RISK ASSESSMENT

1.1 INTRODUCTION

As discussed in EIA/EMP report, ONGC proposes to conduct Development Drilling in Nambar, Khoraghat, Khoraghat Extension and East Lakhibari ML areas in Golaghat district and Borholla ML area in Jorhat district of Assam State. This chapter elucidates the Risk Assessment (RA), Disaster Management Plan (DMP) and Emergency Response Plan (ERP) for the proposed development wells.

1.2 RISK ASSESSMENT

'Risk Assessment (RA)' also known as 'Hazard Analysis' and 'Vulnerability Assessment' is a procedure for identifying hazards and determining their possible effects on a community and environment. Risk or hazard by itself is not an event - it is the potential for an event.

Drilling rig floor is the centre stage of all the drilling operations and it is most susceptible to accidents. Safety precaution with utmost care is required to be taken during drilling as per the prevailing regulations and practices so that accidents can be avoided. Due to advancement in technology, number of equipments has been developed over a period to cater the need of smooth operation on a rig floor. Various standards are required to be referred to cover the variety of equipments used for safe operation in drilling and it is desirable to use a properly prepared manual for occupational safety while working or drilling over a rig. It may, however, be noted that well testing and production testing of hydrocarbons also require proper analysis of hazards involved in production testing operations and preparation of an appropriate Emergency Control Plan.

Hydrocarbon Operations are generally hazardous in nature by virtue of intrinsic chemical properties of hydrocarbons or their temperature or pressure of operation or a combination of them. Fire, Explosion, Hazardous Release or a combination of these are the hazard associated with Hydrocarbon Operations.

Risk Screening

Some of the hazards associated with the drilling are:

- Fires and Explosions:
  - Non-Process Hydrocarbon Leak (Diesel, Fuel, Oil etc.);
  - Non-Process Fire;
  - Control system failure including electrical failure in control room.
- Impact and Collisions:
  - Accidental Falling of Object from Crown Block.
- Loss of Station Keeping / Loss of Stability:
  - Structural Failure;

- Equipment Failure.
- External Hazards:
  - Failure due to Earthquake, Extreme Weather, Strong Winds, Floods and Sabotage etc.

The primary emphasis in Safety Engineering is to reduce Risk to Human Life and Environment. Some of the more important methods used to achieve this are:

- ***Risk Analysis***: Provides a relative measure of the likelihood and severity of various possible hazardous events by critically examining the proposed drilling and associated activities.
- ***Work Safety Analysis***: The technique discerns whether the project site and operating procedures in practice have any inherent infirmities.
- ***Safety Audit***: Takes a careful look at operating conditions, work practices and work environments to detect unsafe conditions

Together, these three broad tools attempt to minimize the chances of accidents occurring. Yet, there always exists, no matter how remote, that Small Probability of a Major Accident occurring. If the accident involves hydrocarbon in sufficient large quantities, the consequences may be serious to the project, to surrounding area and the population therein.

These have resulted in the development of more comprehensive, systematic and sophisticated methods of Safety Engineering such as Identification and Analysis of Hazards and Risk Assessment to improve upon the Integrity, Reliability and Safety of Hydrocarbon Operations.

1.2.1 Methodology

The RA studies are based on Quantitative Risk Assessment Analysis (QRA). QRA aims to provide a systematic analysis of the major risks that may arise as a result of onshore drilling activities. Normally a three 'levels' risk assessment approach is adopted for the industrial activities. The brief outline of the three tier approach is given below:

A) Level 1 – Risk Screening

This is Top-Down Review of Worst- Case Potential Hazards/Risks, aimed primarily at identifying drilling sites or areas within Blocks, which pose the Highest Risk. Various screening factors considered, include:

- Inventory of Hazardous Materials;
- Hazardous Material Properties;
- Storage Conditions (e.g. Temperature and pressure);
- Location Sensitivity (Distance to Residential Areas / Populace).

The Data/Information is obtained from Site. The results provide a relative indication of the extent of hazards and Potential for Risk Exposure.

B) Level 2 – Major Risk Survey (Semi - Quantitative)

The survey approach combines the Site Inspection with established Risk Assessment Techniques applied both Qualitative as well Quantitative Mode. The primary objective is to identify and select Major Risks at a specific location in the drilling site considering possible soft spots / weak links during construction/operation/maintenance. Aspects covered in the risk usually include:

- Process Hazards;
- Process Safety Management Systems;
- Fire Protection and Emergency Response Equipments and Programs;
- Security Vulnerability;
- Impact of Hazards Consequences (Equipment Damage, Business Interruption, Injury, Fatalities);
- Qualitative Risk Identification of Scenarios Involving Hazardous Materials.

Risk Reduction Measures

Selection of critical scenarios and their potential of damage provide means of prioritizing mitigation measures and allocation of resources to the areas with Highest Risks.

C) Level 3 – Quantitative Risk Assessment (Deterministic)

This is the stage of assessment of risks, associated with all Credible Hazards (scenarios) with potential to cause an undesirable outcome such as Human Injury, Fatality or Destruction of Property. The four basic elements include:

- Hazards Identification utilizing formal approach (Level 2, HAZOP etc.);
- Frequency Analysis: Based on past Safety Data (incidents / accidents), identifying likely pathway of failures and quantifying the toxic / inflammable material release;
- Hazards Analysis to quantify the consequences of various hazards scenarios (Fire, Explosion [due to release of NG], Toxic Vapour Release [due to release of H_2S] etc.). Establish minimum value for damage (e.g. IDLH, Over Pressure, Radiation Flux) to assess the Impact on Environment.
- Risk Quantification: Quantitative techniques are used considering effect / impact due to weather data, population data, and frequency of occurrences and likelihood of Ignition / Toxic release. Data are analyzed considering likely Damage (in terms of Injury / Fatality, Property Damage) each scenario is likely to cause.

QRA provides a means to determine the relative significance of each undesired event, allowing analyst and the team to focus on their Risk Reduction Efforts, which will be most beneficial.

1.2.2 Identification of Hazards in Drilling and Production Testing Operations

Various hazards associated with onshore hydrocarbon drilling and testing operations are briefly described in following sub-sections.

1.2.2.1 Minor Oil Spill

There exists a possibility of Hydrocarbon (gases / oil) getting released due to some unavoidable incidents during the Drill Stem Testing. Spillage may occur from lines,

valves and separator or due to tank failure. Once the flow of Oil / Gas from well is stopped, then on-site access for clean-up is possible.

1.2.2.2 Major Oil Spill

A major spill can arise as a result of an uncontrolled flow from a well i.e. Blowout. Provided that ignition does not take place and the well head is not obstructed the well can be shut in at the wellhead.

1.2.2.3 Blowout

Blowout means uncontrolled violent escape of hydrocarbon fluids from a well. Blowout followed by ignition prevents access to the wellhead and is categorized as a major hazard. Contributors to blowout are:

Primary

- Failure to keep the hole full;
- Mud weight too low;
- Swabbing during trips;
- Lost circulation; and
- Failure of differential fill-up equipment.

Secondary

- Failure to detect and control a kick as quickly as possible;
- Mechanical failure of BOP;
- Failure to test BOP equipment properly;
- Damage to or failure of wellhead equipment;
- Failure of casing; and
- Failure of formation or bond of cementing around casing.

If the hydrostatic head exerted by the column of drilling fluid is allowed to drop below the formation pressure, then formation fluids will enter the wellbore (this is known as a **kick**) and can lead to a potential blowout situation. Fast and efficient action by operating personnel in recognizing the above situations and taking precautionary measure can avert a blowout.

1.2.2.4 Hydrogen Sulphide (H_2S)

Hydrogen sulphide gas (H_2S) is extremely toxic, even very low concentrations can be lethal, depending upon the duration of exposure. Without any warning, H_2S may render victims unconscious and death can follow shortly afterwards.

The Occupational Safety and Health Act (OSHA Regulations) set a 20 ppm ceiling limit and a Peak exposure of 50 ppm for 10 minutes exposure. It has also set a TWA limit of 10 ppm for an eight hourly continuous exposure and 15 ppm STEL limit for 15 minutes (OSHA, 1989).

Important characteristics of H_2S gas are given as below:

- H2S is a colourless gas heavier than air and may accumulate in low lying areas
- It is toxic even in low concentrations
- It has an odour of rotten eggs and may cause loss of sense to smell.
- It occurs together with natural gas in all oil provinces of the world. In characteristic H_2S gas areas concentration above 42% in natural gas have been reported.
- The compressibility factor (Z) is higher than that for natural gas and H_2S will thus expand at rather lower pressures; or further up in the bore hole than natural gas.
- It burns with a blue flame to sulphur dioxide and may form an explosive mixture with air at concentrations from 4% to 46%.
- The safe concentration for a normal working period without protection is 10 ppm (as per the TWA limit set by OSHA).
- It attacks the body through the respiratory organs. The best protection is breathing apparatus, with mask covering the whole face and a bottle containing breathing air.
- It dissolves in the blood and attacks through the nervous system.
- It is very irritating for the eyes as it forms sulphurous acid together with water.
- Coughing, eye burning and pain, throat irritation, and sleepiness are observed from exposure to low concentrations of H_2S.
- Exposure to high concentrations of H_2S produces systems such as panting, pallor, cramps, paralysis of the pupil and loss of speech. This is generally followed by immediate loss of consciousness. Death may occur quickly from respiratory and cardiac paralysis. Short exposure of high tensile steel to as little as 1 ppm in aqueous solution can cause failures. Concentrations greater than 15 ppm can cause failure to steel harder than Rockwell C-22. High stress levels and corrosive environments accelerate failures.

When pH is above 9 and solubility is relatively high, it is readily soluble in mud and especially in oil mud's. A 35% hydrogen peroxide solution will neutralize H_2S gas in the mud or 20 gallons of H_2O_2 per 100 barrels of mud. The effect of H_2S concentration on Living Being/Human Being & Animal is given in **Table 1.1.**

Table 1.1: Symptoms of H_2S as per Concentrations

Concentrations	Symptoms/ Effects
100 ppm	Coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue). Altered breathing, drowsiness after 15-30 minutes. Throat irritation after 1 hour. Gradual increase in severity of symptoms over several hours. Death may occur after 48 hours.
Greater than 100 ppm	Loss of smell (olfactory fatigue or paralysis).
500-700 ppm	Staggering, collapse in 5 minutes. Serious damage to the eyes in 30 minutes. Death after 30-60 minutes.
700-1000 ppm	Rapid unconsciousness, "knockdown" or immediate collapse within 1 to 2 breaths, breathing stops, death within minutes.
1000-2000 ppm	Nearly Instant Death

1.2.2.5 Natural Disaster and Hazards

The proposed drilling locations are falls in very severe intensity seismic zone. It is highly vulnerable to high intensity earthquakes. Dozens of earthquakes are recorded in this region every year. Extreme weather, strong wind and other natural hazards will also pose risk to proposed drilling operations.

1.2.3 Development Drilling in ML Area of Golaghat and Jorhat Districts

The blocks are located in the Borholla ML area of Jorhat district having an area of 32.116 sq. km. and Nambar, East Lakhibari, Khoraghat and Khoraghat Extension ML areas of Golaghat district covering an area of 120.5 sq. km. The geo-graphical co-ordinates of the ML blocks are given in **Table 1.2**.

Table 1.2: Co-ordinates of ML Areas

Block/ ML areas	Boundary Points	Latitude			Longitude		
		Degree	Minutes	Seconds	Degree	Minutes	Seconds
Borholla ML	A	26	29	27.29	94	12	59.72
	F	26	23	4.56	94	10	50.52
	L	26	22	31.85	94	8	3.01
	K	26	23	51.99	94	8	3.01
	M	26	24	8.35	94	9	45.48
	N	26	27	49.15	94	9	12.51
Nambar	N1	26	5	47.57	93	53	12.37
	N2	26	4	46.23	93	56	7.45
	N3	26	4	9.43	93	55	19.34
	N4	26	3	25.27	93	56	3.89
	N5	26	2	31.29	93	55	37.16
	N6	26	2	37.43	93	52	5.45
East lakhibari	1A	26	22	50.45	94	2	55.5
	2B	26	22	5.45	94	4	25.5
	3C	26	21	4.09	94	3	31.5
	4D	26	22	7.2	94	0	54
	1A	26	22	50.45	94	2	55.5
	1A	26	22	50.45	94	2	55.5
	2B	26	22	5.45	94	4	25.5
Khoraghat	1A	26	4	9.43	93	55	19.34
	2B	26	4	46.23	93	56	7.45
	3C	26	4	5.34	93	56	52.89
	4D	26	3	25.27	93	56	3.89

Block/ ML areas	Boundary Points	Latitude			Longitude		
		Degree	Minutes	Seconds	Degree	Minutes	Seconds
	1A	26	4	9.43	93	55	19.34
Khoraghat Ext.	1A	26	5	47.57	93	53	12.37
	2B	26	9	23.07	93	56	6.58
	3C	26	9	12.44	93	59	55.55
	4D	26	2	25.57	93	58	17.54
	5E	26	2	31.29	93	55	37.36
	6F	26	3	25.27	93	56	3.89
	7G	26	4	5.34	93	56	52.89
	8H	26	4	46.23	93	56	7.45
	1A	26	5	47.57	93	53	12.37

The fuel for the drilling rigs, DG sets, other machineries and vehicles will be Diesel (HSD with low sulphur < 0.05%). Daily fuel requirement for diesel sets will be 6 klpd. The HSD will be stored in storage tanks (2 nos.) of 40 kl capacity. The exhaust stacks of the DG sets are likely to vent the emissions. The Bulk Hazardous Chemical Storage Facility at Drilling Site (Tentative) is given in **Table 1.3**.

Table 1.3: Bulk Hazardous Chemical Storage facility at Drilling site (Tentative)

Compound	Stored Quantity
HSD (low Sulphur)	40 kl (2 nos. of Storage Tanks)

1.2.4 QRA Approach

Identification of hazards and likely scenarios (based on Level-1 and Level-2 activities) call for detailed analysis of each scenario for assessment of Damage Potential, Impact Area (may vary with Weather Conditions / Wind Direction) and Safety System in place. Subsequently each incident is classified according to Relative Risk Classification provided in **Table 1.4** below**.**

Table 1.4: Risk Classification

Probability	Description
High (> 1/100)	A failure which could reasonably be expected to occur within the expected life time of the plant. Examples of high failure likelihood are process leaks or single instrument or valve failures or a human error which could result in releases of hazardous materials.
Moderate	A failure or sequence of failures which has a low probability of

Probability	Description
(1/100 to 1/1000)	occurrence within the expected lifetime of the plant. Examples of moderate likelihood are dual instrument or valve failures, combination of instrument failures and human errors, or single failures of small process lines or fittings.
Low (<1/1000)	A failure or series of failures which have a very low probability of occurrence within the expected lifetime of plant. Examples of 'low' likelihood are multiple instruments or valve failures or multiple human errors, or single spontaneous failures of tanks
Nature	**Description**
Minor Incidents	Impact limited to the local area of the event with potent for 'knock – on- events'
Serious Incident	One that could cause: • Any serious injury or fatality on/off site; • Property damage of $ 1 million offsite or $ 5 million onsite.
Extensive Incident	One that is five or more times worse than a serious incident.

1.2.4.1 Damage due to Explosion

The explosion of oil or gas (either a deflagration or detonation) results in a reaction front moving outwards from the ignition source preceded by a shock wave or pressure front. After the combustible material is consumed the reaction front terminates but the pressure wave continues its outward movement. In oil development the likely chances of explosion (due to blow out and consequential release of NG) are very less. Blast damage is based on the determination of the peak overpressure resulting from the pressure wave impacting on the object or structure. Damage estimates based on overpressure are given in **Table 1.5** below.

Table 1.5: Damage due to over pressure

Sl. No.	Overpressure (bar)	Damage
1.	0.04	Loud Noise / sonic boom glass failure
2.	0.15	Typical pressure for glass failure
3.	0.5 - 1	Large and small windows usually shattered
4.	0.7	Minor damage to house structure
5.	1	Partial demolition of houses, made uninhabitable.
6.	2.3	Lower limit of serious structure damage
7.	5 – 7	Nearly complete destruction of houses
8.	9	Loaded train box wagons completely demolished

9.	10	Probable total destruction of houses
10.	200	Limits of crater lip

1.2.4.2 Thermal Incidents/ Fire in Storage Area

The diesel storage on the drilling site is limited to 40 kl of storage tanks (2 nos). Any fire in the tank area if not controlled in time (less chances/ unlikely) may soon spread in the drilling site. During blow out some Natural Gas coming out with some oil can also catch fire. However its thermal radiation impact (1st degree burn) will be limited (as the fuels are stored in remote place).

Minor spill can occur as various scenarios and may also catch fire. If fire is not controlled these can lead to domino effect as major scenarios. During the drilling crude oil, some well water may come out which can be treated and disposed off or pushed back in the non-producing well. The likely impact due to major scenario considered as given below in **Table 1.6**.

Table 1.6: Possible Major Scenarios

S. No.	Scenario	Impact Zone	Remarks
1.	HSD Tank failure, spillage & Fire (~ 5 m Pool fire)	~ 8.5	From edge of pool

The impact due to the above scenarios will be within the rig area. It may have some impact on the nearby vegetation but will not have any impact on local population.

1.2.5 Mitigation Measures

1.2.5.1 Control Measures for Major Hazards

Out of different hazards described in sections 1.2, occurrence of (a) Blowout and (b) Emission of Sour Gas (H_2S) are the two major hazards and (c) HSD spillage/ fire. The first two possible incidents can have built in alarm and preventive measures (as more likely to occur if system fails). The third incident has remote chances and more likely due to some domino effect caused by other incident. Occurrence of H_2S along with oil and gas, if detected in any new well, is the major hazard during production testing of each well. Control measures for occurrence of blowout and Emission or Leakage of H_2S gas are discussed in following sub-sections.

Blowout

The precautionary and control measures used for blowout prevention are discussed below:

A. Precaution against Blowout

(i) The following control equipments for Drilling Mud System shall be installed and kept in use during Drilling Operations to prevent the Blowout:

- A Tank 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 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.

(ii) BOP Drill shall be carried out as per OMR & OISD.

(iii) BOP Control Unit shall be kept available near the well which can be used in case of Emergency to control the Well.

(iv) When Running In or Pulling Out tubing, Full Opening Safety Valve (FOSV) shall be kept readily available at rig floor.

B. Precaution after Blowout

On appearance of any sign indicating the Blowout of well, all persons, other than those whose presence is deemed necessary for Controlling Blowout, shall be withdrawn from the Well.

During the whole time while any work of Controlling a Blowout is in progress, the following precautions shall be taken:

(i) A competent person shall be present on the spot throughout.

(ii) An area within the 500 meters of the well on the down wind direction shall be demarcated as Danger Zone.

- All Electrical Installations shall be de-energized.
- Approved Safety Lamps or torches shall only be used within the Danger Zone.
- No Naked Light or Vehicular Traffic shall be permitted within the Danger Zone.

(iii) A competent person shall ascertain the condition of ventilation and presence of gases with an approved instrument as far as Safety of persons is concerned.

(iv) There shall be available at or near the place, two approved type of self containing Breathing Apparatus or any other Breathing Apparatus of approved type for use in emergency.

(v) Adequate Firefighting Equipment shall be kept readily available for immediate use.

1.2.5.2 Control Measures for H2S Leakage/Emission during Drilling

The following control measures for H_2S will become necessary if presence of H_2S is detected at any new well.

A. H_2S Detection System Presence

A four channels H_2S 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:

- Just above Riser/Flow Nipple
- Shale shaker

The detection system should be connected to an Audio Visual (Siren and Lights) Alarm system. This system should be set to be activated at a concentration of 15 ppm H_2S.

The Mud Logging will have a completely independent Detection System which is connected to an alarm in the cabin. This system will be adjusted to sound an Alarm at a concentration level of 10 ppm H_2S as suggested in the Drilling and Production Safety Code for Onshore Operations issued by The Institute of Petroleum.

A stock of H_2S scavenger will be kept at drilling site for emergency use.

B. Small Levels of H_2S

Small levels of H_2S (less than 10 ppm) will not activate the well site alarms. Such levels do not create an immediate safety hazard but could be a first indication of high levels of H_2S to follow.

H_2S will cause a sudden drop of mud pH. The Mud Engineer/Mud Services will therefore organize and supervise continuous pH checks while drilling. Checks should be as frequent as possible and always made following a formation change.

Following control measures will be taken in case of small level of detection:

- Add H_2S scavenger to mud.
- Check H_2S levels at regular intervals for possible increase.
- Inform all personnel of the rig about the presence of H_2S and current wind direction.
- Commence operations in pairs.
- Render sub base and cellar out-of-bounds without further checking levels in this area.

C. High Levels of H_2S

Higher levels of H_2S (greater than 10 ppm) do not necessarily cause an immediate safety hazard. However some risk does exist and, therefore, any levels greater than 10 ppm should be treated in the same manner. Occurrence of 10 ppm or more H_2S concentration will sound an alarm in the mud logging unit.

If higher levels of H_2S (greater than 10 ppm) are found, following steps will be taken:

- Driller to Shut Down Rotary, pick up Kelly, close BOP and Shut Down Pump.
- One pre-assigned roughneck will go to doghouse and put on breathing apparatus. All other Rig Personnel will evacuate the rig and move in Up-Wind direction to Designated Muster Point.
- Driller and roughneck will return to the rig floor and commence circulating H_2S scavenger slowly and reciprocating pipe.
- The level of H_2S will be checked in all work areas. H_2S Scavenger will be added to the Mud and circulated. If H_2S levels drop, drilling will be continued with scavenger in the mud. Approximately 30 % of hydrogen peroxide (H_2O_2) solution will neutralize H_2S gas in the mud at 20 gallon of H_2O_2 per 100 barrels of mud.

1.2.5.3 Natural Disaster and Hazards

Following measures will be adopted to minimize the risks of Natural Hazards:

- Enactment of building codes and construction standards.
- Adaption of earthquake resistant designing in the establishment of structures and installation.
- Adoption of Emergency Shut Down (ESD) mechanism.
- Implementation of offsite and onsite DMP and ERP.

1.2.5.4 Fire Fighting Facility

Fixed Fire Fighting System as per Oil Industry Safety Directorate (OISD) Standard 189 should be in place.

Fire Water System

- One water tank/pit of minimum capacity of 40m^3 should be located at the Drilling Rig Site.
- For production testing, one additional tank of 40m^3should be provided.
- One diesel engine driven trailer fire pump of capacity 1800 lpm should be placed at the approach area of drilling site.
- One fire water distribution single line with minimum 4 " size pipe/casing should be installed at drilling site with a minimum distance of 15 m from the well.

First Aid Fire Fighting Equipments at Drilling Rig

Portable Fire Extinguisher will be installed as per IS: 2190 on the Drilling Rig. The minimum quantities of fire extinguishers at various locations should be provides as per the following **(Table 1.7)**.

Table 1.7: Fire Extinguishers

Sl. No.	Type of Area	Portable Fire Extinguishers
1.	Drilling Rig floor	2 nos. 10 kg DCP type Extinguisher
2.	Main Engine Area	1 no. 10 kg DCP type Extinguisher for each engine
3.	Electrical motor/pumps for water circulation for mud pump	1 no. 10 kg DCP type Extinguisher
4.	Mud Gunning Pump	1 no.10 kg DCP type Extinguisher
5.	Electrical Control Room	1 no. 6.8 kg CO_2 type Extinguisher for each unit
6.	Mud mixing tank area	1 no. 10 kg DCP type Extinguisher
7.	Diesel Storage Area	1 no. 50 lit mechanical foam
		1 no. 50 kg DCP type Extinguisher
		2 nos. 10 kg DCP type Extinguisher
		2 nos. sand bucket or ½ sand drum with spade

Sl. No.	Type of Area	Portable Fire Extinguishers
8.	Lube Storage Area	1 no. 10 kg DCP type Extinguisher
		1 no. sand bucket
9.	Air Compressor area	1 no. 10 kg DCP type Extinguisher
10.	Fire Pump Area	1 no. 10 kg DCP type Extinguisher
11.	Near Dilling In-charge Office	One fire extinguisher/shed with 3 nos. 10 kg DCP type extinguisher and 2 sand buckets
12.	Fire bell near Bunk House	1 no. 10 kg DCP type Extinguisher

1.2.6 Occupational Health

Occupational hazards associated with onshore drilling include exposure to hazardous substances, noise, vibrations, heavy manual handling activity at the site etc.

At Drill Site qualified doctor is available 24 hrs on the Drilling Rig for the Immediate Treatment and First Aid. For serious injuries and diseases patient is evacuated by the Emergency Vehicles exclusively meant for Emergencies to the Nearest Medical Center.

Health Hazard Control is done by adopting following measures:

- Prioritize the health hazards based on their risk potential.
- Identify specific work groups affected by each hazard.
- Determine the controls required to manage these identified hazards. The cost of each identified control versus benefits of its implementation may be evaluated.
- Develop an action plan identifying work to be done.

The health and hygiene of the personnel working at the Drilling Rig for long period will be monitored through periodic health checks of the persons. All employees undergo a periodic medical examination. The record of the health check-up will be maintained centrally off site in confidential file by the medical section. The medical officer at base recommends appropriate treatment for the persons found to be having any Health Problems requiring attention.

During the proposed Drilling Operations, inspections of cleanliness are carried out. First aid boxes are provided at different strategic locations on the drilling rig. The medical officer on board shall regularly inspect the First Aid Boxes and ensures that their contents are in order. Majority of the employees on the drilling rig are trained in First Aid. Regular Drills and Lectures on First Aid are carried out at the Rig. Occupational Health Surveillance Program is summarized in **Table 1.8**.

Table 1.8: Occupational Health Hazards and Mitigating Measures

Cause of health hazard	Risk	Mitigation Measures
Noise (Generators, Cranes, Rig, Movement of Vehicles, etc)	Hearing loss	Use of PPEs in high noise area and written

Handling of heavy equipment and material (Manual handling of material)	Back problem	Standards Operating Procedures (SOP) to be followed.
Handling of chemicals (Chemical stores, Chemical dosing areas, Chemical labs, etc)	Eye problems and chemical ingestion, Dermal effect of chemicals	Procedures to be followed as per Material Safety Data Sheet (MSDS) of all hazardous chemicals for safe handling.

1.2.7 Frequency of Occurrence of Accident Scenario

Frequency of Occurrence of incident is important in risk analysis. Standards Operating Procedures (SOP), Proper Maintenance and Safety Precaution reduce the Frequency of occurrence of such Incident. The data sources referred for failure frequency is E&P Forum (Oil Industry International Exploration & Production Forum) frequency data base from TNO ("Toegepast Natuurwetenschappelijk Onderzoek", a Netherlands Organisation for Applied Scientific Research) and Failure Frequency Data from the Rijmond Report (COVO Study, "Risk analysis of six potentially hazardous industrial objects in the Rijnmond area, a pilot study", prepared and submitted by COVO (Dutch abbreviation for Commission for the Safety of the Pollution at large) Commission report to the Rijnmond public authority, Netherlands). The frequency occurrences for various scenarios are given below in **Table 6.9**.

Table 1.9: Frequency Occurrence for Various Accidents Scenarios

Sl. No.	Scenarios	Frequency of Occurrence
1.	Catastrophic failure of largest nozzle connection in HSD tank	1/1,000,000 per tank per year
	Probability of Ignition	
	• Immediate Ignition	65/1000
	• Delayed Ignition	65/1000
	• No Ignition	87/100
2.	Catastrophic failure of Tank	67/1,00,00,000 per tank per year

Safety precaution, proper maintenance of equipment and risk mitigation measures adopted in storage and handling of inflammable materials will reduce the probability of occurrence of hazardous incident.

1.2.8 Conclusions

- Hydrocarbon Vapour Concentration Detector should be installed at some critical. Lower Flammability Limits (LFL) for some gaseous hydrocarbons are as under:

Compound	LFL (% in air)
Methane	5.0

Ethane	3.0
Propane	2.1
Butane	1.6

1.3 DISASTER MANAGEMENT PLAN

For meeting the emergencies caused by major accidents, planning response strategies are termed as Disaster Management Plans (DMPs). DMPs cannot be considered in isolation or act as a substitute for maintaining good safety standards at a project site. The best way to protect against major accidents occurrence is by maintaining very high levels of safety standards.

The Offsite & Onsite Disaster Management Plan (DMP) and Emergency Response Plan (ERP) are available for existing facilities in the ML Blocks, which are also extended to proposed activities. Details on existing facilities are given in **Table 1.10**. The scope of the DMP On-site Emergency Preparedness Plan is to evaluate the various types of emergencies that can occur at rig installations and processing/production facilities (Drilling and Production activities) and to formulate emergency plans, procedures that can be implemented by ONGC in house. In case the contingency exceed in dimension beyond ONGC's capability, the off-site Emergency plan shall be activated concurrently with the help of District administration.

Table 1.10: Existing GGS Stations within the ML areas

Sl.No.	ML Area	Proposed Wells	Collection stations	Transportation
1	Nambar ML area	04	2 GGS already functional in Nambar area through pipelines	At the GGS, the oil and gas will be separated, Oil will be transported to Nambar GGS-1 and gas will be supplied to the consumer
2	Khoraghat and Khoraghat Ext. ML area	03	2 GGS already functional in Khoraghat area through pipelines	At the GGS, the oil and gas will be separated, Oil will be transported to Khoraghat GGS-1 and gas will be supplied to the consumer
3	East Lakhibari ML area	01	Well will be produced through Early Production system, in which separator and tanks are used	Produced oil & gas from the wells will be transported to Borhalla GGS through tankers
4	Borholla ML area	04	2 GGS already functional in Borholla area through pipelines	At the GGS, the oil and gas will be separated, Oil will be transported to Borholla

Sl.No.	ML Area	Proposed Wells	Collection stations	Transportation
				GGS and gas will be supplied to the consumer

1.3.1 Statutory Requirements

1. Oil Mines Regulation, 1984 of Mines Act 1952

   Contingency plan for Fire shall be prepared for any oil installation – OMR 1984.

2. Environment Protection act and the rules:

   In exercise of the provisions under the Environment Protection Act 1986, the 'Manufacture, Storage and Import of Hazardous Chemicals Rules' came into force in November 1989. Under these rules, 'Preparation of On-site Emergency Plan' is covered in Rule No.13 and 'Preparation of Off-site Emergency Plan' in Rule No.14,

1.3.2 Nature of Emergencies

In ONGC, have three tiers of Emergency Preparedness at Work centers:

1. **A unit specific emergency (ERP):** A unit specific emergency response plan is a plan prepared by every unit considering the emergency scenarios envisaged in the risk register. In case of emergency respective installation activates emergency response plan (ERP) and the emergency is mitigated with the facilities available within the installation. The ERP is activated by the Installation Manager.

2. **On-site emergency (On-site DMP):** The On-site Disaster Management plan is activated in case the emergency requires mobilization of resources from the other units / Asset. This plan is activated by the Chief Emergency Coordinator (CEC), Asset Manager and will exercise control through the Asset Emergency Control Room (ECR).

3. **Off-site emergency (off-site DMP):** The off-site disaster management plan will be put into action in the following situations:

   i) In case of an Onsite emergency spreads beyond the boundary of installation and causes damage to the life or property outside the boundary.

   ii) In case an emergency originated from outside the premises of the installation/Drilling Rig/Work over Rig which is likely to effect the operations of installation.

   The off-site emergency requires mobilization of resources beyond ONGC capabilities such as state emergency services.

1.3.3 Onsite Emergency Organization

The Asset Manager is head of the On-site emergency organization and is designated as the Chief Emergency Coordinator (CEC) at Asset level. He will exercise control through the Asset Emergency Control Room (ECR). The CEC is assisted by an expert team drawn from various disciplines.

The Chief Emergency Coordinator (CEC) will assume control through the Assistant Emergency Coordinator (AEC). The emergency coordinator (CEC) may appoint Surface Manager / Head Drilling Services / Head Well Services as Assistant Emergency Coordinator (AEC). The flow chart of onsite emergency organisation is shown in **Figure 1.1**.

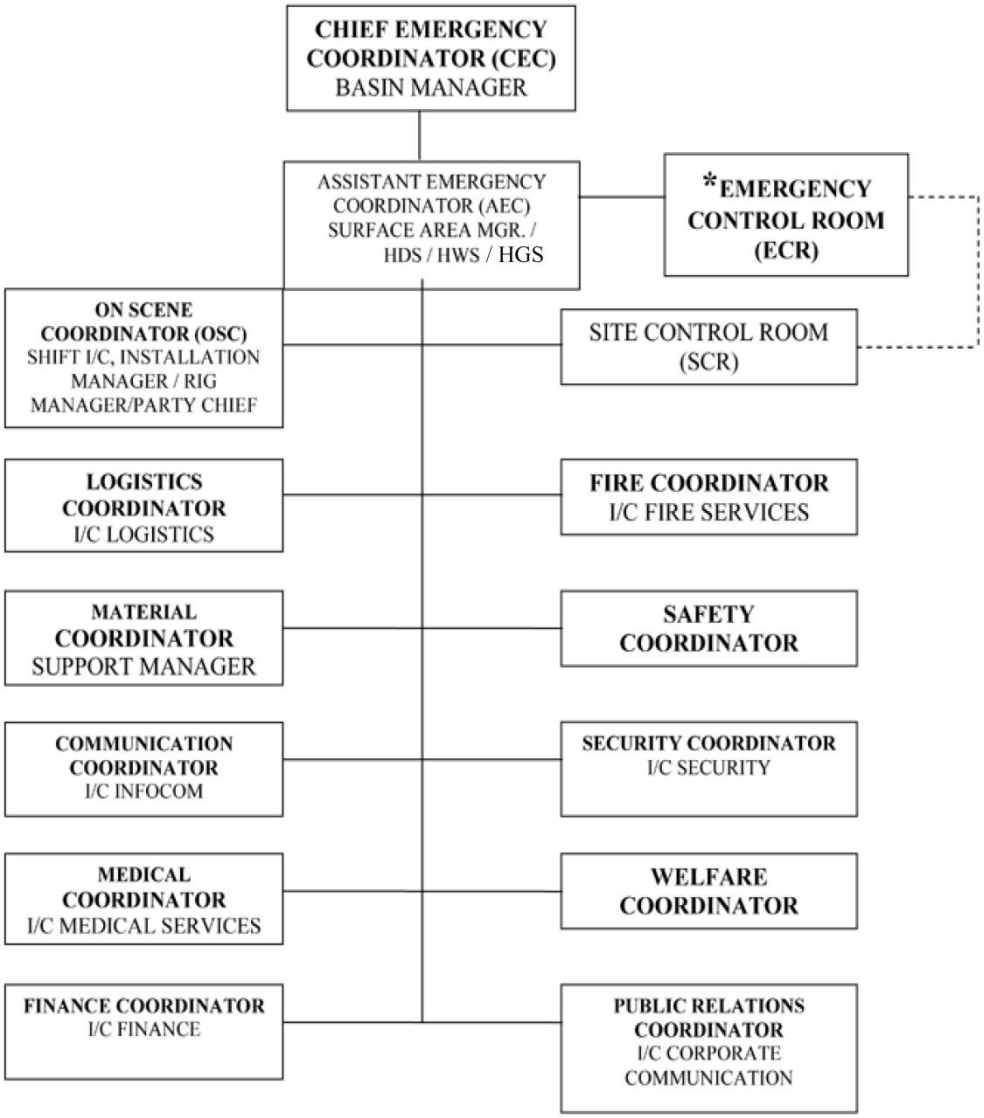

Figure 1.1: Onsite-Emergency Organization

1.3.3.1 Functions & Responsibilities of Various Coordinators

The specified functions and responsibilities of the different coordinators are elaborated. These are the emergency functions and therefore the normal time functions become void. All the coordinators will assume their emergency roles immediately without any time lag.

Chief Emergency Coordinator (CEC): Asset Manager will be the Chief Emergency Coordinator for all the Emergency Management activities at the Emergency Control Centre.

- Establish a control centre and will be In-charge of the entire on-site emergency operation.
- Passing on information to relevant persons and agencies and also warning and advising people who are likely to be affected.
- Convene an emergency meeting of all coordinators to discuss issues such as Rescue operations, Evacuation, Mobilizing the foods and also plans to augment the manpower.
- Get feedback from all coordinators on the latest developments, other information and requirements at frequent intervals to decide on the future course of action.
- Arrange to operate Mutual Aid Scheme through Head HSE. In case of Major Fire / Explosion he has to get mobilized force and appliance from State / Municipal Fire Service.
- In case On-site emergency is escalating and speeding to an off-site emergency, the matter to be informed to the District Collector to enable them trigger off-site emergency plan activities to combat emergency.

Assistant Emergency Coordinator (AEC): In case of an emergency in production operations, the Surface Manager will assume the responsibilities of AEC. He will work under the orders of CEC. The responsibilities are:

- Assessment of the gravity of the situation and to declare the state of emergency
- Establishment of Site Control Room (SCR)
- Mobilization of resources
- Control of logistic support
- Control of rescue operations
- Supervision of Medical attention to injured
- Oversees all situation reports
- Organizes all Post emergency operations

On-Scene Coordinator (OSC): The senior most person or the Installation Manager will assume the role of OSC, unless otherwise directed. In case of abandoning the installation in distress, the In-charge of the nearest Installation will take over the role of OSC. CEC may also appoint a person from base to take over the task of OSC at Site Control Room.

On-scene coordinator is the key person in emergency situation. After receiving the message, shall reach the spot immediately.

- He will take control of Fire Fighting operation / damage control measures till the arrival of Incharge Fire.
- In coordination with Incharge Fire, arrange to take all steps to control emergency situation.
- Closely monitor the emergency situation and change action plan as per need.
- In case of Major / Serious Emergency arrange to blow all clear siren when the emergency situation is under control.

Key Personnel: Key personnel for respective services, depending upon the nature of the emergency shall arrive at the site to take charge of their respective positions such as Logistics Coordinator, Safety (HSE) Coordinator, Fire Coordinator, Finance Coordinator, Medical Coordinator, Communication Coordinator etc.

1.3.3.2 Emergency Control Room (ECR) at Base office

An emergency control room (ECR) will be set up at base office in radio room under the control of Chief Emergency coordinator (CEC). Management decisions and plans will be conveyed from ECR to emergency site by AEC. From Site Control Room (SCR) all developments at emergency site will be communicated to ECR at base.

1.3.3.3 Responding to an Emergency

The procedures for combating emergency situations viz. Blowout at a rig, release of toxic gases in an uncontrolled manner, fire or explosion are defined as emergency procedures. There are written laid out action sequences to be followed while fighting an emergency.

1. A person who detects say a fire, an explosion or a leak of hazardous gas should shout "Fire, Fire, Fire" Help, Emergency as applicable" and communicate the event to the people all around and to Shift I/C by using fire alarm / bell.

2. Should attempt to control or contain the emergency with the available resource if possible.

3. The emergency actions are put into action immediately by the Shift In-charge / Tool Pusher / Rig Manager, who then assumes the role of On Scene Coordinator (OSC). He then accesses the nature of emergency and informs AEC regarding requirement of crisis management team if any to mitigate the emergency.

4. The "Crisis Management Team" arrives at the scene and joins hands with the site crew, other supporting team to further combat the crisis under the guidance of the OSC and AEC.

5. A buddy team is created from the available manpower and kept as standby to the main team.

Assembly point

At every drill site, assembly point is identified as Safe Assembling point during an emergency. People working in the field and who do not have any direct role in Emergency Situation will quickly assemble here and wait for any instructions from the OSC or AEC.

Emergency procedures in the event of blowout

A blow out situation is a consequence of uncontrolled flow of oil / gas and there is every likelihood of fire being triggered off. To tackle such an emergency situation the flow of action can be divided into following two steps.

Step - I : Action on the spot - On-site.
Step - II : Action of Asset in co-ordination with Basin.

The various functions with regard to these steps have been elaborated in the form of action flow sequences and kick control procedures. With a view to avoid overlapping of functions, the various actions required to be taken during a blowout have been identified and the personnel responsible for taking actions have been specified.

The position of blowout well being different in different cases the exact action plan of work to control the blowout spill / blowout fire and for capping of the well would be finalized by competent authorities of the Asset / Basin / Headquarters.

Functions of On-Scene Coordinator (OSC)

Take charge of the situation at the rig and follow the standing instruction given below

- Evacuate all personnel to safe site.
- Switch off engines and generators.
- Remove and secure all well records.
- Avoid and extinguish all naked flames / sparks.
- Pull out all inflammable materials i.e. HSD, Petrol, Gas Cylinders, Chemicals etc. from well premises.
- Pull out all possible equipments to safe distance.
- Start spraying water on well mouth to keep it cool.
- Cordon off the area and do not allow entry of any unauthorized person. Allow only the persons directly involved in operations to go near blowout well and maintain record of such persons.
- Intimate Emergency Control Room (ECR) at base for deployment of additional manpower, materials, logistics / transport arrangements and technical support if any.
- Keep in touch with ECR through Site Control Room (SCR) for update, feedback and instructions from base.
- Assign responsibilities to the concerned persons to control the situation.
- Evacuate all equipments and materials to safe location if required.

Make record of following information for forwarding to Emergency Control Room (ECR) at base:

- Well condition.
- Position of drill string / Tubing string in the well.
- Last tubing and annulus pressure recorded.
- Number, Name and Designation of persons at site, measures initiated to meet the situation, details of injury / casualty, if any.

Emergency procedure for Control of Kick

A kick during drilling or work over operations is an event preceding a blowout. A blowout situation is never sudden and almost always follows after several indications or pointers. A kick is sudden outflow or upsurge of the drilling mud or work over fluid due to unexpected encountering of a gas zone or high pressure fluids, which throws out the fluids upwards out of the well bore. The kick of the out flowing fluid needs immediate remedial attention lest it assumes a more dangerous form of blowout. The remedial action by the crew and the kick control procedures are elaborated below.

Duty guidelines for Rig operational crew

All operations will be carried out under the control and guidance of the Shift In-charge / Tool Pusher, who then functions as the OSC.

When a kick is detected, the Shift In-charge will give a signal and all members of the crew will take up their respective positions. The signals will be in the form of short sirens in a continuous manner from the driller's console.

SHIFT IN-CHARGE (SIC)	Stand on brake and control as necessary. Supervise all activities to control the situation. Ensure functioning of BOP and choke manifold lines. Ensure help is provided to Chemist in order to maintain mud parameters as directed by authorities. Ensure safe removal of records, men and materials to safe and secure place.
ASSISTANT SIC	Be available at control panel of BOP to operate as per direction of RM / SIC / AE(D) / AEE(D) and the guidelines issued to close BOP, install Kelly cock etc. Keep watch on pressure on discharge line, stand pipe and annulus pressure and increase in mud volume in the pit / tanks. Help Chemist in preparation of mud and maintaining mud parameters as required. Ensure operation of degassing unit, if any. Also keep watch for rise in mud level in the suction tank. Work on choke line / kill line of BOP. - Keep watch on the float in the mud pit for loss or gain of mud and inform SIC the status and request SIC to alert site personnel of impending danger.
TOP MEN	Both of them will work on choke-line and valves.
RIG MEN	They will help the SIC in fitting NRV / Kelly etc. and will be available at derrick floor.
RIG ENGINEER (M)	To be near the engine waiting for directives from SIC.
FITTER	To be available near the pump and will give pump connection as and when advised by SIC / Chemist.
RIG ENGINEER (E)	To be available near BOP panel board and will attend electrical work if any needed for charging the accumulators.
CHEMIST	To liaison with SIC and calculate kill mud weight as per available data and take necessary steps to prepare mud as per requirement. It must be ensured however, it should be checked at the time of kick control and SIC should be informed of condition.
GEOLOGIST	To keep contact with the SIC and keep him abreast of possible reservoir condition and convey the data recorded at Mud Logging Unit.

SECURITY GUARD	To see that no unauthorized person enter the site. He should remain at the drill site and not allow the villagers to assemble near the gate. He should ensure that there is no open fire nearby.
OTHERS	To assemble near the bunk house or storehouse within full view of SIC so that any of them is summoned by SIC at the time of need. They should also ensure that there is no open fire at the site and nearby area.

After above mentioned steps are completed, all lines, valves, closed position of BOP are to be inspected by shift In-charge and certified.

Well Kick Shut in procedure for On Land and Jack up Rigs

A well kick shut in procedure for On-land and Jack up rigs as listed below is adopted from OISD STD 174.

i) Shut in procedure while drilling

1. Stop rotary
2. Pick up Kelly to clear tool joint above rotary table.
3. Stop mud pump, check for self-flow. If yes, proceed further to close the well by any of the following methods for shut in the well as shown in **Table 1.11.**

Table 1.11: Shut in Procedure while Drilling

Sl. No.	Soft Shut – in	Hard Shut – in
1.	Open hydraulic control valve (HCR valve) / manual valve on choke line.	Close Blow out Preventer. (Preferably Annular Preventer)
2.	Close Blowout Preventer.	Open HCR/Manual valve on choke line when choke is in fully closed position.
3.	Gradually close adjustable /remotely operated choke, monitoring casing pressure.	Allow pressure to stabilize and record SIDPP, SICP and Pit Gain.
4.	Allow the pressure to stabilize and record SIDPP, SICP and Pit gain.	----------

SIDPP – Shut In Drill Pipe Pressure

SICP – Shut In Casing Pressure

FOSV - Full Opening Safety Valve

ii) Shut in procedure while tripping

1. Position tool joint above rotary table and set pipe on slips.
2. Install Full Opening Safety Valve (FOSV) in open position on the drill pipe and close it.

Following methods are recommended for shut-in the well as shown in **Table 1.12**.

Table 1.12: Shut in Procedure while Tripping

Sl. No.	Soft Shut – in	Hard Shut – in
1.	Open hydraulic control valve (HCR valve)/ manual valve on choke line.	Close Blow out Preventer. (Preferably Annular Preventer)
2.	Close Blowout Preventer. (Preferably Annular Preventer)	Make up Kelly and open FOSV.
3.	Gradually close adjustable/ remotely operated choke, monitoring casing pressure.	Open HCR/Manual valve on choke line when choke is in fully closed position.
4.	Make up Kelly and open FOSV	Allow pressure to stabilize and record SIDPP, SICP and Pit Gain.
5.	Allow the pressure to stabilize and record SIDPP, SICP and Pit gain.	------

iii) Shut in procedure when string is out of hole

1. Close blind/shear ram.
2. Close adjustable/remotely operated choke and open HCR valve.
3. Record shut in pressure.

1.3.4 Offsite Emergency Plan

The OFF-SITE Emergency Plan for existing processing/production facilities of ML areas in ONGC, Assam Asset is a compilation of various emergency scenarios. It also includes the probable impact on 'off the site' due to emergency and the action plan to combat / mitigate the consequences of a disaster situation.

1.3.4.1 Assessment of Hazard leading to Off-Site Emergency

The hydrocarbon produced from the Borholla ML area of Jorhat district and Nambar, East Lakhibari, Khoraghat and Khoraghat Extension ML areas of Golaghat district was transported to existing processing/production facilities through trunk lines and tankers. No. of person working in each of the installation may vary from 25-30 per shift. The equipments at the installation mainly consist of bank of separators, storage tanks and oil dispatch pumps. Crude oil is always stored in bulk.

Fire is the most common hazard in a Crude Oil and Natural Gas processing operations and there are also possibilities of explosion and toxic gas dispersion which can arise due to the severe operating and storage conditions. Any incident of the above nature is likely to cause extensive damage to the plant property and personnel.

Disaster situation arising out of the hazards encountered in the above mentioned installations is normally not expected to affect beyond 200m. An estimated maximum area within 1.0 - 1.5 Km radius can be considered for declaration as emergency or danger zone.

Outside the premises of the these installations, environmental hazards are likely to occur due to the leakage / bursting of either trunk pipeline or flow lines from wells and flaring of natural gas.

Hazard in Flow Lines: A pipeline connecting one installation to another installation is termed as a trunk line while a pipeline connecting hydrocarbon well to the installation is called as a flow line.

The trunk pipeline and almost all the well flow lines pass through the agricultural fields. The trunk and flow lines are sub-surface pipelines and are laid 1.2 m below the ground level. Due care has been taken during laying of trunk and flow lines. As far as possible laying of pipeline is avoided in populated area. The main risk in transportation of oil / gas through pipeline is leakage of oil / gas which may result in fire if source of ignition is present. Once, detected, the emergency procedure will be activated and remedial action will be taken to control the leak, spread of fire etc. Moreover, no major evacuation is required as pipelines are passing through non populated areas.

Hazard in Transportation of Condensate by Tankers: The crude oil is transported through road tankers from various isolated installations within the Asset to processing/production installation. There is a chance of oil spill due to overturning or collision of tankers. In this case, a small quantity of crude oil is likely to be spilled. When an emergency arises the nearby police station may be contacted to cordon off the affected area and all sources of ignition are removed to safe distance to avoid fire. Nearby public is instructed not to light any source of ignition. Efforts should be made to stop the flow of oil into nearby water bodies to avoid water contamination. For this purpose, improvised booms made of bamboo's plants etc. can be rigged up to contain the oil and prevent its spreading.

1.3.4.2 Disaster due to Man-made causes (Terrorist attack)

Other than above technical and operational hazards ONGC units also poses disasters due to man-made causes such as Terrorist attack, Bomb threats. The action plan for these scenarios is as below:

i) IED Attack

Primary rule

If a suspected device is encountered, it should not be handled and the area should be secured. Improvised explosive devices are very unstable. They are extremely sensitive to shock, friction, impact, and heat, and may detonate without warning. Even the smallest devices can cause serious injury or death.

Secondary rule

- Always assume that there is more than one device present, whether any other bomb or a device has been located.

- Package-type IEDs: Institute security procedures in receipt and dispatch section and instruct employees on how to recognize suspicious packages.
- Luggage-type IEDs: Train security personnel and employees regarding unattended packages of any type. Never pick up or open any suspicious package or piece of luggage. If an IED is discovered, call the police and do not touch the device.
- Vehicle-borne IEDs: Perform a vulnerability/threat assessment for the facility with special attention to this type of explosive delivery mechanism. Consider the use of enhanced security away from your key buildings (such as a vehicle checkpoint) or the use of bullards or barriers to block vehicular access to building entrances.

ii) Chemical Attacks

A chemical emergency occurs when a hazardous chemical has been released and has the possibility of harming people's health. Potentially lethal, chemical agents are difficult to deliver in deadly amounts. If released outdoors, the agents often dissipate rapidly. As such, the most lethal area for a chemical release is inside a confined space, such as a building, public place, or subway system.

Industrial chemicals, while not as lethal, can be just as effective if released in sufficient quantities. Chlorine, ammonia, benzene, and other toxic chemicals are routinely transported through densely populated areas in rail tankers or truck tankers and could be the target of a terrorist attack.

Chemical terrorist attacks will most likely be overt because the effects of most chemical agents are immediate and obvious. Your response will have to be thought out and practiced in advance to be effective.

Evacuation

Some types of chemical emergencies will require evacuation from the immediate area. If you are up-wind and in the open, evacuate up-wind and away from the incident. Cover your mouth and nose with a damp cloth. If you have been exposed, you will have to be decontaminated by first responders.

Shelter in Place

If you are already in down-wind and/or in a multistory building, you may be instructed to shelter in place or to make that decision on your own. Most likely you will only need to shelter for a few hours. The procedure includes:

- Go inside as quickly as possible shut and lock all windows and doors; turn off all HVAC equipment and any fans.
- If you have multiple floors, go as high as practical, three to five floors. (Most chemical agents are heavier than air.)
- If you have duct tape, tape over door and window
- cracks, vents, electrical outlets, and any opening to the outside.
- Wait for instructions from first responders before leaving.

iii) Biological Attacks

A bio-terrorist attack could happen in any workplace, yet most company personnel know little about potential bio-toxins or bio-pathogens or how to recognize these agents and respond in the event of an attack.

There are several ways a bio-terrorist event may manifest itself. The biological event may result from a covert attack. A covert attack may be unleashed by the receipt of an object, such as a package or piece of mail, accompanied by a warning or threat. For example, release of a biological agent could occur through delivery of a package contaminated with anthrax spores or another pathogen. Biological agent release also could occur via the ventilation system (HVAC) in a building, where dispersal could take place within a matter of minutes. Because the covert release is not witnessed, the effects of such an event can be widespread and difficult to isolate or recognize.

While terror is intended to produce casualties, disruption, and fear, the use of biological agents is particularly injurious. Biological attacks are delayed events. The sudden appearance of generalized symptoms in victims who present themselves to medical providers may initially disguise the true source of exposure. Only when a trickle of patients turns into a flood or mysterious pathogens quickly make their presence felt does the magnitude of the event reveal itself.

The goal of the medical care community (i.e., hospitals, physicians, and other health care providers) is to recognize and diagnose the disease (which frequently may be unfamiliar to most clinicians) and to provide treatment. The goal of public health authorities is to detect and control the outbreak of the illness. Public health officials will focus on identifying and treating exposed persons and preventing the spread of disease.

In response to a covert release, it is important for ONGC health officials to recognize the signs and symptoms of an emerging disease among employees. If an overt release is recognized, take immediate action to isolate the exposed employees and/or area of agent dispersion and to remove others from the area of release. Notify local public health authorities immediately and follow their directions. Decontamination may also be warranted in response to an overt release.

iv) Radiological Attacks

A radiological weapon or “dirty bomb” is a crude device that combines a conventional explosive with highly radioactive material. When detonated, the blast vaporizes the radioactive material and propels it across a wide area.

The main danger from a dirty bomb is the initial blast, which could cause serious injury or property damage. The radioactive materials will likely not be concentrated enough to cause immediate serious illness, except to those very close to the blast site or those who inhale smoke and dust. Dirty bombs are designed to cause tremendous psychological damage by exploiting the public’s fear of radiation. These are not weapons of mass destruction, but weapons of mass disruption aimed at wreaking economic havoc by making target areas uninhabitable for extended periods.

There are three basic ways to reduce your exposure:

1. Reduce the time near the source of radiation,

2. Increase the distance from the source of radiation,

3. Increase the shielding between person and the source of radiation. Shielding is anything that puts distance and mass between person and the radiation source.

Evacuation

If a person is outside, evacuate up-wind from the blast site cover the nose and mouth with a wet cloth to reduce the risk of inhaling radioactive smoke or dust. Once out of the immediate area, seek shelter and wait for instructions from first responders. If individual has been exposed to dust or smoke, follow the decontamination procedure.

Shelter in Place

If a person is close to the blast and inside a building, stay inside if the building is intact. Move to the basement and turn off all HVAC equipment and fans bringing in outside air it is not necessary to seal doors and windows, but it may be helpful. Wait for instructions from first responders.

1.3.4.3 Action Plan - Reporting of an Off-Site Emergency

The off-site disaster management plan will be put into action in the following situations:

a) In case of an Onsite emergency spreads beyond the boundary of installation and causes damage to the life or property outside the boundary.

b) In case an emergency originated from outside the premises of the installation/Drilling Rig/Work over Rig which is likely to effect the operations of installation.

The off-site emergency requires mobilization of resources beyond ONGC capabilities such as state emergency services.

In case of an off-site emergency, the On-site Chief emergency coordinator (Asset Manager) will report the matter to the District Collector, who is Chairman of District emergency committee. Further, the Chairman will mobilize other members of District Emergency committee as per the organization Chart for an Off-site emergency management (**Figure 1.2**).

Communication to Corporate Disaster Management Group (CDMG)

The Chief Emergency coordinator shall immediately inform CMD, Director (HR),-CCEC, Director-concerned and Director-I/C HSE on the situation and his assessment for intervention of Corporate Disaster Management Group (CDMG).

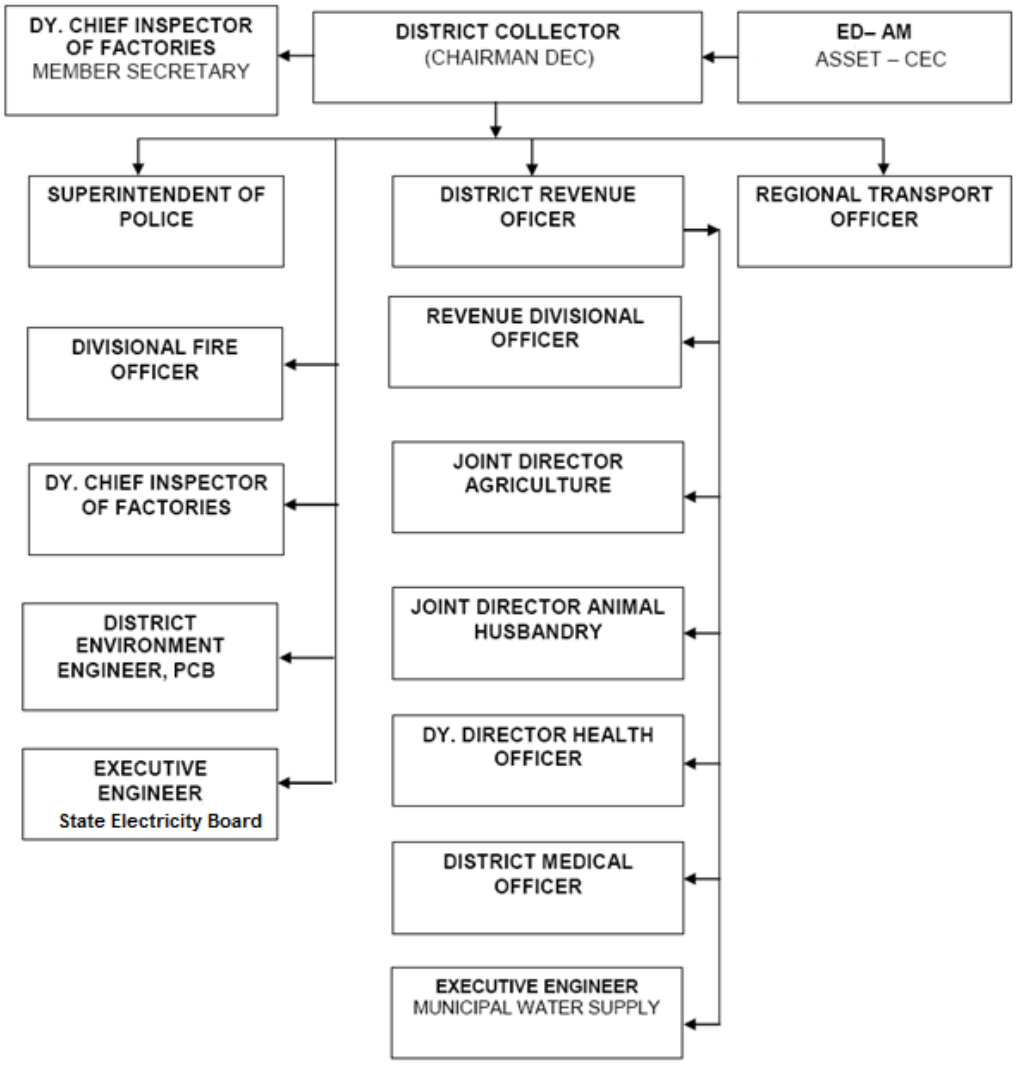

Figure 1.2: Flowchart for Offsite Emergency Management

Functions and responsibilities of emergency Committee

When a call is received from On-site Emergency coordinator regarding emergency / disasters, District Collector, who is also chairman of the District Emergency committee, will initiate the district level action plan to combat the emergency.

Responsibilities of Chairman of District Emergency Committee

a) Take overall responsibility for combating the off-site emergency.
b) Declare an area of 500 m or up to 1.5 Kms as felt appropriate around the site as a "Hazardous Zone".
c) Inform the District Police, Fire Personnel to combat the emergency. Arrange if necessary, for warning and evacuating the public from the villages by the Superintendent of Police.
d) Inform the team of Doctors headed by District Health & Medical Officer; also help and support from nearby hospitals may be called for.
e) Inform the Regional Transport Officer to arrange for transportation of victims and evacuation of people trapped within the hazardous zone.

f) Inform the Executive Engineer of state electricity department to give uninterrupted power supply or de-energize power supply, as required.
g) Inform the Revenue Divisional Officer (RDO) and District supply officer to provide safe shelter, food and other life-sustaining requirements for the evacuees.

Responsibilities and duties of members of Service group

In the implementation of the Off-site emergency plan a service group will assist the Collector of respective district. This group consists of the following members from the district area & has responsibilities as indicated.

District Collector	Press and Public Relations
Superintendent of Police	Warning & Advice to the public security measures, Rescue & Evacuation
District Revenue Officer	Coordinates Transport, Civil Supplies, Health, Medical and other services.
Revenue Divisional Officer	Rallying post
Regional Transport Officer	Provide transport
Deputy Director Health	To take care of Public Health & Preventive medicines
District Medical Officer	Treatment of affected persons
Divisional Fire Officer	Help in firefighting operations & rescue.
District Environmental Engineer	Advice for protection of environment and reduction in environmental losses
Joint Director, Animal Husbandry	Taking care of cattle in the affected area.
Joint Director, Agriculture	Taking care of standing crops
Executive Engineer, State Electricity Department	Ensuring uninterrupted powers supplies or de-energizes power supply as required.

1.3.4.4 Mock Drill for Onsite and Off-Site Emergency Management

ONGC may conduct Mock Drill to check the efficacy of Onsite and Off-site Emergency plan for review and updation in association with Government officials.

Once in every year this plan will be practiced on field mock exercise involving dramatized scenarios to test the communication system, action plan and response of all Key agencies within ONGC and Government officials. Such on field mock exercise will be selected from high risk areas and near real approach of actual fire fighting / evacuation operations will be undertaken. An emergency will be alerted through different types of Siren Sound Code example fire, explosion, toxic release etc. Siren codes as per OISD STD 116 reproduced here in Format-I will be followed.

Emergency Siren Codes	
Scenario	**Siren Sound Code**
Major Fire	A wailing siren for two minutes. Siren should be sounded three times for 30 seconds with an interval of 15 seconds.
Disaster	Same type of siren as in case of Major fire, but the same will be sounded for 3 times at the interval of 02 minutes.
Gas Leak	A wailing sound for 2 min. 5 times for 20sec at 5 sec interval
Blow-out with Fire	same as 'Major Fire' Siren
Blow-out without Fire	same as 'Gas Leak' Siren
Air Raid	As per guidelines of Air Defence Dept. of the area.
All Clear	Straight run siren for 2 minutes
Test Run	Straight run for 2 minutes

(Reference: OISD-STD 116, page 26)

Note: Sound for Gas situation and blow-out sirens have been devised internally, as it is not mentioned in OISD-116.

During mock drill exercise observers would be appointed in key areas to take note of individual responsibilities, response time and lapses. Every mock exercise will be followed by "post – mock-drill meeting" to discuss the findings of observers and shortcomings. The lessons learnt from such exercises will be summarized in the form of a report to improve upon the overall preparedness and will also be used as inputs for updating the plan to the extent necessary.

If in any case the exercise cannot be carried out due to operational reasons the same shall be done as the table top exercise to test the communication system, action plan and response of all Key agencies within ONGC and Government officials.

1.3.4.5 Review of the Plan

The off-site emergency plan will be reviewed by ONGC and District Emergency Committee as per requirement and updated accordingly.

1.3.4.6 Blow Out Contingency Plan

The Contingency Plan for Blowout is shown in **Figure 1.3.**

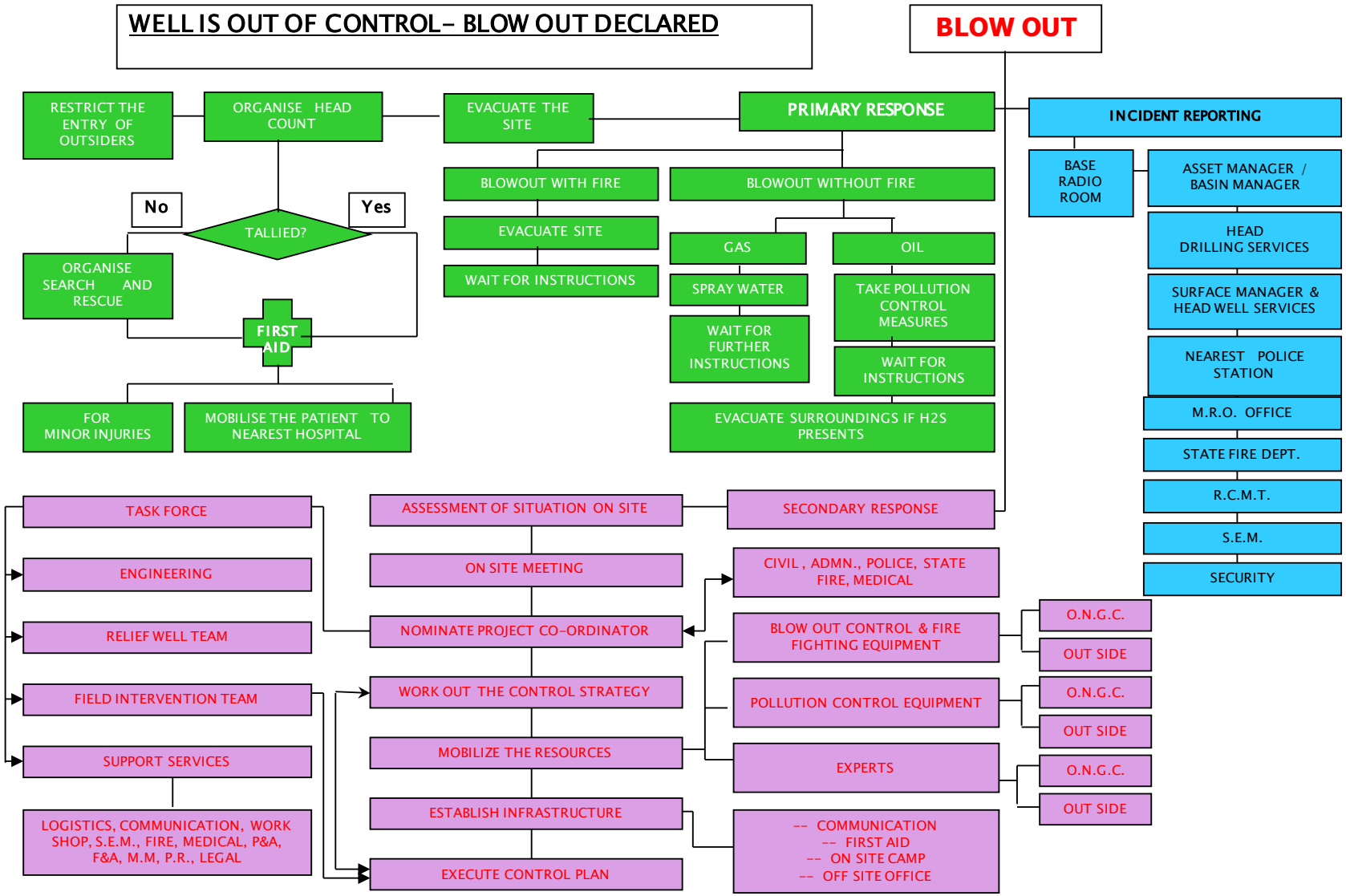

Figure 1.3: Blowout Contingency Plan