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## **Executive Summary**

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### **1.0 Introduction**

Oil India Ltd. (OIL) has been playing an important role to meet the energy requirements of the country. The rising population and the consequent increase in demands of petroleum products have put a lot of pressure on OIL. Despite the best effort of different petroleum companies and OIL, the country has to import oil from the international market. The Government of India gives emphasis for the exploration activity. It is expected that the continuing initiative for exploration by OIL in the MN-ONN-2000/1 block of Mahanadi Basin will meet the challenge partially.

If MN-ONN-2000/1 block is successful, it will ease the pressure to some extent, on the nation to import crude oil. At present, India's demand for petroleum products is growing at a rapid rate and it would reach a level of 155 MMT by 2006-2007. With a view to meet this growing demand, the exploration activities are accelerated on land as well as in deep waters. Considering the current demand and supply, the level of self-sufficiency is likely to decline to about 30% over the next few years. Therefore, substantial efforts are needed to boost the level of exploration activity so that new finds can be made and the production of crude oil & gas can be significantly raised in the years to come.

Oil India Ltd. (OIL) alongwith its Joint Venture Partners viz. ONGC, GAIL & IOC has been awarded an exploration block MN-ONN-2000/1 in Mahanadi Basin of Orissa State under New Exploration Licensing Policy (NELP) of the Government of India. In support of the long-term hydrocarbon exploration program, OIL intends to drill one exploration well within the Block.

Further exploratory drilling may be performed depending on the results of the initial drilling program and on the results of other geological evidences in the block.

### **1.2 Project Setting**

Block (MN-ONN-2000/1) falls within the Mahanadi Basin of Orissa and encompasses an area of 7900 sq. km. The block includes a major township in Cuttack district located on the Kolkata-Bhubaneshwar highway in Orissa.

This circle block extends from west of Kendupatana and east of Katikata village. Sadhupur village is 7 km away village Katikata. Nemalo village is in

southwest direction from well location Sadhupur. The block falls partly in the Orissa tectonic block and mainly in the Mahanadi Basin.

### 1.3 Objectives of Risk Assessment Study

The objectives of the Risk Assessment are as follows:

- ◆ Identification of vulnerable zones in the drilling area
- ◆ Estimation of hazard distances for the Maximum Credible Accident scenarios
- ◆ Suggestions for risk mitigation measures and delineation of approach to Disaster Management Plan (DMP)

### 1.4 Scope of Work

The scope of the present report is to carry out risk assessment of offshore well. Standard industry practices of risk assessment were considered in the project.

The hazard potential of various fuels/chemicals and estimation of consequences in case of accidental release are the issues of immediate relevance to be considered. It is therefore, imperative to carry out MCA analysis (termed as Rapid Risk Assessment) at the first stage, which identifies vulnerable areas of the facility and suggests a set of recommendations for improved safety.

Oil India Limited, (OIL) retained National Environmental Engineering Research Institute (NEERI), Nagpur to undertake Risk Assessment Study for their proposed offshore wells.

The work undertaken consists of the following stages:

- ◆ Collection of relevant data on well
- ◆ Damage distance computations

Maximum Credible Accident analysis is carried out to arrive at the hazard distance for the worst case scenario. The consequences of all the scenarios are computed and hazard distances are worked out and listed for flammable materials and possible explosion effects.

Risk mitigation measures, based on MCA analysis and engineering judgements are suggested in order to improve overall system safety.

## 2.0 Drilling Process

Drilling of oil / gas wells employs mobile drilling rig. The drilling rig consists of a derrick at the top of which is mounted a crown block. A hoisting block having a hook is suspended from the crown block and a swivel is attached to the hosting block by its shackle. From the swivel a tube of square section is suspended, which is called “kelly stem”. The kelly stem is passed through a square hole in horizontal rotary table which is driven by electric motor.

### 2.1 Exploration Plan for MN-ONN-2000/1 Block

Oil India Ltd. (OIL) alongwith its Joint Venture Partners viz. ONGC, GAIL & IOC has been awarded an exploration block MN-ONN-2000/1 in Mahanadi Basin of Orissa State under NELP-II. None of these locations occur within the coastal regulatory zone. Final well locations within these polygons has been selected & stacked by the operator. In general the wells will be located avoiding dwellings, minimizing interferences with agricultural activities, community infrastructure and avoiding disturbances to forested lands and otherwise sensitive or unique habitats. Habitat with potential to support flora and fauna (including fisheries) with special conservation status or of local socio-economic importance shall be avoided.

The well shall be logged and proposed to be drill stem tested. Water based drilling mud will be used. If potential oil and or gas reserves are observed then the well shall be cased with production casing. After confirming casing integrity and cement bonding, the well shall be temporarily abandoned for future completions. Depending on the success of exploratory drilling program and results of other geo-scientific evidences OIL may seek permits to drill additional exploration wells within this Block. In the event of commercial discovery it is expected that OIL would proceed with planning and application for approval to construct potential pipeline and hydrocarbon processing facilities though the exact nature and location of these facilities cannot be predicted at present.

## 3.0 Maximum Credible Accident Analysis

MCA stands for Maximum Credible Accident or in other words, an accident with maximum damage distance, which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. In practice, the selection of accident scenarios for MCA analysis is carried out on the basis of engineering judgement and past accident analysis.

### **3.1 Consequence Analysis**

Quantification of the damage can be done by means of various models, which can then be translated in terms of injuries and damage to the exposed population and buildings.

Oil and gas may be released and result into jet fire & less likely unconfined vapour cloud explosion causing possible damage to the surrounding areas. The extent of the damage depends upon the nature of the release. The release of flammable material and subsequent ignition results in heat radiation, pressure wave or vapour cloud depending upon the flammability and its physical state.

### **3.2 Results and Discussions**

#### **3.2.1 Consequence Analysis of Wells**

Accidental scenarios visualised for the consequence analysis of wells considering operating pressures greater than atmospheric are jet fire for well blowout scenario.

#### **3.2.2 Well Blowout**

The release of well fluid due to well blowout can lead to a jet fire if the released gas ignites immediately since the operating pressure is very high. Length of jet flame and heat load generated by the flame depends upon the mass flow rate of released material.

The damage distances due to well blowout are computed for the hole diameter of 26". The damage distance for heat load of 4 kW/m<sup>2</sup> as 1051.02m, 1015.54m and 978.40m for stability class 2F, 3D and 5D respectively. Similarly, the damage distances for 12.5 kW/m<sup>2</sup>, and 37.5 kW/m<sup>2</sup> were also computed as shown in

**Table 3.6**

## **4.0 Risk Mitigation Measures**

### **4.1 Risks to Personnel**

#### **Risks to Personnel**

Good safety management, strict adherence to safety management procedures and competency assurance will reduce the risk. Safety practices are needed to carry out jobs safely and without causing any injury to self, colleagues and system.

For total safety of any operation, each team member must religiously follow the safety practices / procedures pertaining to respective operational area. If

every team member starts working with this attitude, zero accident rate is not a distant dream.

Any operation is a team effort and its success depends upon the sincerity, efficiency & motivation of all team members. Safety in such operations is not a duty of a single person, but it is everyone's job.

Use of protective fireproof clothing and escape respirators will reduce the risk of being seriously burnt. In addition, adequate fire fighting facilities and first aid facilities should be provided, in case of any emergency.

## **4.2 Specific Recommendations**

### **4.2.1 Wells**

- ◆ Proper insulating joints should be provided on well head
- ◆ Co-ordination with local authorities, such as port, police, fire, ambulance, nearby industries should be ensured to meet any eventuality
- ◆ The well should be physically inspected regularly

## **5.0 Disaster Management Plan**

Some of the major disasters occurred at Bhopal, Mexico and other parts of the World in last few decades, have made people all over the world concerned about the dangers of chemical accidents. Occurrence of such accidents makes it essential for the Central and State Government agencies as well as the local authorities to be prepared to help mitigate the sufferings and assist during eventualities resulting from any unfortunate occurrence of chemical accident.

### **5.1 Objectives of Disaster Management Plan**

In order to be ready to face adverse effects of accidents caused by hazardous substances, a Disaster Management Plan (DMP) will be prepared, as required under the Acts and Rules (Manual on Emergency Preparedness for Chemical Hazards, MoEF New Delhi). This will be prepared prior to commissioning of sections and approval of competent authority. Similarly an Emergency Preparedness Plan will be formulated and approval of competent authority will be obtained prior to commissioning of facilities.

### **5.2 Disaster Management Plan: Key Elements**

Following are the key elements of any Disaster Management Plan:

- ◆ Basis of the plan
- ◆ Accident prevention procedures/measures
- ◆ Accident/emergency response planning procedures
- ◆ Recovery procedure

### **5.3 Approach to Disaster Management Plan**

“Disaster” is an extremely rare major emergency / accident having high potential which can cause damage to human life / property arising suddenly either due to natural causes or due to human activities. It is necessary to foresee the possible hazardous situation and be in a state of readiness to prevent / minimize the adverse effects.

This includes recommendation on:

- ◆ Accident prevention procedures
- ◆ Response system
- ◆ Safety awareness
- ◆ Fire fighting system.