measures (actions) that ONGC will implement;
- The parameters that will be monitored to ensure effective implementation of the action;
- The timing for implementation of the action to ensure that the objectives of mitigation are fully met.

Expenditure on Environmental Matters

- The one-time expenditure for environmental management and mitigation is estimated to be Rs. 3, 81,530 per well.

Environmental Mitigation

The drilling program will be designed to avoid or minimize impacts to the environment and local communities wherever practicable & desirable. Where residual impacts remain, which may have moderate or significant effects on the environment, mitigation measures have been described in EIA (Chapter 5) which will either reduce the impact to an acceptable level or adequately offset it. Some major mitigation measures are:

- Disposal of drill cuttings and drilling mud as per G.S.R. 546 (E) point no C "Guidelines for Disposal of Solid Waste, Drill Cutting and Drilling Fluids for Offshore and Onshore Drilling Operation";
- Acoustic insulation of Diesel Generating Sets;
- Controlling air emission from Diesel Generating Sets to limiting values as per NAAQS, 2009;
- Post-project restoration of site.

Environmental Monitoring

The following will be monitored on a regular basis during Drilling operation to ensure a high level of environmental performance being maintained:

- Chemicals used in drilling fluid make up;
- Fluid losses;
- Post project sampling and effect on baseline data generated during preparation of EIA report
- The general effectiveness of pollution control measures shall also be monitored

Conclusions

The study brings out the following points:

- The sources of air emissions include diesel generator sets, flaring of natural gas at drilling site during well testing and emission from DG set run during power failure at EPS. It was observed that the ambient air quality due to proposed activities is not expected to cause an effect on vegetation and human settlements in the vicinity of the sites.
- The noise generated due to the diesel engines operating the rig along with the mud circulation system is considered to be significant in the vicinity of the noise generating equipment only. This can be mitigated satisfactorily by the workers wearing ear protection while working. This noise is temporary and lasts for a short period.
• The proposed drilling activities shall generate indirect employment in the region due to the requirement of workers in supply of raw material, auxiliary and ancillary works, which shall marginally improve the economic status of the people.

• The hardening of existing loose/soft surface roads to facilitate the movement of the heavy equipment required for drilling shall lead to improvement in transport facilities / infrastructure in the area.

• In the event that commercial quantities of hydrocarbon reserves are discovered, more long-term employment opportunities would be generated. Besides, the hydrocarbons brought to the surface shall help in contributing the ongoing efforts of the government to meet the national demand of petroleum resources.

• The risk of occupational hazards, personal injuries, accidents during rig building and operation shall be very less as safety measures shall be adequately implemented by ONGC.

Thus, it can be concluded on a positive note after the implementation of the mitigation measures as suggested in EMP/DMP, the proposed activities of ONGC shall have overall beneficial impact on local population.