CHAPTER 6: RISK ANALYSIS AND DISASTER MANANGEMENT PLAN

6.1 INTRODUCTION

Exploratory drilling and testing operations of hydrocarbon wells are considered hazardous in nature, which can pose risk to life and property in an unlikely event of sudden and violent release of hydrocarbon fluid and hydrogen sulfide (H_2S) gas and due to other unsafe acts and conditions. Therefore, detailed hazard identification, risk assessment have been carried out and disaster management plan has been prepared for prompt response in the event of an emergency.

6.2 HAZARD IDENTIFICATION

Hydrocarbon exploration and testing 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 these factors. Fire, explosion due to hazardous release of crude oil, gas, H_2S or a combination of these are the hazards associated with hydrocarbon exploration and testing operations. These have resulted in the development of more comprehensive, systematic and sophisticated methods of safety engineering, such as, hazard identification and risk assessment to improve upon the integrity, reliability and safety of hydrocarbon operations.

The primary emphasis in safety engineering is to reduce risk to human life and environment. The 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 site, to surrounding area and the population therein.

Derrick floor is the center stage of all the exploratory 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, numbers of equipment have been developed over a period to cater the need of smooth operation on derrick 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 rig.

6.2.1 MINOR OIL SPILL

During hydrocarbon exploration and testing operations, details of classification of possible oil spill scenario(s) and respective activities are as follows:

Classification of spill	Extent of spill	Impact	Scenarios
Tier 1 Response can be adequately addressed using equipment and materials available at the site.	Spill contained on site.	Minor equipment damage. Brief disruption to operations.	• Diesel fuel refueling (i.e. drill rig hose leaks, overfilling or connection/disconnection incidents). • Drilling fluid (i.e. leaks from tanks, pumps or other associated equipment within the closed loop circuit system). • Drilling fluid chemicals (i.e. chemicals used during drilling; note that the volumes are limited by the storage containers used i.e. 200 L drums etc.). • Hydraulic oil (i.e. leaks from a split hydraulic hose or failed connector; moderate pressure, low volume lines).
Tier 2 Response requires additional oversight expertise, equipment, and materials available	Localized spill with potential for escaping the site or that has escaped the site but is of limited extent	Moderate to major equipment damage/loss. Partial or short-term shutdown of operations.	• Transportation incidents associated with the delivery of diesel fuel to the drill-site (i.e. third party supplier's truck rollover or collision). • Complete failure of an on-site storage tank (e.g. diesel fuel for generators).
Tier 3 Response requires oversight, expertise, equipment, and materials available	Major incident or a spill that has extended beyond the site.	Extensive equipment damage/loss. Long-term shutdown of operations.	• Uncontrolled fluid flow (blowout) from a well during exploratory drilling

Spill response strategies for combating incidents include:

- Prevent or reduce further spillage: One of the first response actions, if safe to do so, is the isolation of the source and prevention of further discharge.
- Monitoring and evaluation: Monitoring and evaluation are used to: Determine the location and movement (if any) of the spill, its appearance, its size and quantity,

changes in the appearance and distribution of the spill over time and potential threat to the environment and the resources required to combat the spill (i.e. a more effective and coordinated response).

- Mechanical containment and recovery: restriction of spill movement through the use of physical barriers (e.g. bunds, booms, diversion swales). Containment would be followed by the physical removal of the spilled material. This may be accomplished using sorbent pads, vacuum trucks, skimmers or other mechanical means appropriate to the material spilled.
- Protection of sensitive areas: Bunds or booms will be used to prevent spills from migrating down a watercourse or stream.
- Clean-up: This involves earthmoving equipment used to recover the absorbed spill and affected soil. Such operations may involve the collection of significantly greater volumes of material than was originally released.
- Combinations of the above strategies.

Affected area due to oil spill will be isolated. Spilled oil will be recovered and stored. Contaminated earth will be collected and disposed in consultation with Assam State Pollution Control Board. Oil contaminated area will be reclaimed using bioremediation technique through oil zapper or other appropriate methods.

6.2.2 BLOWOUT

Blowout means uncontrolled violent escape of hydrocarbon fluids from a well. Blowout followed by ignition, which prevents access to the wellhead is a major hazard. Major 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 Blow Out Preventer (BOP);

- Failure to test BOP equipment properly;
- Damage to or failure of wellhead equipment;
- Failure of casing; and
- Failure of formation or cement bond 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 well bore (this is known as a kick) and a potential blowout situation has developed. Fast and efficient action by operating personnel in recognizing the above situations and taking precautionary measure can avert a blowout.

❑ **Presence of Sour Gas (Hydrogen Sulphide-H_2S) in Blowout**

As per available data, there is no chance of presence of H_2S, however, as a hypothertical case, scenario of presence of 3% H_2S has been considered for consequence analysis.

Presence of Sour Gas (H_2S) in blowouts wells can pose immediate dangers to life and health at and around the rig area. Operators drilling wells where H_2S is a known hazard may or may not have a clear-cut policy regarding ignition of the well if a blowout occurs. Burning H_2S creates sulfur dioxide (SO_2) that is also highly toxic. Therefore, the situation is still dangerous, and a safety system should be put in place to monitor for 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. In addition it is corrosive and can lead to failure of the drill string or other tubular components in a well.

The Occupational Safety and Health Act (OSHA regulations) set a 10 ppm ceiling for an eight hourly continuous exposure (TWA limit), a 15 ppm concentration for short term exposure limit for 15 minutes (STEL) and a peak exposure of 50 ppm for 10 minutes.

Important characteristics of H_2S gas are given below:

1. *H_2S is a toxic colourless gas heavier than air.*
2. *It has an odour of rotten eggs but see 'point 6' below.*
3. *In concentrations greater than 100 ppm, it will cause loss of senses in 3 to 15 minutes and death within 48 hours.*
4. *In concentrations greater than 600 ppm death occurs in less than 2 minutes.*
5. *The safe concentration for a normal working period without protection is 10 ppm.*
6. *In concentration greater than 10 ppm, the olfactory sense to smell the gas is lost, the need for detectors is apparent.*
7. *It attacks the body through the respiratory organs.*

8. *It dissolves in the blood and attacks through the nervous system.*
9. *It is very irritating for the eyes as it forms sulphurous acid together with water.*
10. *The Occupational Safety and Health Act (OSHA) sets a 10 ppm ceiling for an 8 (eight) hour continuous exposure (TWA limit), a limit of 15 ppm for short term exposure limit for 15 minutes (STEL) and a peak exposure concentration of 50 ppm for 10 minutes.*
11. *The best protection is breathing apparatus, with mask covering the whole face and a bottle containing breathing air.*
12. *It burns with a blue flame to sulphur dioxide which is almost as dangerous as H2S.*
13. *It forms an explosive mixture with air at concentrations from 4% to 46%.*
14. *Short exposure of high tensile steel to as little as 1 ppm in aqueous solution can cause failures.*
15. *Concentrations greater than 15 ppm can cause failure to steel harder than Rockwell C-22. High stress levels and corrosive environments accelerate failures.*
16. *When pH is above 9 and solubility is relatively high, it is readily soluble in mud and especially in oil muds.*
17. *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.*
18. *It occurs together with natural gas in all oil provinces of the world.*
19. *In characteristic H2S gas areas concentration above 42% in natural gas have been reported.*
20. *H2S may also be formed in significant amounts from the degradation of modified lignosulphonates at temperatures exceeding 204^0C.*
21. *Coughing, eye burning and pain, throat irritation, and sleepiness are observed from exposure to low concentrations of H2S.*
22. *Exposure to high concentrations of H2S 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.*

6.2.3 OTHER HAZARDS AT DRILLING RIG OPERATIONS

6.2.3.1 HAZARDS DURING PREPARATION FOR SETTING UP THE SUBSTRUCTURE

Equipment(s) are unloaded and positioned at or near the exact location that it will occupy during operations. The substructure is assembled, pinned together, leveled, and made ready for other rig components on the floor. Equipping the cellar begins but can be done

throughout the rigging up process. This includes welding on a drilling nipple to the conductor pipe and attaching a flow line.

Potential Hazards:

- Being struck by the crane, load, truck.
- Pinched fingers when assembling equipment.
- Burns from cutting and welding on the drilling nipple.
- Temporary eye irritation from welding light flash.
- Falling from heights.

6.2.3.2 HAZARDS DURING SETTING UP THE RIG FLOOR AND MAST OR DERRICK

Once the substructure is set in place, the process of setting up the rig floor begins by installing stairways and guardrails to allow access to the rig floor. Then, the draw works is set in place and secured to the substructure. On mechanical rigs, the engines are set in place and the compound and associated equipment connected to the draw works. On electric rigs, the electric cables (lines) are strung to the draw works.

The bottom of the mast is raised to the rig floor and pinned in place. The crown section is then raised into place on the derrick stand. The "A-legs" are raised and pinned into place. The monkey board is pinned in place on the mast and all lines and cables are laid out to prevent tangling when the mast is raised. A thorough inspection of the mast should be made before raising the mast/derrick. The mast is now ready to be raised. The engines are started, and the drilling line is spooled onto the draw works drum. Once the mast has been raised and pinned, the remaining floor equipment can be set into place. If the rig has safety guy lines, they must be attached to the anchors and properly tensioned prior to continuing the rigging up process. A derrick emergency escape device is installed on the mast.

Potential Hazards

- Falling or tripping during rigging up;
- Falling from rig floor;
- Being struck by swinging equipment;
- Being struck by falling tools;
- Being crushed or struck by equipment due to failure or overloading of hoisting equipment;
- Getting entangled in lines during rising of the derrick or mast;
- Failure to properly install derrick emergency escape device; etc

6.2.3.3 HAZARD IN RIGGING UP THE CIRCULATING SYSTEM

While one crew finishes preparing the rig floor, another crew might be rigging up the circulating system. The mud tanks and mud pumps are set into the predetermined location. The mud lines are then connected and electric cords are strung.

Potential Hazards:

- Being struck by or crushed by equipment being set into place;
- Getting caught in pinch points;
- Being struck by crane, load, truck or forklift tipping;
- Being struck by hammer when connecting mud line unions; etc

6.2.3.4 HAZARDS DURING INSTALLING THE AUXILIARY EQUIPMENT

All remaining drilling and auxiliary equipment must be set into place and installed where needed. The catwalk and pipe racks are positioned and the pipe and drill collars are set on the racks.

Potential Hazards:

- Getting struck or pinched by, or caught in between, tubulars being loaded onto racks.
- Having feet pinched or crushed when setting up the pipe racks and catwalk.

6.3 CONSEQUENCE ANALYSIS

The risk presented by a blowout (hydrocarbons release event) is determined by the frequency and consequence of its possible outcomes. The consequence of igniting a hydrocarbon release during blowout depends on the type of material released, the mass release rate, the timing of the ignition, and the environment into which the hydrocarbon is released. Briefly, typical outcomes are:

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

Jet fire emanating from the release source may follow a flash fire or explosion.

I. Early Ignition

In the risk assessment, gas and two-phase events that ignite early are modeled as jet fires. Liquid releases that ignite early are modeled as pool fires.

Briefly, jet fires are modeled as follows:

- Mass release rate is determined (for each representative hole size) based on the operating temperature and pressure at the point of release.
- From the mass release rate, the jet flame length and associated fatality area.

II. Late Ignition

In the event of two-phase releases that ignite late are modeled as explosions.

Delayed ignition is not assumed to occur for oil releases. The consequential effect of a hydrocarbon gas explosion on personnel is determined by a variety of factors, including:

- Direct effects of blast overpressure;
- Whole body translation due to the blast wave;
- Thermal effects on personnel inside the burning gas cloud.

It is assumed that all personnel caught inside the burning gas cloud are likely to be fatally injured due to thermal radiation effects and inhalation of burning gases. Outside the gas cloud, personnel may still suffer from the effects of flash fire.

❑ Thermal Radiation

Thermal radiation from a hydrocarbon fire is a significant hazard to personnel. The degree of injury caused by thermal radiation is related to the intensity of the thermal radiation and the exposure time.

Thermal radiation effect modeling to estimate the likely injury or damage to people and objects from thermal radiation from incident outcomes is the most straightforward of the three types of physical exposure modeling referred to above.

The consequence caused by exposure to heat radiation is a function of:

- The radiation energy onto the human body [kW/m^2];
- The exposure duration [sec];
- The protection of the skin tissue (clothed or naked body).

The following damage distances for thermal radiation have been used:

37.5 kW/m2	:	Damage to process equipment. 100% fatality in 1min. 1% fatality in 10sec.
12.5 kW/m2	:	First degree burn for 10 sec exposure
4.0 kW/m2	:	First degree burn for 30 sec exposure

- **Ignition of Blowout**

Surprisingly, few surface blowouts ever ignite. Less than 10 blowouts per year ever catch on fire, worldwide. Typically, large formation water flows lifted by the hydrocarbon flow make ignition difficult if not impossible. Water comes into the blowout zone, drawn in by low flowing bottom hole pressure; or adjacent wet zones are exposed to the flow path.

Highly flammable blowouts may never ignite if no ignition source is present and flow is quickly dispersed. Thus, knowledgeable and experienced blowout specialists always restrict blowout access and carefully inspect the area around blowouts for ignition sources, particularly areas within an explosive vapor cloud.

6.3.1 Model Used For Consequence Analysis

PHAST (Version 6.53.1) software of DNV has been used to perform the consequence calculations. PHAST is a consequence and risk assessment software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials. PHAST software allows detailed modeling and quantitative assessment of release of pure and mixtures of liquid and gaseous chemicals.

6.3.2 Scenarios wise Findings of Consequence Analysis

Subsequent to the accidental release of hydrocarbon, the consequence depends on various factors e.g. type and quantity, presence and location of an ignition source, meteorological conditions, etc. The consequence analysis for the selected accident scenarios for hydrocarbon releases have been carried out to estimate the effect distances and outcomes of same have been described in subsequent sections.

- **Blowout during Drilling of Well**

Formation pressure in hydrocarbon wells is typically may be high, thus conventional BOP stack is used at drilling rig.

Release of Hydrocarbon through 150 mm hole containing 3 % H_2S gas due to Blowout

I. IDLH Concentration of 3 % H_2S

In the event of vertical release of hydrocarbon, IDLH concentration of hydrogen sulphide (H_2S) will not reach to the ground. Therefore, no hazard is anticipated.

IDLH Concentration	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s – E	1 m/s - F
100 ppm	No Hazard	No Hazard	No Hazard	No Hazard

II. UFL and LFL Concentration Distances

In the event of release of hydrocarbon during blow-out, hydrocarbon /fluid gas cloud will be formed, if it is not getting source of ignition. Computed hydrocarbon gas concentrations between UFL and LFL are as per given below:

Concentration	UFL and LFL Concentration Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
UFL	0.404159	0.152782	0.416789	0.293871
LFL	4.61949	3.10683	4.15458	3.75605
LFL Fraction (50%)	9.80738	9.64045	11.9256	10.6855

Heights (m) for above distances are given below:

Concentration	Height of UFL and LFL Concentration (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
UFL	13.7872	16.2498	14.3967	15.4029
LFL	38.2636	51.8099	39.4372	44.1115
LFL Fraction (50%)	52.1327	76.1167	56.745	63.4986

III. Flash Fire Envelope

On ignition of Hydrocarbon gas within LFL, flash fire envelope will be formed as per details given below:

Concentration	Length of flash fire envelope (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
Furthest	4.61949	3.10683	4.15458	3.75605
Furthest (50%)	9.80738	9.64045	11.9256	10.6855

Heights (m) for flash fire envelope are given below:

Concentration	Height of flash fire envelope (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
Furthest	38.2636	51.8099	39.4372	44.1115
Furthest (50%)	52.1327	76.1167	56.745	63.4986

Flash fire envelope distances are depicted in Figure 6.1.

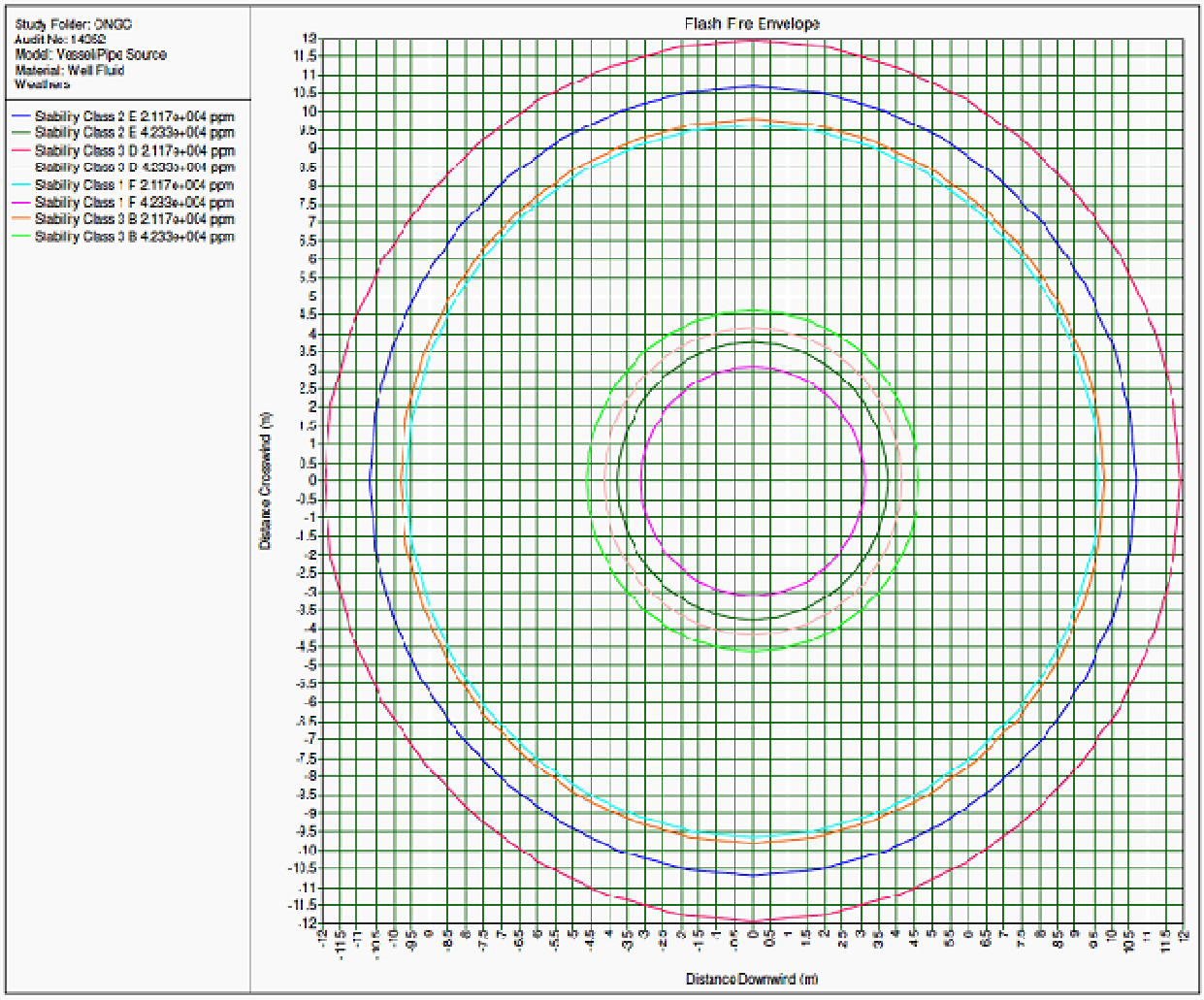

FIGURE 6.1: FLASH FIRE ENVELOPE

IV. Jet Fire on Immediate Ignition

In the event of ignition of blow out, computed thermal radiation distances resulting from jet fire are as per given hereunder:

Radiation Level	Thermal Radiation Level Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
4 kW/m^2	75.4995	55.3992	71.9165	63.3931
12.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached
37.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached

Thermal radiation distances and intensity radii from jet fire are depicted in Figure 6.2.

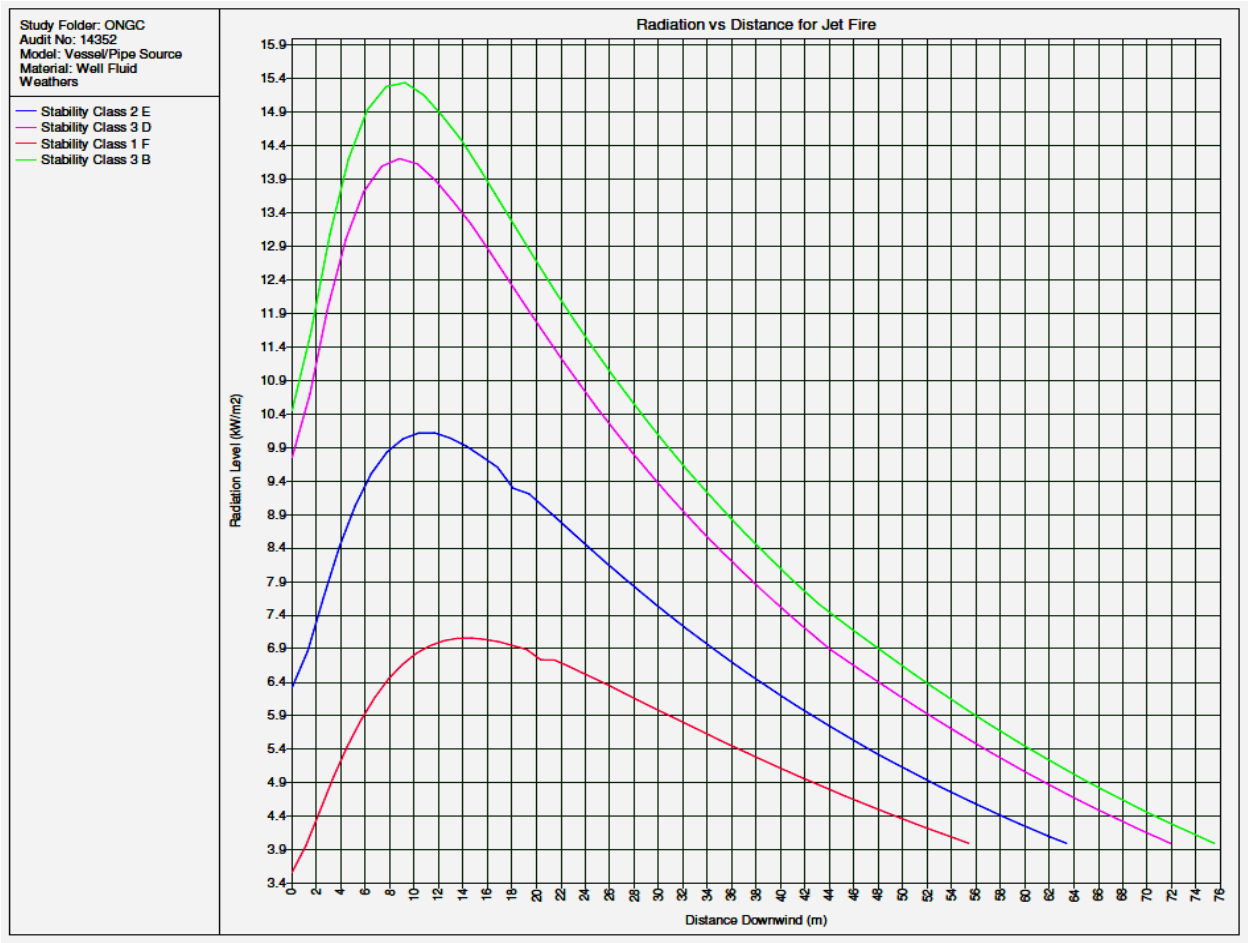

FIGURE 6.2: RADIATION VS DISTANCE FOR JET FIRE

6.4 FAILURE FREQUENCY

6.4.1 BLOWOUT AND WELL RELEASE FREQUENCIES

The study (Source: White Rose oilfield development on the Grand Banks, offshore Newfoundland by Husky Oil Operations Limited) estimates that there have been 51,000

development wells drilled in that period of 1955 to 1988 giving a frequency of 4/51,000 =7.8E-05 blowouts per well drilled.

The frequency of well blowout and well release is discussed in The International Association of Oil & Gas Producers Risk Assessment Data Directory. Table 6.1 shows the expected frequency of such events based on historical data from recent years.

TABLE 6.1: OGP BLOWOUT AND WELL RELEASE FREQUENCIES

Operation	Frequency			
Category	**Average**	**Gas**	**Oil**	**Unit**
Blowout	6.0E-05	7.0E-05	4.8E-05	Per drilled well
Well Release	4.0E-04	5.7E-04	3.9E-04	Per drilled well

OGP - Oil & Gas Producers

Additional correction factors could also be considered based on the likelihood that the wind is blowing in the direction of populated areas. Also for smaller releases it is believed that the well release could be isolated by mechanical means reducing the event duration.

The above estimate is, however, still very conservative for a number of reasons. The data on which the above frequency is based cover several decades.

In past years, drilling technology has improved significantly since that time and the risk of a development drilling blowout will inevitably be lower than the above frequency suggests. Finally, the drilling rig will operate in accordance with stringent operating procedures and these will be in line with the best practice of well drilling operation worldwide.

6.4.2 STRUCTURAL FAILURE FREQUENCY

Det Norske Veritas (DNV 1997) states that the total structural failure frequency is comprised of:

- Structural failure within design: 2.4E-05 per year;
- Structural failure due to extreme weather: 1.2E-05 per year;
- Structural failure due to ballast failures: 1.2E -05 per year;

Therefore, the total structural failure frequency is 4.8E-05 per year, including failure in design, extreme weather and ballast failures.

6.5 RISK MITIGATION MEASURES

This section discusses the measures for risk reduction and enhancement of safety during exploratory drilling operations:

6.5.1 RISK MITIGATION TO CONTROL HAZARDS

Occurrence of blowout and sour gas (H_2S) are the two major hazards. Occurrence of H_2S along with oil and gas is the major hazard during exploratory drilling and production testing (The past experience and historical information available for drilling, exploration and production of hydrocarbons in the area revel that H_2S gas shall not befound in hydrocarbon reserves of the region. However, in the event of occurrence of H_2S during drilling operations, associated hazards and risk are considered for completeness of the study). Control measures for occurrence of blowout and release of H_2S gas are discussed in following sub-sections:

6.5.2 BLOWOUT

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

❑ **Blowout preventor Assembly**

- Blowout preventor assembly shall consist of:
  - One bag type of preventor for closing regardless whether drilling equipment is in the hole or not.
  - One blind ram preventor closing against an open hole.
  - One pipe rampreventor closing against drill pipe in use in the hole.
- In blow out preventor assembly, two seamless steel pipes at least 50 mm of diameter connected below each set of blow out preventor, (one for bleeding off pressure and the other for killing the well) shall be provided. These pipes shall be straight and lead directly into the well.
- Each pipeline shall consist of component having a working pressure equal to that of the blowout preventor.
- After the surface casing is set in a well no drilling shall be carried out unless blowout preventor assembly is securely installed and maintained.

❑ **Blowout Preventor (BOP) Control Units: Location and Conditions**

- BOP control units should be located at a distance of nearly 30 m from well center.
- Status of following should be checked and maintained in good condition:
  - Pressure gauges;
  - Pressure steel lines/fire resistant hoses;
  - Level of hydraulic oil;
  - Charging of unit; and
  - Availability of sufficient number of charged bottles.

❑ **Control System for Blowout Preventors**

- All manual control for manually operated blowout preventor shall be located at least 0.60 meters outside the derrick substructures. Instructions for operating the controls shall be posted prominently near the control wheel;
- A control of power operated blowout preventor shall be located within easy reach of driller floor;
- A remote control panel for blowout preventors shall also be installed around floor level at a safe distance from the derrick floor;
- All control for blow out preventors shall be clearly identified with suitable markers; etc

❑ **Other Preventive Measures**

The following control equipments for drilling mud system should be installed and kept in use during drilling operations to prevent the blowout:

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

❑ **Measures after Blowout**

During controlling a blowout, the following precautions shall be taken:

- 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 and a competent person shall be present on the spot throughout;
- 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;
- 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;
- Two approved type of self containing breathing apparatus or any other breathing apparatus of approved type for use in an emergencyshall be available at or near the place,. Adequate firefighting equipment shall be kept readily available for immediate use; etc

6.5.3 CONTROL MEASURES FOR H_2S DURING DRILLING

❑ **H_2S Detection System**

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 at or near to:

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

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 Operators issued by The Institute of Petroleum.

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

❑ **Small Levels of H2S**

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 man will therefore organize and supervise continuous pH checks while drilling. Checks should be as frequent as required depending on ROP 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.

❑ **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 greater 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 and pumps, pick-up the string so that drill pipe is in the BOP and chain down the break;
- One pre-assigned roughneck will go to the doghouse and put on the breathing apparatus. All other rig personnel will evacuate the rig and move up wind to designated muster points;
- Driller and roughneck will return to the rig floor and commence circulating H_2S scavenger slowly and reciprocating the pipe string;
- 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 H2S gas in the mud at 20 gallon of H_2O_2 per 100 barrels of mud; etc

❑ **Control Measures for H_2S During Experimental Production Testing**

H_2S scavenging chemicals (caustic soda solution, calcium hydroxide or iron oxide slurry) will be continuously injected in the recovered gas/oil/formation water after pressure reduction through choke before sending the same to separator.

6.5.4 SAFETY SYSTEM FOR DRILLING RIGS

Operational Safety is the foremost concern while working on drilling rig. Derrick floor is the center stage of all the operations and it is most susceptible to accidents. Safety precaution with utmost care is required to be taken as per the prevailing regulation and practice so that accidents can be avoided. Due to advancement in technology, number of equipment has been developed over a period to cater the need of smooth operation on derrick floor. Various

standards are required to be referred to cover the variety of equipment used for safe operation in drilling and become cumbersome at times to refer standards for each equipment as per given hereunder;

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

6.5.5 Ensure Availability and Provisions before Spudding of the well

To enhance the safety at the drilling rig during drilling operation following should be ensured:

- Geo-technical Order (GTO)/ drilling program with shift in-charge;
- PPE for crew;
- First aid box ;
- Wash pipe should be greased after every 8 hours or as specified by the manufacturer;
- Kelly bushes to be greased after every 24 hours or as specified by the manufacturer;
- Lower & upper kelly cock (its operating lever should be kept at designated place at derrick floor);
- Kelly saver sub on Kelly;
- Mud check valve /full opening safety valve;

- BOP control panel on derrick floor;
- Before lowering casing, inspect all the instruments such as, weight indicator, pressure gauges, rotary torque, SPM counter, RPM counter mud volume totaliser, flow meter & trip tank;
- Required Number of drill collars and heavy weight D/Ps;
- Ensure availability of two mud pumps in good working condition;
- Rat hole and mouse hole be drilled;
- Twin stop safety device should be made in working order;etc

6.5.6 General Safe Practices during Drilling Operation

- Penetration rate shall be monitored. In case of any drilling break, stop rotary table, pull out the Kelly, stop mud pump and check for self flow;
- Different type of drill pipes should not be mixed up during making up the string;
- Protectors should be used on drill pipes while lifting and laying down the pipes on catwalk;
- Drill pipe rubber protector should be installed on drill pipes body while being used inside the casing;
- Before starting drilling, hole should be centered to avoid touching of kelly with casing / wellhead and ensure that no damage is done to well head and BOP;
- Continuous monitoring of the gain/loss of mud during;
- BOP mock drill should be carried during drilling / tripping and under mentioned operations;
- Safe Working Conditions and Practices to be Adopted During Drilling Operations; etc

6.5.7 Emergency Preparedness

- BOP drills and trip drills should be done once a week;
- Deficiency observed in BOP drill should be recorded and corrective measures should be taken; etc

6.5.8 Fire Fighting Facility for Drilling Rig

To detect the release of hydrocarbon during exploration and testing, hydrocarbon detectors should be placed, so that control measures may be taken to prevent fire and explosion.

A temporary closed grid hydrant system with monitors, hydrant points and fire hose boxes may be installed to cover exploration wells, oil and gas production facilities and oil and diesel fuel storage tanks. Portable fire extinguishers of DCP, mechanical foam and CO2 types of

sufficient capacity and in sufficient numbers along with sand buckets should also be placed at strategic locations.

Electrical and manual siren systems should be provided at the Security Gate of the experimental production facility. Electrically operated siren of 500 m range along with push buttons at appropriate locations to operate the siren should be installed.

Adequate personal protective equipments including sufficient number of breathing apparatus must also be kept ready in proper working condition.

Emergency control measures should also be adopted as per Mines Act 1952, Oil Mines Regulation 1984 and Oil Industry Safety Directorate Standard 2000.

As per Oil Industry Safety Directorate (OISD) Standard, for the drilling rigs and well testing following fire fighting system/equipments should be provided:

- Fire water system; and
- First aid fire fighting system.

❑ **Fire Water System**

- One water tank/pit of minimum capacity of 50 kl should be located at the approach of the drilling site.
- For experimental production testing, one additional tank/pit of 50 kl should 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 6.3: DETAILS OF FIRE FIGHTING EQUIPMENTS

Sl. No.	Type of Area	Portable Fire Extinguisher
1.	Derrick 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

Sl. No.	Type of Area	Portable Fire 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
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 Dill 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

6.5.9 MEDICAL FACILITIES

First aids facilities should be made available at the core drilling site and a 24 hour standby vehicle (ambulance) should also be available at the well site for quick transfer of any injured personnel to the nearest hospital, in case an accident occurs and medical emergency arises. Prior arrangements should be made with the nearby hospitals to look after the injured persons in case of medical emergency during core hole drilling and experimental production testing operations.

6.6 DISASTER MANAGEMENT PLAN

6.6.1 INTRODUCTION

In view of the hazards associated with the Oil Exploration and Production industry, it is essential that a disaster control plan be evolved to effectively deal with the situation utilizing the available resources. There are many agencies involved in the activities associated with a disaster e.g. Government, Fire Service, Medical, Police, Army, Voluntary Organization etc.besides the various departments of the concerned organization itself which requires an organized multi - disciplinary approach to the problem.

Oil & Natural Gas Corporation Ltd. is a public sector Oil Company presently engaged in the exploration, drilling and production of Crude Oil & Natural Gas from Offshore & Onshore fields. A&AA Basin, with its headquarters at Chinamara, Jorhat is responsible for entire hydrocarbon exploration activities of ONGC in Northeastern part of India.

For meeting the emergencies caused by major accidents, planning response strategies are termed as Disaster Management Plan (DMP).

6.6.2 PURPOSE OF THE PLAN

The purpose of this Disaster Management Plan (DMP) is to set out the appropriate course of action to mitigate the impact of an emergency event. The plan provides for a procedure allowing all those involved to mobilize their resources in an orderly way and to react in time effectively. Disaster, in present context means an occurrence resulting in uncontrolled release of hydrocarbon and other associated developments. Most disasters have three common characteristic features i.e. loss of control, unwanted release of energy and failure to arrest chain of events. These may result in loss of life, damage to property, adverse effect on the environment and ecological imbalance.

This plan therefore aims at :

1. *To visualize the possible emergency scenario that are likely to occur;*
2. *To evolve a pre-planned methodology of carrying out various emergency combating plans;*
3. *To prepare detailed responses for each type of emergencies;*
4. *To train operating personnel by means of mock drills, so as to make them well acquainted with the response action;*
5. *To minimize the damage to the environment during emergency; etc*

The plan therefore, aims at immediate response to an emergency event to prevent escalation and also the response in the event of such escalation.

Generally, the following five phases are involved in an emergency:

1. Discovery and Notification: An event with an imminent threat of turning into an accident must first be discovered and the discoverorquickly notifies the same to the plant safety officer.
2. Evaluation and Accident Control Initiation: Based on the evaluation of available information, the safety officer makes a rapid assessment of the severity of the likely accident and initiates the best course of action.
3. Containment and Counter Measures: Action is first taken to contain and control the accident by eliminating the causes which may lead to the spread of accident. Measures are also taken to minimize the damage to personnel, property and environment.

4. Clean-up and Disposal: After the accident is effectively contained and controlled, the cleanup of the site of the accident and safe disposal of waste generated due to the accident are undertaken.
5. Documentation: All aspects of accidents, including the way it started and progressed as well as the steps taken to contain and the extent of the damage and injury, must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment. It may be noted that some aspects of documentation, such as, photographs of the site of accident and main objects involved in the accident, survey for damage estimation, etc. may have to be carried out before the cleanup and disposal phase. However, the effort in all cases is to recommence the operation as soon as possible.

6.6.3 CRISIS MANAGEMENT TEAM

ONGC will develop site specific on site and off site emergency plan. These plans will consider linkages with local administration, local communities and other operators in the area to provide necessary support to ONGC to manage the emergency and also to disseminate information on the hazards associated with the emergency.

ONGC will follows safety guidelines and emergency response procedures as per the detailed regulations given in the Oil Mines Regulation 1984 and Oil Industry Safety Directorate (OISD) Standard 2000. However, we are providing a brief outline of a desirable onsite Disaster Management Plan (DMP). Proposed On site DMP is discussed in the following sub-sections.

6.6.4 EMERGENCY CLASSIFICATION

Severity of accident and its likely impact area will determine the level of emergency and the disaster management plan required for appropriate handling of an emergency. Emergency levels and the action needed for each level are indicated below:

6.6.4.1 LEVEL 1 EMERGENCY

Disaster would be one in which emergency response personnel within the installation would be able to contain and deal effectively with the disaster and its aftermath. In this level of emergency, the response is site specific where site personnel are involved and it takes into account the proposition that the situation is controllable with the help of resources available at site. An installation-specific Emergency Response Procedure (ERP) is available at each installation for this level.

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6.6.4.2 LEVEL 2 EMERGENCY

Disaster would require efforts from ONGC resources at the work centres. Level II response is normally activated when the incident Coordinator reaches the site and after an assessment and taking initial actions decides that the situation requires still bigger response by higher authorities of the company, due to severity of the incident, lack of resources or adverse media publicity, community response etc. From this point, the steps of this DMP are applicable.

6.6.4.3 LEVEL 3 EMERGENCY

Disaster would be of such a magnitude that it would be beyond the containing ability of work centre and would require mobilisation of resources through local administration, mutual aid agencies and State / Central Govt. assistance. The CEC (Chief Emergency Co-ordinator) then activates the offsite DMP.

An accident involving very serious hazard and with likely impact area extending beyond 500 m from the operational area, that is, drilling area limits, such as, major fire, very large release of inflammable material. Major fires will usually have the triggering effect resulting in the propagation of explosion. In a level 3 emergency, evacuation of population in villages, if any, adjoining the operational area may sometime become necessary if threatened area extend to populated village area adjoining the site of the primary accident in a direction of maximum impact.

6.6.4.4 LEVEL 4 EMERGENCY

Disaster response is initiated when the Company authorities after implementation and assessment of emergency procedures decides that the local resources are not capable to cope-up with the emergency situation. There are adverse business implications and the situation is worsening and drawing more and more adverse reactions which would require the intervention of Corporate & National level. For such responses, Corporate DMP has been prepared and available at each installation.

Finally, since every emergency situation is unique in characteristics, the exact plan would be decided by the competent authorities. This plan would, at best, serve as guide for drawing the exact plan.

On-site Disaster Management Plan (DMP) will meet the hazards created due to all Level 1 emergencies and most of the Level 2 emergencies. In addition to on-site DMP, off-site DMP may also have to be put into operation for some Level 2 and all Level 3 emergencies.

Luckily the maximum vulnerable zone may not be extended much beyond exploratory drilling and testing area due to blow out and fire around HSD storage area in a sparsely populated area around chosen drilling locations. Therefore, Level 3 Emergency requiring evacuation of surrounding village population is not applicable in case of drilling and testing area. Even the Level 2 emergency is likely to be confined within a limited distance from the drilling site and HSD storage area, the evacuation of personnel only from affected area will be required. Even under the worst accident scenario, evacuation of less than 30 persons may be involved and damage, if any, to nearby installations is expected to remain confined within the operational area.

6.6.5 LEGAL REQUIREMENTS FOR DISASTER PLANNING

Relevant statutory requirements, as given below and asamended from time to time, inter alia, are applicable for emergency response preparedness in E&P industry:

1. *Oil Mines Regulation (OMR), 1984;*
2. *Central Electricity Authority Regulation, 2010;*
3. *Manufacture, Storage and Import of Hazardous Chemicals (MSHIC) Rules, 1989 and amended thereof;*
4. *The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996;*
5. *Explosives Rules, 2008;*
6. *Atomic Energy (Radiation Protection) Rules, 2004; etc*

Additionally, all statutory requirements notified by the Central Government or States, from time to time, shall be complied with, as applicable. Clause-72 of Oil Mines Regulations (OMR), 1984 requires the Mines owner to formulate a contingency plan for fire and clause-64 requires development of an emergency plan for petroleum pipelines specifying actions to be taken in the event of fire, uncontrolled escape of petroleum from pipelines. Also, Clause -45(3) requires preparation of emergency plan for blow-out of oil and gas wells. The rules on “Chemical Accidents (Emergency Planning, Preparedness and Response) – 1996 compliments the set of rules on accident prevention and preparedness notified under the Environment (Protection) Act, 1986, in 1989 entitled “Manufacture,Storage and Import of Hazardous Chemicals Rules”and envisages a 4-tier crisis management system in the country.

6.6.6 ON-SITE DISASTER MANAGEMENT PLAN

The On-site Disaster Management plan is activated in case the emergency requires mobilization of resources from the A&AA Basin. This plan is activated by the Chief

Emergency Coordinator (CEC). Basin Manager of A&AA Basin is the CEC at Basin level and will exercise control through the Basin Emergency Control Room (ECR).

6.6.6.1 EMERGENCY ORGANIZATION

The existence of a well-defined emergency organization is the most vital part of an emergency preparedness plan drawn up to combat any emergency situation. On-site emergency organization chart (Fig 6.4) will be appropriately activated and made functional while combating an emergency situation. The core action group of the emergency organization comprises of the various functionaries of the Basin.

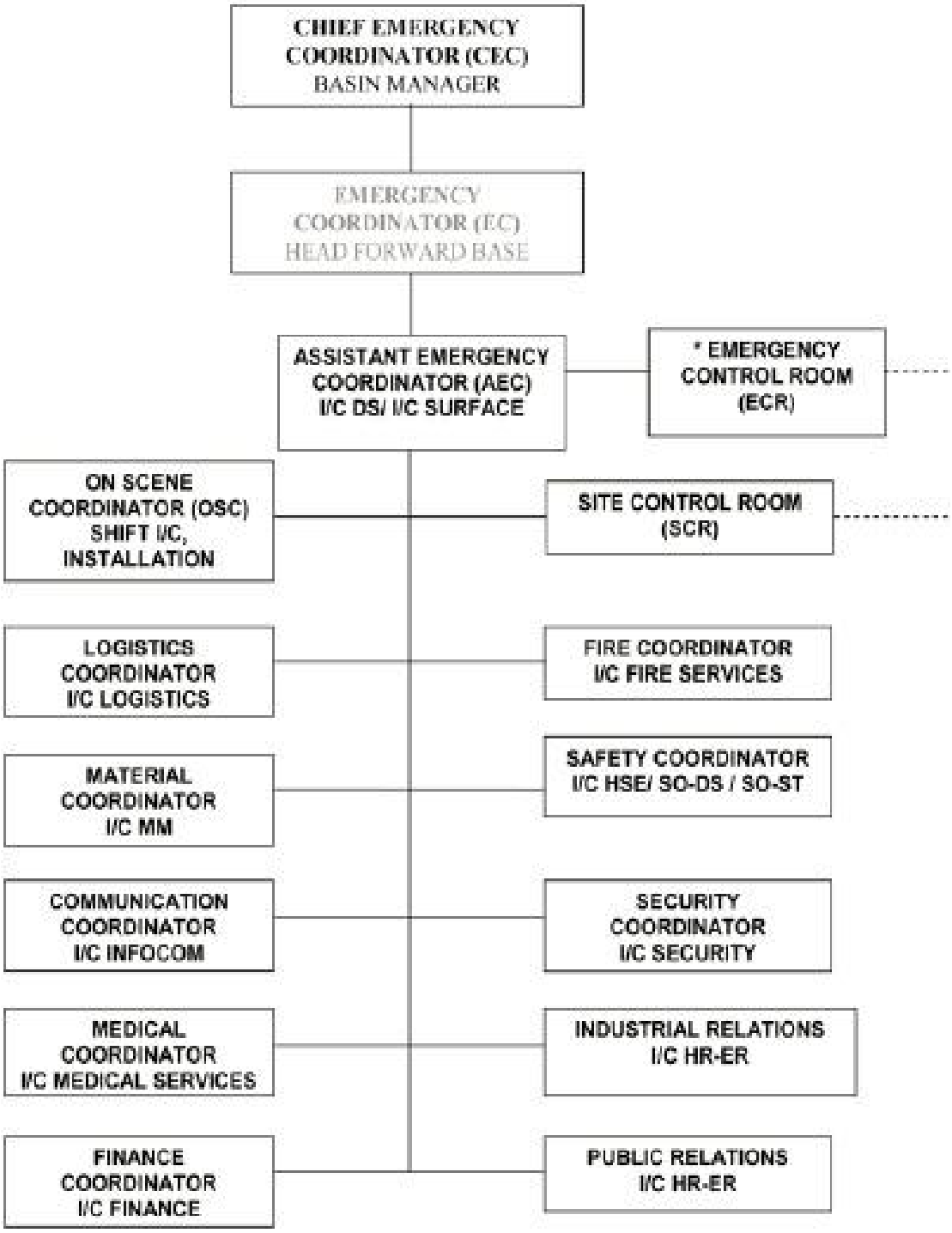
The Basin Manager, A&AA Basin is head of the On-site emergency organization and is designated as the Chief Emergency Coordinator (CEC) at Basin level. He will exercise control through the Basin Emergency Control Room (ECR). The CEC is assisted by an expert team drawn from various disciplines.

The Chief Emergency Coordinator (CEC) will assume control through the Assistant Emergency Coordinator (AEC). The Chief Emergency Coordinator (CEC) may appoint Head Drilling Services / Head Well Services/Surface Area Manager as Assistant Emergency Coordinator (AEC).

The AEC will have the following expert representatives / services to function under his direct control and provide all the necessary assistance and inputs of men and material.

Chief Emergency Coordinator (CEC)	*Basin Manager, Assam & Assam Arakan Basin*
Assistant Emergency Coordinator	*Head - DrillingServices /Well Services / Geophysical Services and Surface Are Manager*
On-Scene coordinator (OSC)	*Shift I/C in the initial phase & Installation Manager RIC in the intermediate phase*
Logistics Coordinator	*I/C Logistics*
Safety Coordinator	*I/C HSE*
Material Coordinator	*Support Manager*
Medical Coordinator	*I/C Medical Services*
Finance Coordinator	*I/C Finance*
Security Coordinator	*I/C Security*
Fire Safety Coordinator	*I/C Fire Services*
Communication Coordinator	*I/C Infocom Services*
Public Relation Coordinator	*I/C Corporate Communication*
Welfare Coordinator	*I/C Industrial Relations*

FIGURE 6.4: ORGANIZATIONAL SETUP FOR THE ON-SITE DMP

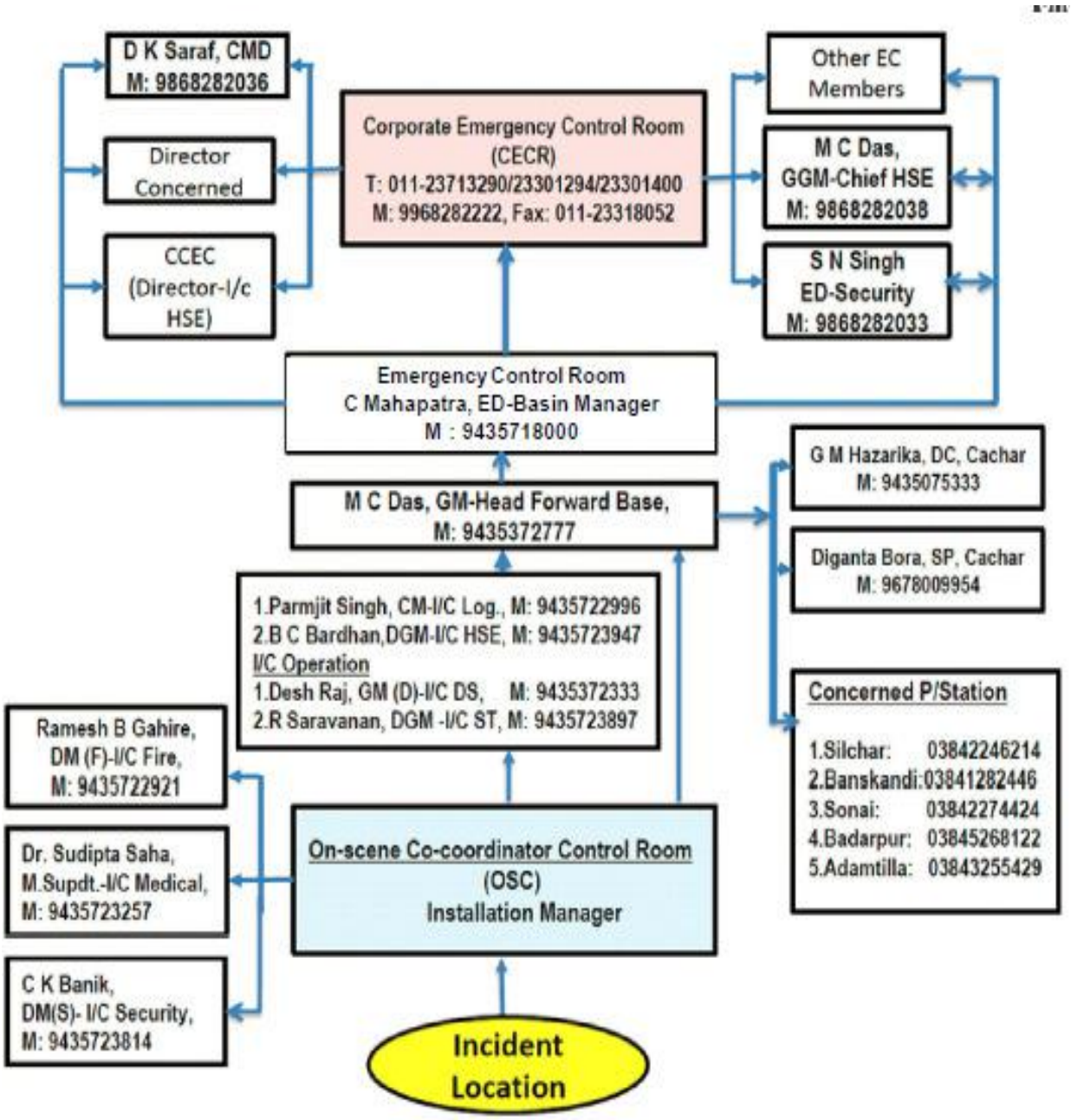


6.6.6.2 EMERGENCY CONTROL ROOM

An Emergency Control Room shall be in place from where the operation to handle the Emergency are directed and coordinated. The ECR should be equipped with good

communication facilities like Telephone (2 nos.), Radio Equipment, Wall Chart showing Locations of Installations, fire station, copy of the Disaster Management Plan, List of Key personnel, their addresses and telephone numbers, note pads etc.

Drilling Oil Mines	*ECR will function from Drilling Services Control Room, Jorhat.*
Production&Work Over Oil Mines	*ECR will function from Surface Team Control Room, Jorhat*
CACHAR FORWARD BASE	*ECR will be established in Srikona Office Complex*



6.6.6.3 ORGANIZATION DURING EMERGENCY

- **Site Control Room (SCR)**

LOCATION: In case of Emergency at Site, a Site Control Room will be set up at a safe distance near the Site by the Mines Manager.

DUTY OFFICER: A team consisting of two to four officers not below E-4 to E-5 level will be deputed in SCR on 12 hr. Shift basis by the Mines Manager, assisted by equivalent number of E-0 to E-2 level officers. In case of Emergency in Surface Team installations, the concerned Mines Manager will nominate Duty Officers at the time of Emergency. List of Duty Officers for Drill site / Installation Emergency is given in Annexure-I.

FACILITIES: Emergency vehicle, Communication facilities, Mobile Van, Ambulance, Lighting arrangement and Food shall be provided at the SCR in the minimum possible time.

FUNCTIONS: Assessment of situation and requirements, for mobilization of equipment/resources etc.

- ✓ To pass on the information regarding latest positions to Emergency Control Room
- ✓ To keep record of all decisions and messages received
- ✓ To keep records of all materials received at site during Emergency.

- **Emergency Control Room (ECR)**

DUTY OFFICERS: Head of services will depute two Officers not below E-4 level on 12 hrs. Shift in ECR. The names of the Duty Officers are given in Annexure-I

One Finance Officer of E-4 or above level will also be deputed in ECR by concerned Head of services/ Head of Finance to extend financial concurrence for rescue operations, procurement of various materials required to handle the Emergency.

FUNCTIONS:

- ✓ Command and Control of entire operations.
- ✓ Information to all officers as per standing list given in Annexure-1
- ✓ Round the clock monitoring and flow of information to & from the site of emergency.
- ✓ Maintenance of running record of events & action taken Casualty list & information to next of Kin.
- ✓ Preparation of Management Report on the situation at every 12 hr. interval.
- ✓ Co-ordination with the key personnel for guidance and assistance required at site.
- ✓ Co-ordination with other Oil companies
- ✓ Co-ordination with Local authorities– Police, Civil Administration, Hospital & Fire etc.
- ✓ Sanction and procurement of the items required during emergency.

- ✓ Arrangement of food, water, shelter, medicine & logistics etc.,
- ✓ Information to Public.
- ✓ Co-ordination with Regions / Projects and Head – Quarter.
- ✓ Co-ordination with fire brigade & fire tender facilities available with different organisations nearby.

- ❑ **On Scene Coordinator (OSC)**

At initial stage, someone close enough to the scene of Emergency (Installation Manager / DIC / senior most people) will exercise as On Scene Coordinator. He will take the charge of the situation immediately before Mines Manager reaches the site and takes over from him.

In case of unmanned location, anyone noticing the hazards will inform the control room on receipt of the information. The control room will direct at least two persons from the nearest installation to visit the site with walkie–talkie and safety torch.

RESPONSIBILITIES:

The responsibilities of the OSC are as follows

- ✓ Initial assessment at the spot and need for mobilization of resources.
- ✓ Inform Emergency Control Room in case, the communication is lost due to disaster. Seek assistance from nearby rig or installation for communication.
- ✓ In case of fire, commands the fire fighting operations till fire service assistance reaches on the scene.
- ✓ Arrange ambulance & doctor if required.

- ❑ **Chief Emergency Coordinator (CEC)**

The Head of the concerned Operational Group will be the Chief Emergency Coordinator and will exercise control through ECR. He will keep record of messages and decisions taken to control the Emergency. He will also appraise the Basin Manager from time to time on steps taken to control the situation and status of Emergency.

- ❑ **Crisis Management Team (CMT)**

The Crisis Management Team of ONGC is headed by Head CMT Corporate stationed at Mumbai and comprises of four Regional Teams stationed at Rajahmundry, Mumbai, Baroda & Sivasagar headed by the respective Head RCMT. In A&AA Basin there is an additional CMT consisting of three officers, stationed at Jorhat base office.

REGIONAL CRISIS MANAGEMENT TEAM (RCMT)

Regional Crisis Management Team comprises of officers having experience in handling major emergency. The RCMT is expected to be informed within 30 minutes of occurrence of incident by the Mines Manager / Emergency Control Room. The Team will immediately proceed to the location and take action to bring the situation under control.

FUNCTION OF THE RCMT:

- ✓ Familiarise itself thoroughly with the manual and its implications.
- ✓ To plan strategies for different Crisis situation so that all necessary inputs can be mobilized without loss of time. Frequent mock drill to be carried out.
- ✓ In the event of Crisis, go to the scene of emergency, assess the situation and take over all fronts out and / or fire up to the point of normalizing the well.
- ✓ Determine the type of assistance required for handling the emergency.
- ✓ To seek guidance and assistance from coordinator group.
- ✓ Updating the action plan of Disaster management on the basis of their experience.
- ✓ Keep them well informed of the technical development through various journals / magazines, suggest scope of improvement in equipment and practices.

- ❑ **Support Services Group**

The Support Services Group will comprise of coordinators from Central Workshop, Electrical, Civil, Logistics, E&T, Health Services and HR/ER, Geology and Reservoir etc. They will provide all necessary help required by emergency control room / Site Control Room / RCMT be in constant touch with Emergency Control Room and may have to stay at the site of Emergency. The name & telephone numbers of the coordinators are given in Annexure-I.

TABLE 6.3: FUNCTIONS AND RESPONSIBILITIES

Sl.No.	Coordinator	Functions/ Responsibilities
1	Support Manager (HR)	Relief and welfare operations ✓ To identify location of relief camp at a safe distance from the affected area and arranegement for shelter (Tent, cot, chair, blanket etc) ✓ To arrange food, drinking water, beverage at relief camps ✓ Maintenance of record of Casualties ✓ Coordinate with local Authorities
2	Fire Service	Monilise fire fighting persons and equipments to the site
3	Info-com (E&T)	✓ Ensure communication facilities ✓ Set up Emergency communication (Walkie-talkie, VHF etc) at the Site Control Room
4	Electrical	Arrangement of Emergency DG and Flame proof lighting at

Sl.No.	Coordinator	Functions/ Responsibilities
		the site
5	Logistics	Arrangement of transport facilities, cranes, moles etc. for men and materials
6	Central Workshop	Aarrangement of fabrication of any device or gadget on priority as required by Emergency team
7	Material Management	✓ To assist in issuing of materials ✓ Arrangment of equipmen, materials, expertise etc., as per requirement of ECR
8	Civil	Civil jobs such as construction of temporary road, control of Oil spread by sand bags or digging of pits, water pumping and storage arrangements etc.
9	Chemistry	Arrangement of chemicals and additives required for mud preparation
10	Medical (Health Service)	Mobile first-aid team with adequate medical facility and ambulance at emergency site
11	Security	✓ Deployment of Security personnel at vulnerable locations ✓ Cordoning off the affected site ✓ Police Help
12	Sub Surface Team (Geology & Reservoir)	To assist in Geological/ Reservoir information about the well
13	Helicopter Services	To seek permission of Chief Emergency Coordinator/ H-ES for shifting of seriously injured persons to Hospitals by Helicopter
14	Corporate Communication (CC)	Press Briefing with approval of Basin Manager

6.7 CONTINGENCY PLAN TO PREVENT BLOW-OUT

The following actions shall be taken by the Shift – in charge to bring the situation under control.

A. On experiencing Kick, following safety actions to be taken, if BOP fails to seal Well Mouth

Sl.No.	Situations	Actions
1	Alert crew to ensure escape if situation worsens	Shift I/C
2	Divert flow partially, intermittently or fully to waste pit (safe distance)	Drilling crew
3	Send SOS message to Base Office,	Shift I/C

Sl.No.	Situations	Actions
	(i) By EPABX (II) By Emergency Vehicles	
4	Switch off all engines/ generators	I/C Mech/ Elect
5	Remove all inflammable material away	Rig Crew (Drilling/ Mech./ Elect.)
6	Remove important Records to Safe place	Rig Crew (Drilling/ Mech./ Elect.)
7	Remove costly instruments/ equipments to safe place	Rig Crew (Drilling/ Mech./ Elect.)

B. If the Blow out issudden and massive while initial safety action could not be performed

Sl.No.	Situations	Actions
1	Carry out rescue operation for Top man and move other Rig crew to safe distance	Shift I/C
2	Send SOS message to Base Office, (i) By EPABX (II) By Emergency Vehicles	Shift I/C
3	Reorganise to try operations like BOP, Diversion of flow etc. as listed in (A), if situation permits	Shift I/C
4	If heavy spillage occurs, try to contain in the restricted area	Shift I/C
5	Alert the inhabitants, if private residence near	Geologist/ Chemist

As soon as an Emergency is declared and the site is evacuated, Site Control Room will be established near the Drill site at a safe distance.

When well is out of control, blow-out will be declared. The contingency plan for prevent blow-out is given Figure 6.5.

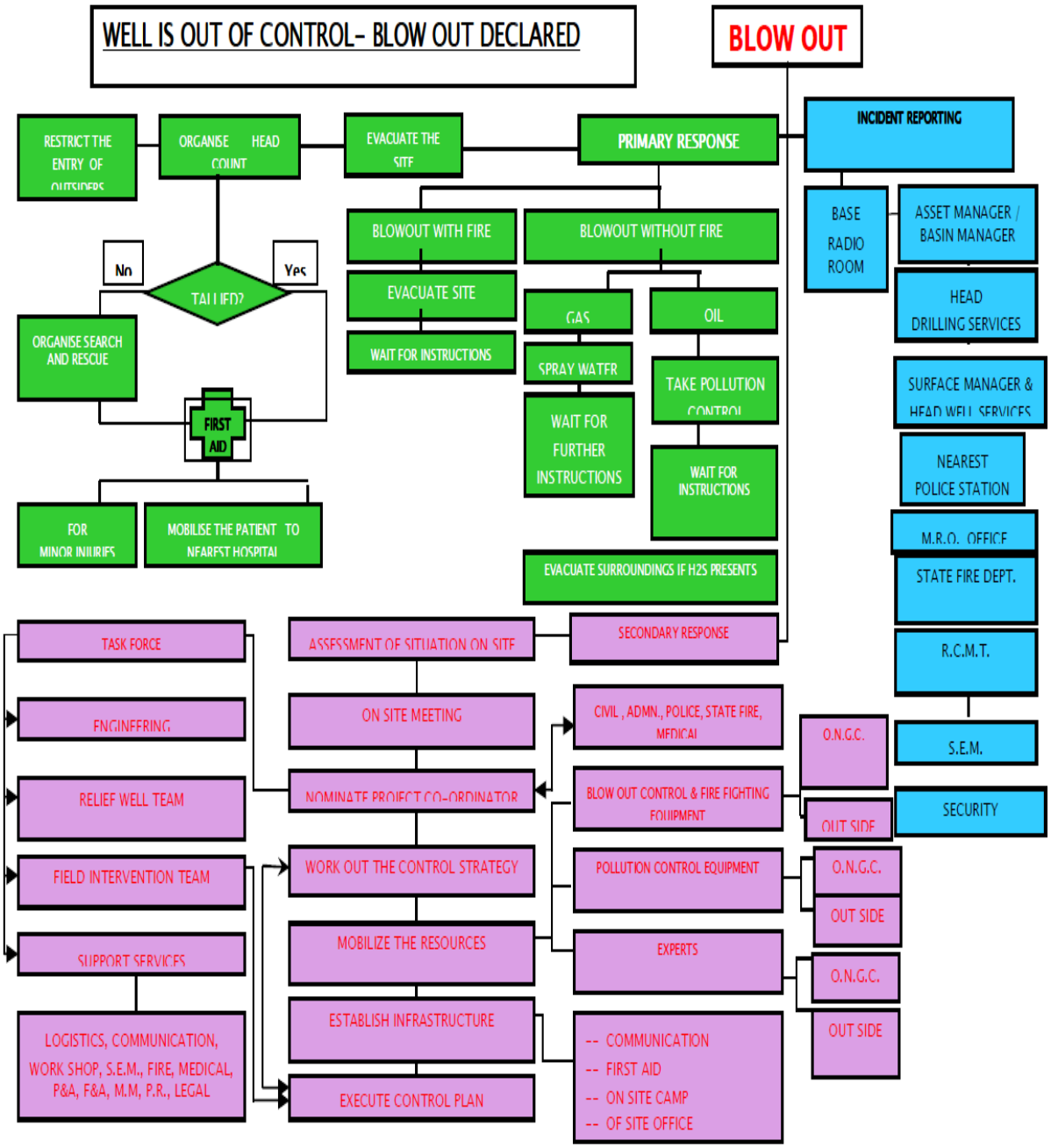


FIGURE 6.5: CONTINGENCY PLAN TO PREVENT BLOW-OUT

6.8 CONTINGENCY PLAN TO PREVENT TERRORIST ATTACK

In the recent years, activities of the militant organization in the North East region has been increased manifold and incident of militant attack on oil installations, Telephone exchanges, Police Stations, Electrical Sub Stations, Air Force Stations and on Armed Force personnel have been experienced. In such incidents huge properties are at stake & numbers of lives are at risk. In view of the same it is essential to prepare a plan to effectively deal with the situation utilizing the available resources. Also, there is a need for appropriate action by the existing force contingent, Local Govt., Fire Service, Medical, Police, Army and various departments of ONGC, A&AA Basin, Jorhat for organized and appropriate approach for the problem arisen.

Sl.No.	Situations	Actions
1	Immediately inform Shift I/C or Post commander CISF at site, I/C security control room of the site. Further he will also sound alarm to alert people	First Person notice
2	Quickly communicate the message by means of VHF, HF set/ Telephone personally to the nearest Police Station/ CISF/ CRPF/ ARMY/ Assam Police as the case may be & ONGC Security Control Room	Sift I/C, First Person noticed
3	The I/C control room on receipt of such information will inform Commandant CISF, ED Basin Manager, Head Security, I/C Fire of ONGC and Local Fire Bridget, DC & SP of the district	First Person noticed/ Control Room
4	Alert everybody in the site	First Person noticed
5	Immediately instruct/ advice the staffs to adopt appropriate measures to save themselves and to minimnize the possible loss/ damage	First Person noticed
6	He will also ensure evacuation of the staff affected by the attack and rescue them to safer place whatever is possible. He shall also advice people to assemble at the specified assembling point.	First Person noticed
7	Inform all First Line Managers/ Base Fire Station/ Base Control office. Information should be given to the Sector Commander, CISF, Borholla and Sarupathar as the case may be for immediate action by CISF	First Person noticed
8	Try to save lives and property	Security I/C, Shift I/C
9	In case of fire try to extinguish with available resources. Simultaneously inform nearest fire station	First Person noticed
10	The place of attack should be evacuated and isolated	First Person noticed
11	In case all communication system failure, information to be	Sift I/C, First Person

Sl.No.	Situations	Actions
	passed personally by any other means	noticed
12	Entry at Main gate should be regulated	Security I/C
13	First aid and Madical treatment should be provided if required	Medical officer

6.9 First Aid Facilities

6.9.1 Specific Safety Provisions for the Safe First Aid Procedures

First Aid Kits are to be maintained at each installation/ WorkCentre as per OISD GDN-204.

S No	Name of Item	Quantity	Units	Purpose
1.	Tincture Iodine	30	ml	Cuts/ Wounds
2.	Tincture Benzoin	30	ml	Cuts/ Wounds
3.	Rectified Spirit	30	ml	Clean wounds
4.	Antiseptic Solution (e.g. Dettol, Savlon)	100	ml	Clean wounds
5.	Cotton Absorbent	1	Roll	
6.	Dressing gauge, sterile	6	Packets	
7.	Bandage, roller	2"	6 nos	
8.	Bandage, roller	4"	6 nos	
9.	Adhesive plaster	2"	1 roll	
10.	Scissor, stainless steel	4"	1 nos	
11.	Blade, new	12	nos	
12.	Bandage, Triangular	3	nos	
13.	Medicinal Adhesive strip (eg. band Aid)	24	nos	
14.	Tab Paracetamol (eg. Crocin)	10	nos	Fever,body/head ache
15.	Tab Antacid (eg. Digene)	10	nos	Indigestion
16.	Tab Antispasmodic (e.g. Cyclopan)	10	nos	Pain Abdomen
17.	Tab Salt	24	nos	Vomiting
18.	Tab Anti emetic (vomiting, e.g. Avomine)	10	nos	
19.	Oral Rehydration Solution (e.g. Electoral)	12	12 sachets	Lose motion
20.	Antibiotic skin powder (e.g. Nebasulph)	2	nos	Dressing of wounds
21.	Antibiotic eye drops (e.g. Sophramycin)	2	nos	
22.	Antibiotic skin ointment (e.g. Neosporin)	2	nos	
23.	Assorted sized Splints	4	nos	Immobilisation
24.	Tourniquet	1	nos	Stop bleeding/Snake bite

6.9.2 Administration of Artificial Respiration

1. Put victim on back, tilt his head back to get a straight neck.
2. Place thumb in the mouth, fingers on outside of lower jaw. Pull jaw upward.
3. Open your mouth wide open, place firmly your mouth over the mouth of victim while your free hand pinches nose of the victim shut.
4. Blow with some force into the adult victim's chest (gently in child) until the movement is seen.
5. Repeat this 12 times a minute (20 times a minute for child).
6. If still some blockade is noticed, then turn adult victim on side, give sharp blow on shoulder blades several times, clean his mouth, reposition the head of victim for artificial respiration and try again and again.
7. In case of child, to clear the blockades, hold the child upside down by feet on your arm, child's face downand give it several sharp pats between shoulder blades, clean mouth of the victim, reposition its head and give artificial respiration. If victim is vomiting, turn his head, clean the mouth and resume artificial respiration.

6.9.3 ELECTRIC SHOCK

After releasing victim, loosen the clothes, and extinguish all clothing that may be smouldering. Stop bleeding once by applying a suitable bandage. Ascertain whether the victim has sustained any burns, and if he is breathing. Examine the burns, and lay the victim in a suitable position. If possible, arrangement may be made to send for a doctor, but start Artificial respiration without the least waste of time, if breathing is stopped. Method to adopt: - When there are no burns on the chest or abdomen use Schaffer's Prone Pressure method. If there are burns, use Silvestre's method.

6.10 CONTACT PHONE NUMBERS IN CASE OF EMERGENCY

1. CRISIS MANAGEMENT TEAM (CMT)

Name	Designation	Telephone No.	
		Office	Mobile
Debashish Pramanik	GM(D)-Head CMT	022- 24088209 022-24088935 (fax)	9969222371
RCMT-SIVASAGAR			
P Babu Rao,	DGM(D)-Head	45501	9435716881
Anil Kumar,	CE(M)	45447	9435717237
G Srinivas,	CE(P)	45511	9435716697
SE(D)	SE(D)	45504	9435717393
Subrato Das,	DYSE(D)		9435717223
AV Ramarao,	DYSE(D)	45506	9435716969
Sanjeev Kumar,	DYSE(D)	45502	9435717238
Jagroop Yadav,	EE(D)	45424	9435716793
BR Konwar,	EE(M)		9435717224
PC Rabha,	EE(D)		9435716145
CMT-JORHAT			
Subhash Babu Sharma	CE(D)-I/C CMT	0376-2707258	9435718930
Jiten Yien,	SE(D)	0376-2707302	9435718497
PC Bora			9435718071

2. EMERGENCY CONTROL ROOM (DRILLING SERVICES)

Name	Designation	Telephone		
		Office	Residence	Mobile
D. Bhattacharyya	DGM (D)-I/C Safety, DS	7358	7736	9435718271
S. J. Dutta,	SE (D)	7280	7280	9435718075
Shri B. K. Das	Dy. SE (D)	7308	7846	9435718135

3. EMERGENCY CONTROL ROOM (SURFACE)

Name of Employee	Designation	Office	Mobile
Dr. A. K. Samant	DGM (Chem.)	7591	9435718283
Sushil Chandra Kalita	SE (P)	7596	9435718774

4 EMERGENCY CONTROL ROOM (WELL SERVICES)

Name of Employee	Designation	Office	Mobile
A.J. DAS	DGM (P)	7598	9435992708
S.N. BORPUZARI	CE (P)		9435992706

5. ENGINEERING SERVICES

Name of Employee	Designation	Telephone		
		Office	Residence	Mobile
D.K.Goswamy.	DGM(Civil)	7390	7773	9435718710
N.K.PANDIT	CE (E)	7632	7793	9435718023

6. IMPORTANT TELEPHONE NUMBERS OUTSIDE AGENCIES

6.1 DIRECTOR GENERAL OF MONES SAFETY

Agency	Tel No. Office	Tel No. Resi/Mob.	Fax No.
Director General of Mines Safety, Dhanbad	0326- 2221000	0326-2221041	0326- 2221027
Director General of Mines Safety, Sitarampur	0341- 2510713	0341-2510713	0341- 2510717
Director of Mines Safety, Guwahati- Mr. D. K. Sahu	0361- 2550129	9435674412	
DDMS, Digboi	03751- 264371	03751-264371	03751-264456

6.2 POLLUTION CONTROL BOARD ASSAM

AGENCY	TEL NO: Office	MOBILE
Member Secretary, PCBA, Guwahati	(0361)–2652774	
Regional Exe. Engineer, PCBA, Golaghat	(03774)-260039	8811013007
Regional Exe. Engineer, APCB, Shivasagar	(03772)-222823	

6.3 OIL INDIA LTD.

Sh.A.K.Acharya, Head Safety & Environment, Duliajan (0374) 2800542 (0374)2800433

6.4 OISD (DELHI)

NAME	DESIGNATION	TEL NO: Office
Shri Hirak Dutta,	Executive Director	0120-2593800/33
Shri Tarsem Singh	Director(E&P)	0120-2593832

7. IMPORTANT TELEPHONE NUMBERS A&AA BASIN, JORHAT. STD Code: 0376

NAME	DESIGNATION	OFFICE	
		BSNL	EPABX
ONGC Health Centre,Cinnamara		2360031	7554 / 7555
ONGC Dispensary(Jorhat City)		2320810	
L S Sehdeva	CM(S), I/C-Security, Nazira		41009
Shri D.K.Taye	DM(S), Sivasagar		41020
Dinesh Kumar	CM (Fire),I/C Fire, Shivasagar		45854
Nitya Dutta	Sr Fire Officer , Nazira		41755
Ramesh B Gahire,	DM-I/C Fire Services-Silchar	03842-254281	5556
C K Banik,	DM, I/C Security		
N C Das,	FO, Silchar		5557
Security control room, Cinnamara		2361513	7213
Fire control room, Cinnamara			7086/7088
CISF control room, Cinnamara		2360113	7424 / 7256
Transport control room, Cinnamara			7676 / 7677
Wireless control room, Cinnamara			7630
Production control room, Cinnamara			7592
Fire station, Borholla GGS			7650 / 7654
Fire station, Koraghat GGS II			7688 / 7690

13. CACHAR FORWARD BASE – Contact Numbers

Junction line Tel No: 229018/229019/229020/229021/229030 FAX: 03842-254044, 0382-254546, ICENET FAX: 7762-4202 Wireless Control Room: Extn. 4212 P&T – 268532

Name	EPABX	DIRECT	Direct #	MOBILE	RESIDENCE
Mukul Chandra Das GM (Geology)- Head Forward Base	5400	285400	254548	9435372777	229044
Bimal Chandra Bardhan DGM(CHEM) I/C Mis	5402	285402		9435723947	229050
HR-ER					
K.R.Narayanan Chief Manager (HR)- I/C HR	5500	285500	254549	7086007000	
FINANCE					
Naveen kumar Sidana CM(F&A) I/C F&A	5520	285520		9435723677	229028
INFOCOM SERVICES					
Akhilesh DGM(E&T) I/C INFOCOM SERVICES	5570	285570	254544	9435372444	229040
LOGISTICS & AUTO					
Parmjit Singh, CM(Logistics) I/C Logistics	5561	285561		9435722996	264229
Transport Control Room	5609	285609	254547		
MATERIAL MANAGEMENT					
Rajvinder Singh (CM)-I/C (MM)	5536	285536		9435723845	
FIRE SECTION					
Ramesh B Gahire, DM(Fire Services),I/C Fire Services.	5556	285556	254281	9435722921	229033
N C Das, FO	5555	285555		9435705871	
Fire Control Room	5555	285555	254281		
SECURITY SECTION					
C K Banik,DM, I/C Security	5557	285557		9435723814	222034
M K Das, Sr SO	5558	285558		9435723889	
Security Control Room	5666	285666			

MEDICAL SERVICES					
Dr.Sudipta Saha, Medical Supdt.	5567	285567		9435723257	229026
Dr. P S Ghosh (MO)	5569	285569		9435723459	
DRILLING SERVICES					
Desh Raj, GM(Drilling)- HDS	5600	285600	254543	9435372333	229025
DRILLING					
Chandan Paul, DGM(Drill)	5630	285630		9435723245	222125
Gopal Choudhary,DGM(D)	5541	285541		9435723953	229047
V.N.Rao, DGM(D) LM(D)	5602	285602		9435723804	265248
Ambabha Majumdar, DGM(D)	5513	285513		9435723843	264138
E-I400-XII-Drllsite		381	2909501		
E-1400-XII-DSA		381	2909503		
Rig E-760-IX Drill site (WLL)		03843-211751			
Rig E-760-IX DSA (WLL)		03843-211494			
CFB (IP PHONE)				862-500 / 862-502	
FCT RIGXI				9435723851	
FCT RIGXII				9435723852	
CEMENTING					
Kamal Kumar Jolwani, DGM(D), LM-Cmtg	5630	285630		9435723800	267161
DRILLING- ELECTRICAL					
B P Singh, DGM(E)	5603	285603		9435722905	267025
DRILLING- INSTRUMENTATION					
Swamy Venkateshwar ,SE	5609	285609		9435723908	
DRILLING- MECHANICAL					
M Akilan, DGM(Mech)	5608	285608		9435723899	267065
U H Adhatrao, SE(M)				9435722924	
MUD SERVICES					
Ambreish Kumar, Chief Chemist LM-(MUD)	5445	285445		9435722643	
ENGINEERING SERVICES					
B N Jayasimha, DGM(Civil)	5450	285450		9435723514	264493
ELECTRICAL					
S Bhattacharjee, SE(E) I/C Electrical	5441	285441		9435723825	
MECHANICAL					
P.B. Ezhil Kandavel,CE(Mech)	5440	285440		9435723804	
SURFACE					
R Saravanan, DGM(Prodn)	5650	285650		9435723897	268005
S K Swain, CE(P)	5652	285652		9435722998	
Rakesh Kumar, CE(P)	5654	285654		9435723783	
Adamtilla GCS (WLL)		03843-211508			
Adamtilla GCS (IP PHONE)		862-200			
Baskandi EPS (LL)		03841-256888			
Baskandi EPS (WLL)		03842-218426			
Panchgram, BP#16 (LL)		03844-273986			
Geology					
D. Lokanath, DGM (Geolo)	5420	285420		9435723495	264401
H K Singha, Chief.Geophy(S)	5592	285592		9435722610	

PUBLIC UTILITIES					
Location	**BSNL Numbers**				
Cachar Cancer Hospital	235135				
Fire Brigade, Silchar	101	245801			
Green View Nursing Home	234043	238406			
Lions Eye Hospital	237977	237978	231601		
Mediland Hospital	230145				
Mousami Hospital	230152				
Nightangale Hospital	230626				
SMC Casuality	234196	233832			
South City Hospital	240991				
Valley Hospital	242847				

14. IMPORTANT TELEPHONE NOS. OF KEY PERSONNEL, CACHAR FORWARD BASE:

Name of Key Personnel	STD Code	Tel. No. Office	Tel Residence	Fax Number
Dy. Commissioner, Cachar	03842	245056	245054	03842-233905
ADC Cachar	03852	233831	236747	
Dy. Commissioner, Karimganj	03843	262345	262103	03843-264150
Dy. Commissioner, Hailakandi	03844	222251	222204	03844-244496
Circle officer, Hailakandi	03844	222268	--	--
DIG(SR) Silchar	03842	254911	261825	03842-245911
Sup. of Police, Cachar, Silchar	03842	245866	245057	03842-231525
SDPO Lakhimpur	03842	267536	--	--
ASP Cachar	03842	245860	237398	--
Sup. Of Police, Karimganj	03843	262371	262030	--
ASP, Karimganj(HQR)	03843	262823	262821	--
S.P ,Hailakandi	03844	222242	222492	03844-223846
S.P Kailasahar (Tripura)	03824	2222392	2322236	--
SDPO,Dharmngr (Tripura)	03822	220309	220309	--
ASP, Karimganj(Nodal Officer)	03842	262624	262818	--
ADIG (CID) GUWAHATI	--	--	--	2547648
IGP (security) GUWAHATI	--	--	--	2380620
SP (Guwahati)	0361	2546286		
Law & Order IGP (GHY)	0361	2455126		