**OIL AND NATURAL GAS CORPORATION LIMITED**

# RA and DMP for Drilling of 29 exploratory wells in 10 ML Blocks in Patan and Mehsana Districts

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**Environment for Development**

## 1.1 Risk and Hazards

In this section, the possibilities of accidental events that may be encountered in the proposed project are assessed. Details of the hazards and safety measures have been identified. The analysis is based on known potential failure causes for HSD storage in the proposed project and past experience of the consultants.

### 1.1.1 Hazard Identification

#### Hazard Associated with Proposed Activities

The project description, and other project related data provided by the client have been comprehensively reviewed to identify the hazardous operations. Also the information on the hazardous properties (MSDS) of all the chemicals handled at the site have been reviewed to identify the hazards associated with the same. Key equipment associated with potential hazards is summarized in Table -1.

***Table -1: Key Plant Equipment with Quantities, Material Contained & Operating Conditions***

| S. No. | Component | MOC | No. / Quantity | Maximum Operating Pressure / Flow Rate | Control System / Indicators |
|---|---|---|---|---|---|
| | Drilling | | | | |
| 1 | 2" diameter piping (for transportation of HSD from storage tank to D.G Set & Diesel generator) | MS | Length: 30 m | 1 kg/cm$^2$ | Visual observation |
| 2 | HSD Fuel Storage Tank | MS | 40 KL | 1 kg/cm$^2$ (Hydrostatic pressure in case of partial leaks) | Level indicator, earthing, flame arrestor & visual observation |

#### Hazardous Inventory

Definition of hazardous chemical is based on the Manufacture, Storage, & Import of Hazardous Chemicals Rules, 1989 as amended in 2008 with inputs from MSDS' of relevant chemicals and available database software such as the United States Environment Protection Agency (USEPA's) CAMEO software suite.

#### *Flammable Gases*

Natural gas (Methane) may come along with crude oil from the well, which is a flammable gas. In accordance with the Oil Mines Regulation Rules, 1984, a flare stack of 9m height will be provided.

#### *Flammable Liquids*

Crude oil is a flammable liquid. Release of Crude oil from storage tank and leak through pipeline have been considered in the present study.

#### Event Classification and Modes of Failure

Component failures are the initiating events for the failure scenarios, which can escalate to consequences like fires, explosions and equipment damage. Eventual failures could be in the form of small gasket leaks in a flange joint or guillotine failure of a pipeline or even rupture / catastrophic failure of equipment. Major failure modes identified in this project are:

Storage tank (HSD) - small/large leaks & Catastrpoic rupture

Hazards that can lead to accidents in operations are discussed in this section. Important hazardous events are classified and defined in Table 2.

***Table 2: Event Classification***

| Type of Event | Description |
|---|---|
| BLEVE | Boiling Liquid Expanding Vapour Explosion; may happen due to catastrophic failure of refrigerated or pressurized gases or liquids stored above their boiling points, followed by early ignition of the same, typically leading to a fire ball |
| Deflagration | Is the same as detonation but with reaction occurring at less than sonic velocity and initiation of the reaction at lower energy levels |
| Detonation | A propagating chemical reaction of a substance in which the reaction front advances in the unreacted substance at or greater than sonic velocity in the unreacted material |
| Explosion | A release of large amount of energy that form a blast wave |
| Fire | Fire |
| Fireball | The burning of a flammable gas cloud on being immediately ignited at the edge before forming a flammable/explosive mixture. |
| Flash Fire | A flammable gas release gets ignited at the farthest edge resulting in flash-back fire |
| Spill Release | 'Loss of containment'. Release of fluid or gas to the surroundings from unit's own equipment / tanks causing (potential) pollution and / or risk of explosion and / or fire |
| Structural Damage | Breakage or fatigue failures (mostly failures caused by weather but not necessarily) of structural support and direct structural failures |
| Vapour Cloud Explosion | Explosion resulting from vapour clouds formed from flashing liquids or non-flashing liquids and gases |

**MCLS Selected for Consequence Assessment**

On the basis of the discussions in this chapter 2, the MCLS' selected for further study are described in Table 3

***Table 3: Event Classification***

| S. No. | Component | MOC | No. / Quantity | Material(s) Modeled | Types of Failure Possible | Maximum Operating Pressure / Flow Rate | Consequences Studied | Control System / Indicators | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1. | HSD Storage Tank | MS | 1 No. (40 KL) | Flammable liquid: HSD | 10 mm, 25 mm hole in tank Catastrophic Rupture of storage tank (100% contents) | 1 $kg/cm^2$ (Hydrostatic pressure in case of partial leaks) | Pool Fire & Explosion | Level indicator, earthing, flame arrestor & visual observation | Stoppage by operator |

### 1.1.2 Consequence Analysis

Consequence analysis is accomplished by estimating various components required prior to accomplishing the final task of risk assessment. Risk is considered to be a function of frequency (likelihood of occurrence of a given event) and damage (generally expressed in terms of fatalities to people; but also injuries and property damage) caused by the occurrence of the event. Before estimating damage, it is required to find out the release quantities and their primary consequences. This is done using intermediate steps of source modeling and consequence assessment. These steps are described in this section.

- Toxic, flammable and explosive substances released from sources of storage as a result of failures or catastrophes, can cause losses in the surrounding area in the form of:
- Toxic gas dispersion, resulting in toxic levels in ambient air,
- Fires, fireballs, and flash back fires, resulting in a heat wave (radiation), or
- Explosions (Vapour Cloud Explosions) resulting in blast waves (overpressure)

### 1.1.3 Consequence of Fire/ Heat Wave

The effect of thermal radiation on people is mainly a function of intensity of radiation and exposure time. The effect is expressed in terms of the probability of death and different degrees of burns.

***Table 4: Damage due to Radiation Intensity***

| Radiation $Kw/m^2$ | Damage to Equipment | Damage to People |
|---|---|---|
| 1.2 | Solar heat at noon | |
| 1.6 | - | Minimum level of pain threshold |
| 2.0 | PVC insulated cable damage | |
| 4.0 | - | Causes pain if duration is longer than 20 sec. But blistering is unlikely. |
| 6.4 | - | Pain threshold reached after 8 sec. Second degree burns after 20 sec. |
| 12.5 | Minimum energy to ignite wood with a flame; melts plastic tubing. | 1% lethality in one minute. First degree burns in 10 sec. |
| 16.0 | - | Severe burns after 5 sec. |
| 25.0 | Minimum energy to ignite wood at identifying long exposure without a flame. | 100% lethality in 1 min. Significant injury in 10 sec. |
| 37.5 | Severe damage to plant | 100% lethality in 1 min.<br>50% lethality in 20 sec.<br>1% lethality in 10 sec. |

***Table 5: Overpressure Damage***

| Overpressure bar | Damage |
|---|---|
| 1 | Fatality |
| 0.41 | Ear Drum Rupture to humans |
| 0.2 | Structural Damage to buildings |
| 0.03 | Glass Damage |

Reference: World Bank Technical Paper no. 55- Technical Ltd. For assessing hazards – A manual

### 1.1.4 Consequence of Containment Failure and Release of Material into Environment

The model is very useful in risk assessment studies where, frequency results provided in this report are based on the above, generalized, algorithm and from published failure data.

Weather condition selected are 2/B (prevalent during the day), 1.5/E (prevalent during the night) and 4.0/D (prevalent during monsoons) has been considered for modeling.

**Release of HSD**

During Drilling, Release of HSD can occur from two scenarios.

- Release of HSD due to 25mm hole in HSD storage tank, and catastrophic failure of the HSD storage tank.

***Table 6: Radiation Level and Effect Distance***

| Failure Scenarios | Consequences | Met. Data | Effect Distance in Meters to Radiation Level | | |
|---|---|---|---|---|---|
| | | | 4 kW/m$^2$ | 12.5 kW/m$^2$ | 37.5 kW/m$^2$ |
| Drilling | | | | | |
| 25 mm eq. dia leak in HSD Storage Tank | Jet fire | 2/B | 1.45 | NR | NR |
| | | 4/D | 1.34 | NR | NR |
| | | 1.5/E | 1.50 | NR | NR |
| | Early Pool fire | 2/B | 21.29 | 14.02 | 6.76 |
| | | 4/D | 22.01 | 15.21 | 7.49 |
| | | 1.5/E | 20.92 | 13.40 | 6.45 |
| | Late Pool Fire | 2/B | 54.22 | 22.04 | NR |
| | | 4/D | 60.28 | 23.93 | NR |
| | | 1.5/E | 51.67 | 21.40 | NR |
| Catastrophic rupture of HSD storage tank | Late pool fire | 2/B | 117.84 | 51.93 | NR |
| | | 4/D | 130.97 | 53.57 | NR |
| | | 1.5/E | 112.81 | 52.00 | NR |

N.R – Not Reached

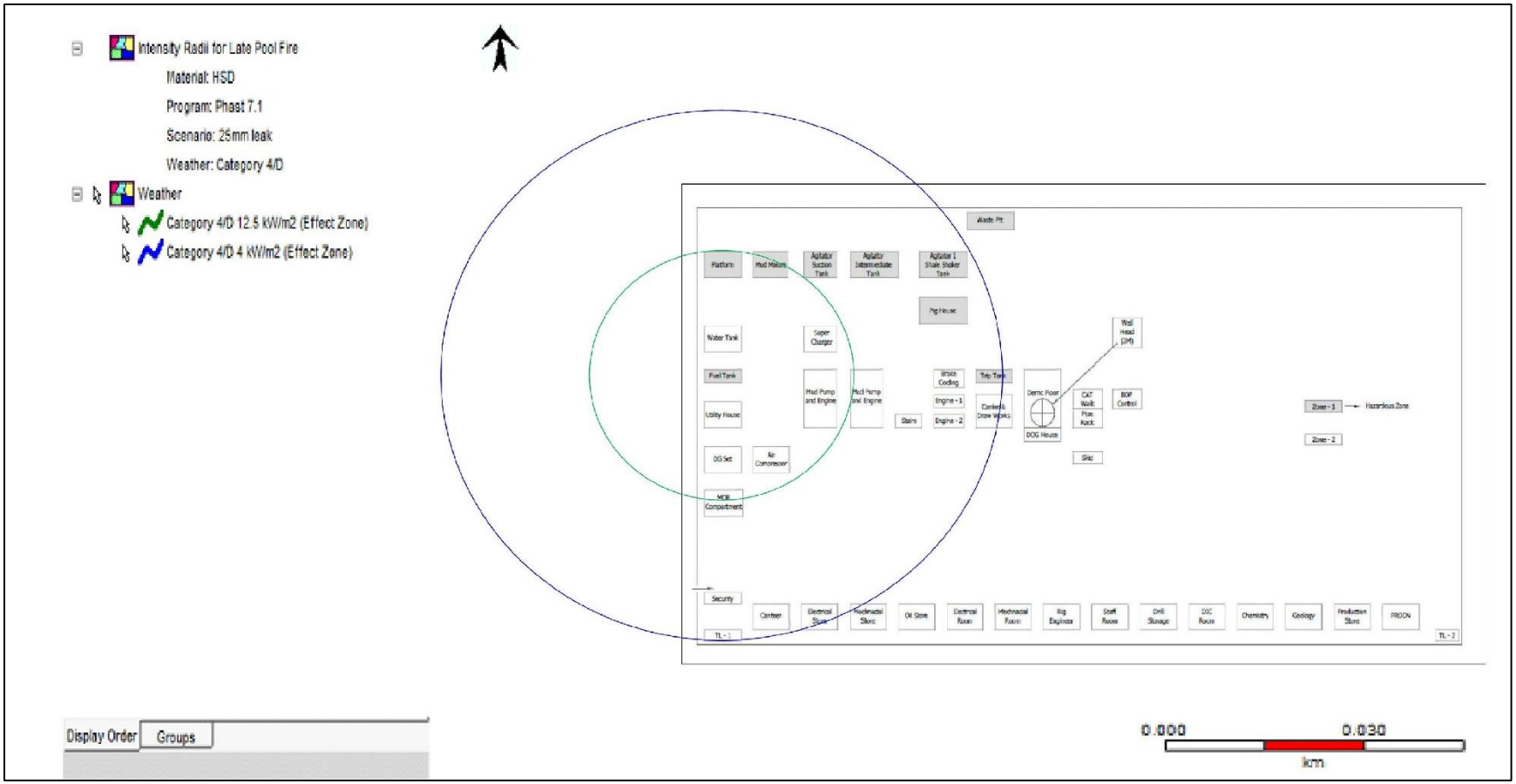


***Figure 1: Risk Contour for late pool fire due to 25 mm equivalent Diameter Leak in HSD Tank at Weather Condition 4/D***

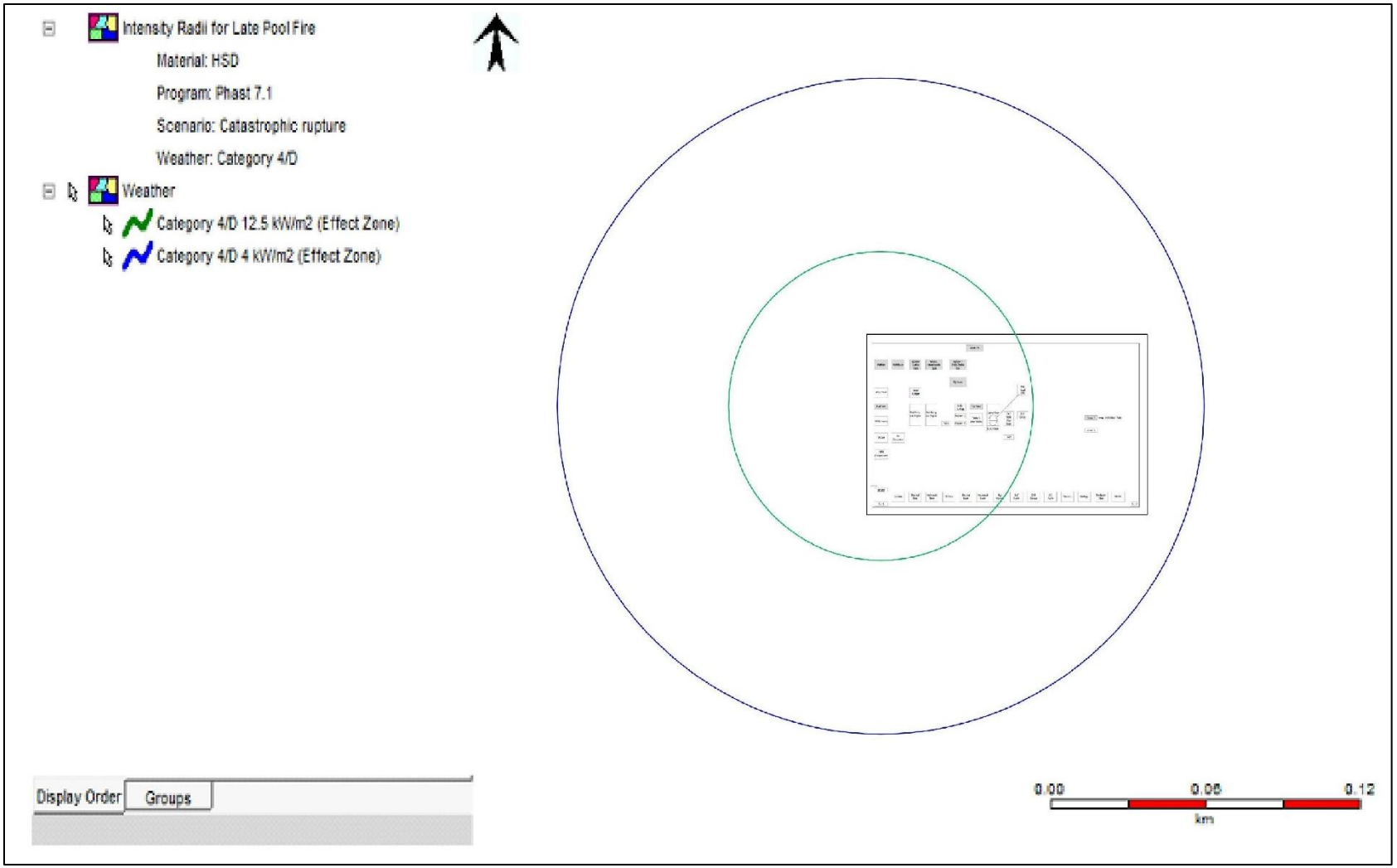


***Figure 2: Risk Contour for late pool fire due to Catastrophic Rupture of HSD Tank at Weather Condition 4/D***

### 1.1.5 Safety Consideration while Installation of Drilling Site Facilities

**Site Layout**

The site layout and buildings will be designed considering the following key safety issues:

- The wind direction will be taken into consideration and then respective facilities will be arranged in the plot plan
- The site perimeter will be appropriately fenced in the interests of security and public safety
- Emergency exits and safe assembly point will be provided in all facilities as per regulatory requirements including the Oil Mines Regulations, 1984

**Drilling Site Facilities**

Adequate general lighting arrangements shall be provided during working hours at the following places:

- Where the natural lighting is insufficient;
- Derrick floor;
- Driller's stand and control panel;
- Monkey board;
- Derrick sub-structure near blowout preventer controls;
- Flare Stack area
- Every place where persons are to work;
- Every means of escape, access or egress;

**Fire Protection**

- Suitable fire-fighting equipment will be provided to take care of any eventuality. Firefighting arrangement shall be provided as per OISD 189.

**Personnel Safety**

- ONGC HSE policy shall be implemented at site
- Suitable Personal Protective Equipment will be provided to all personnel and PPE policy shall be implemented
- Essential equipment such as eyewash facilities shall be provided at relevant locations
- Antidotes for all chemicals being used as per MSDS shall be kept ready at the site
- First aid box shall be kept at site and training to staff for first aid shall be provided
- Work permit systems / Job Safety analysis / Tool box talk to be strictly followed
- HSE training shall be incorporated into routine activities
- Every person employed at site where firefighting equipment may be required to be used, shall be trained in the use of equipment & regular fire drills / emergency evacuation drill etc shall be held for this purpose.

### 1.1.6 Mitigation Measures

- ONGC shall make sure that all the contractors working at site shall undergo Period medical checkup in two stages which include clinical examination and laboratory test if required
- During construction, appropriate PPE shall be provided to site workers and staff members

- Acoustic enclosures will be provided to DG sets and other noise generating equipment
- ONGC shall develop and implement a spill management plan to prevent risk of spill which may cause health problem

Considering the above mitigation measures as well as the other conditions, the impact scores on Occupational Health and Community Safety are likely to be as mentioned in Table 7

***Table 7: Impact Scoring of Occupational Health, Community Health & Safety***

| Code | Impacting Activity | Impact Scoring | | | Remarks |
|---|---|---|---|---|---|
| | | Consequence, C | Probability, P | Final Score C x P | |
| C1 | C2 | C3 | C4 | C5 | C6 |
| | Drilling | | | | |
| 1 | Clearance of vegetation at site and preparation of approach roads | 1 | 2 | 2 | - |
| 2 | Excavation and paving of site | 1 | 2 | 2 | - |
| 3 | Vehicle Movement for transportation of rig, materials and equipment | 1 | 1 | 1 | - |
| 4 | Setting up the rig floor and derrick, handrails, guardrails, stairs, walkways, ladders , flare stack, drilling fluid circulating system & other equipment and machinery | 1 | 1 | 1 | - |
| 5 | Workforce accommodation & Sanitation | 2 | 2 | 4 | Probability is given higher score since, Safety Performance 2011 data of OGP shows % fatalities in land travel of about 23%, which is highest amongst all activities involved in drilling operation |
| 6 | Chemical and fuel storage | 2 | 2 | 4 | Consequence is given a low score since ONGC follow safety rules and regulation strictly and provide PPE to workers onsite and has good past records |
| 7 | Preparation of Drilling Fluid | 1 | 1 | 1 | Low risk |
| 8 | Storage handling and disposal of solid/ hazardous waste | 2 | 2 | 4 | Low Risk |
| 9 | Storage, handling and disposal of waste water | 1 | 2 | 2 | |

| Code | Impacting Activity | Impact Scoring | | | Remarks |
|---|---|---|---|---|---|
| | | Consequence, C | Probability, P | Final Score C x P | |
| C1 | C2 | C3 | C4 | C5 | C6 |
| 10 | Blow out | 2 | 2 | 4 | - |
| 11 | Dismantling of rig and associated machinery | 2 | 2 | 4 | - |

## 1.2 Disaster Management Plan

In view of the hazardous nature of products / process handled by the ONGC, Disaster Management Plans (DMPs) has been prepared. These plans are based on various probable scenarios like Well Blow Out, Fire, Explosion, Natural Calamities etc. The consequence arising out of such incidents are accurately predicted with the help of latest technique available by various Risk Analysis Studies. To minimize the extent of damage consequent to any disaster and restoration of normalcy is the main purpose of DMP. There are on site Emergency Plans that deal with handling of the emergency within boundary of the plants mainly with the help of industry's own resources. Also when the damage extends to the neighboring areas, affecting local population beyond boundaries of plant, Off-site Emergency plans is put into action in which quick response and services of many agencies are involved e.g. Government, Fire Services, Civil Defence, Medical, Police, Army, Voluntary organizations etc.

### 1.2.1 Objective of DMP

The following are the main objective of Disaster Management Plan:

- Safeguarding lives both at installations and in neighborhood.
- Containing the incident & bringing it under control.
- Minimizing damage to property & environment.
- Resuscitation & treatment of causalities.
- Evacuating people to safe area.
- Identifying persons and to extend necessary welfare assistance to causalities.
- Finally when situation is controlled, efforts are to be made to return to normal or near normal conditions.

### 1.2.2 Disaster Management Plan: Structure

Following are the key elements of DMP:

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

A broad outline of responsibilities and duties of different team members concerning the emergency management plan are given in Figure 3: and Figure 4:

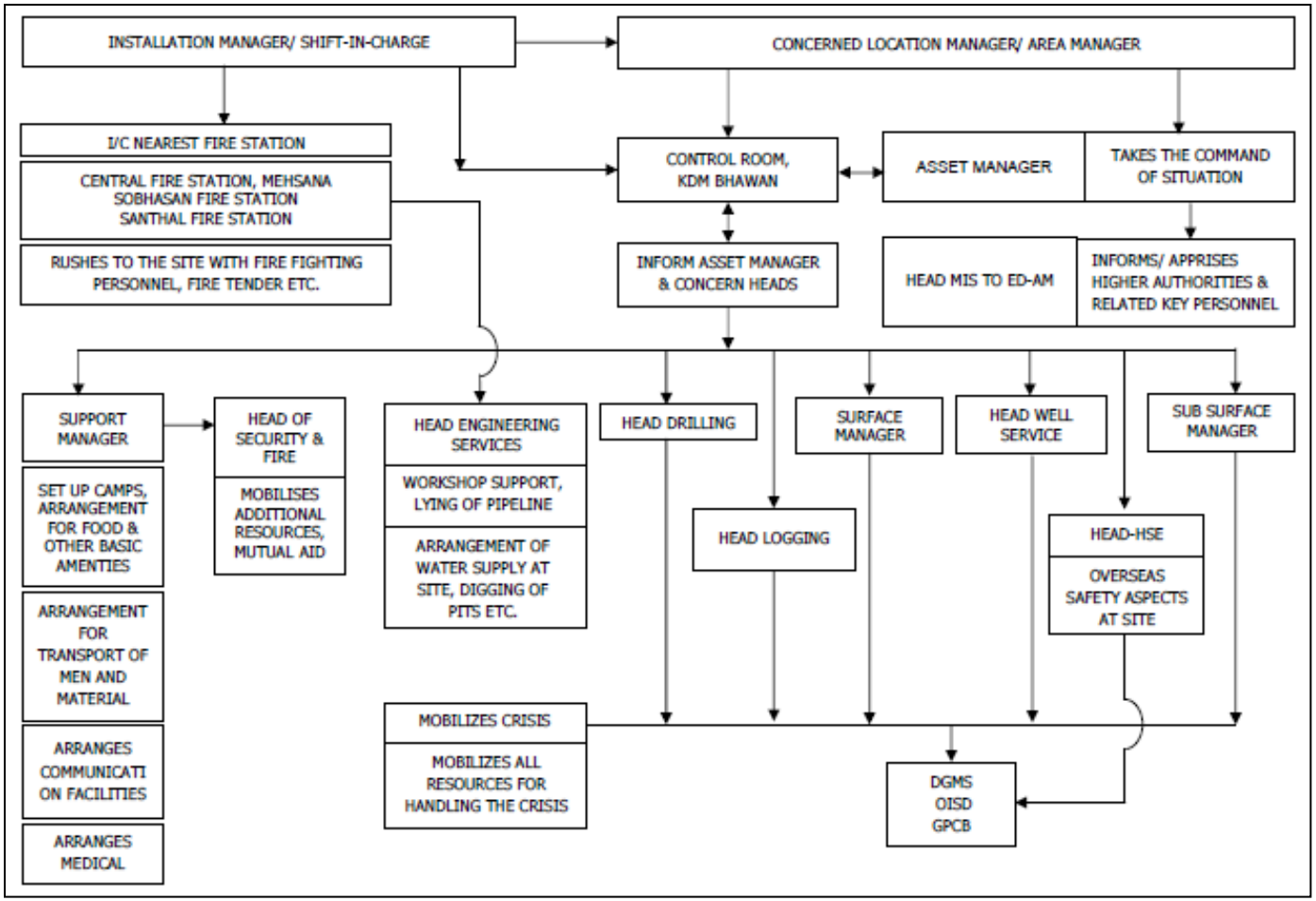


***Figure 3: Organogram during Onsite Emergencies***

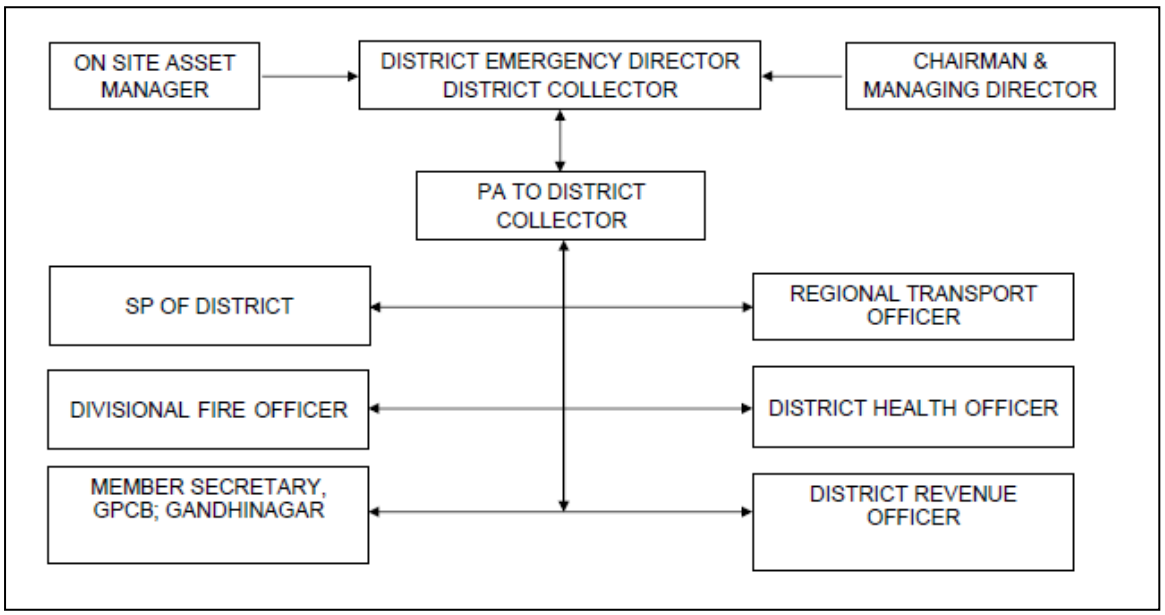


***Figure 4: Organogram for Offsite Emergencies***

Types of Anticipated Hazard

The following are three major disasters likely to happen during the drilling activity:

- Well Blowout
- Fire / Explosion
- Gas Leakage ($H_2S$, Natural Gas etc.)

**Well Blow out**

Blow-out (uncontrolled gushing of oil & gas) is the worst situation, which may arise at oil wells during drilling, work-over operations, perforation, and reservoir studies at active wells etc. or due to some unforeseen reasons.

A blow out, though rare, is the worst accident that can occur in a drilling operation that is often accompanied by fire and explosion exposing workers to serious danger to their lives, burns and poisoning. To understand the failure modes resulting to formation of kick and subsequent blow outs we have to understand the safety systems installed for blow out prevention.

Prevention of blow outs rests primarily on control of any kick in the well bore. A kick means entry of formation fluids into well bore in large enough quantity to require shutting in the well under pressure. Once a kick is detected, steps can be taken to control entry of formation fluids into the well bore by over balancing the expected bottom hole pressure with properly conditioned mud and operation of safety valves i.e. BOP, whereby the space between the drill pipes and the casings can be closed and well itself shut off completely. Several instruments are provided on a drilling rig for detection of kicks.

***Instrumentation in Mud System***

Continuous monitoring of condition of mud in the well provides information useful for well control. The following instruments and equipments are used in the drilling mud system for this purpose:

- A pit level indicator registering increase or decrease in drilling mud volume. It is connected with an audio-visual alarm near the drillers control panel.

- A trip with float-marking device to accurately measure the volume of mud going in to the well. This is useful to keep the well fed with required quantity of mud at all times.
- A gas detector or explosive meter installed at the primary shale shaker together with an audio-visual alarm at the drillers control panel to indicate the well presence of gas-cut mud in the well.
- The kick in the well is prevented by keeping the hydrostatic head of the drilling fluid greater than the formation pressure. The primary control can be lost in the following situations:
- While tripping, if the well is not kept full with the required volume of mud.
- If there is reduction in hydrostatic pressure in the well due to swabbing, which maybe caused if the drilling string is pulled out too fast or by a balled-up or clogged bit, which is indicated by insufficient filling of mud.
- If there is loss of circulation, which may be caused either due to running in too fast, thereby, causing the weak horizons of the well to break or while drilling through a formation with cracks or cavity.

**BOP Stacks**

In a well, after the surface casing blow-out prevention (BOP) equipment is installed and maintained before resuming drilling Annular preventer for closing the well regardless of size / shape of the drill string in the hole or no string in the hole.

- The spool is double ram
- preventer, blind ram for closing against open hole as well as pipe ram for closing against drill pipes.
- Drilling spool located below the double ram preventer provided with choke and kill lines which are connected to the choke and kill manifold. A non-return valve is provided in the kill line.

Standard operating Procedure for Blow out is given in Table 8:

***Table 8: Standard Operating Procedure for Blow Out***

| S. No | Action | Details of action | Action to be taken by |
|---|---|---|---|
| 1 | Declaration of well `Out of Control' | If the I/C of the operation of the Rig feels the well is out of control and could not be brought under control through normal procedure, emergency should be declared. | DIC of the Rig |
| 2 | Switch-off the Power | Immediately after the Blowout is declared, switch off the Main power system, which can cause the ignition. | DIC of the Rig |
| 3 | Ensure personal safety | Call all personnel from the Rig floor area. Ensure whether all the persons reported or not. If anybody is entrapped try to rescue. | DIC of the Rig |
| 4 | First Aid | If anybody is injured, carry out the first aid and send him to the nearest hospital. | DIC of the Rig |
| 5 | Communication to control room. | Report the Emergency to Base control room. | DIC of the Rig |

| S. No | Action | Details of action | Action to be taken by |
|---|---|---|---|
| 6 | Communication to senior officers | Base control room has to communicate the Emergency to all the key personnel. | Base control room |
| 7 | Activation of SOP | Based on the information received and also after visiting the site, seeing the gravity of situation, SOP for dealing the emergency has to be activated. | Asset Manager |
| 8 | Make water supply arrangements. | Make arrangement to connect water line/ spray water on the Wellhead, if the well not on fire. | I/C Fire services |
| 9 | Relief Camps | People are to be evacuated from the premises of 1000 meters. If there is release of Toxic gas like H2S, relief camps are to be organised with all facility for the evacuated people till the well is controlled. | Head HR |
| 10 | Crude Oil Containment | Make trenches to collect the crude and subsequently transport to nearest GGS | Asset CMT Head |
| 11 | Remove the Rig equipment | Remove all the rig unwanted equipment around the wellhead to protect them from the danger of fire and also to create access to the wellhead. | Head RCMT of the Area |
| 12 | Establish communication center at site | In-built communication room has to be mobilized and made operational. | Head RCMT of the Area |
| 13 | Manning of communication center | Personnel should be deployed on round the clock basis to the communication centre at the problem site. | Head Info com |
| 14 | Establish Base control room | Establish communication control room in the base with the all type of communication facilities. Control room should work on round the clock basis. | Concerned services Head |
| 15 | Establish First Aid Centre | First aid centre & medical support has to be established. | Head Medical Services |
| 16 | Care of Casualties | Nearest hospital / Care Centre should be alerted for receiving the emergency cases. | Head Medical Services |

| S. No | Action | Details of action | Action to be taken by |
|---|---|---|---|
| 17 | Cordoning of area. | Boundary has to be fixed all around the problem area and has to be declared as restricted area. | Head Security |
| 18 | Mobilize the Blowout Control equipment from<br>RCMT location. | Blow-out control equipment as directed by RCMT should be mobilized. | LM (Logistics) |
| 19 | Logistic support | Transport equipment for the mobilization of personnel, equipment, removal of debris etc., are to be provided as desired by Head-RCMT | LM (Logistics) |
| 20 | Accommodation/<br>Food/ Beverages | Accommodation for all CMT Experts at nearest possible location. | Head HR |
| 21 | Action plan for controlling blowout | Based on the condition of the well on the surface and<br>Sub-surface & the available data, workout step-by-step detailed action plan with bar charts. | Head CMT<br>Operations |
| 22 | Insurance related matters | Reporting of incident to the underwriters, also supplementation of required data to them, communication of other decision / advise etc., to Head CMT-Ops, claims, pursue of claims. | Rep. of Finance |
| 23 | Construct leveled<br>Surface | A leveled surface with required hardening has to be provided at a place required by Head RCMT to place the office/ rest/ store room etc. | LM (Works) |
| 24 | Pumping arrangements and fill water. | Dig pits as suggested by Head RCMT. Lay the pipeline, and arrange pumps to pump the water from the main source to water pits. | LM (Works) |
| 25 | Install Fire<br>Pumps | Install fire pumps, Monitors at required places and test them on load. | Head-RCMT |
| 26 | Pin point the equipment /expertise /special services which is not available with RCMT | As per the action plan, identify the equipment, workout expertise and services required for each operation also | Head CMT<br>Operations |

| S. No | Action | Details of action | Action to be taken by |
|---|---|---|---|
| 27 | Directional drilling | Find out Directional drilling services as desired by Head CMT. Operations could be provided by local team or not. | Head Drilling Services |
| 28 | Snubbing services | Find out if snubbing unit can carry out snubbing services required or not. | Head CMT Operations |
| 29 | Safety during operations | Safety of the personnel, equipment etc is to be taken care with out compromise during control operations. | Head CMT Operations |
| 30 | Monitoring of the plan | Action plan has to be monitored on day-to-day basis; constraints if any. | Corporate communication |
| 31 | Press Briefing | Every day or once in three days press briefing are to be organized in consultation with Head CMT operations, Asset Manager. | Asset Manager /CC |
| 32 | VIP Visits | VIP Visits should be planned in such a way that control operation should not be hampered and also safety of the VIPs should be taken seriously. | Asset Manager |
| 33 | Review meeting | Review meeting with regard to progress, constraints if at all should be organized every two days. All the responsible persons noted above should attend the meeting. | Asset Manager |

**Fire**

Fire is one of the major hazards, which can result from storage tanks. Fire prevention and code enforcement is one of the major areas of responsibility for the fire service. Hence the facility should be equipped with:

- Water supply
- Fire hydrant and monitor nozzle installation
- Foam system
- Water fog and sprinkler system of Mobile Fire fighting equipment or First aid appliances
- Proper dyke area should be provided for the storage of chemicals. In the event of a fire, the fire in the dyke area should be addressed first so as to minimize the heat input to the tank
- A wind direction pointer should also be installed at storage site, so that in an emergency the wind direction can be directly seen and downwind population cautioned.
- Shut off and isolation valves should be easily approachable in emergencies
- Hydrocarbon detectors to be installed at strategic locations near the units and pipelines handling hydrocarbons at higher temperatures and pressures to assess any leak
- Storage areas must be adequately separate from buildings process areas and other dangerous substances

- These measures should be backed up by relief systems such that the combination of vessel design, protection, quality control and relief eliminates the possibility of complete vessel failure

**Action Plan for Fire Fighting**

***General***

As soon as fire is noticed, shout "FIRE" "FIRE" "FIRE" or "AAG" "AAG" "AAG". Try to eliminate the fire by using proper portable fire extinguishers.

***Installation Manager:***

He should ensure regularly the working status of fire equipments / its maintenance through fire section and see that they are kept in their respective places as per the need. As soon as, the fire accident is reported, rush to site and take charge of the situation. Inform Mines Manger besides Area Manager as well Fire Manager.

***Shift In-charge***

If situation demands sound "Hooter"; call on the nearest Fire Services and Hospital attending doctor. Inform Installation Manager / Field Manager / Surface Area Manager. Give instructions to the assembled staff and get the best out of them.

***Drilling Officials***

Remove other inflammable materials to the safer distance. Remove important documents to a safer place. The first aid trained persons should be ready to give first aid to the injured persons and move them to the hospital if required. Get well acquainted with the location of the wells.

***Electrical Officials***

No naked flame should be allowed. Generator should be stopped. Electrical lines are required to be de-energized. See that uninterrupted supply of water from tube well to the fire services.

***Mechanical Officials***

Get the instruction from the Shift In-charge to act accordingly to stop the equipments and ready to carry out repair jobs if required like pump problems of fire services etc. Help production officials in removing inflammable materials.

***Transport Officials***

Get vehicles parked at a safer distance. See that approach road is clear for fire services vehicle to the approach the accident site.

***Security at Gate***

To prevent unauthorized entry of persons / vehicles inside the area of responsibility and also to ensure no abnormal activity by unauthorized persons is allowed.

***Fire Officials***

On arrival they fight fire with the assistance of site staff in extinguishing the fire. If the situation still proves to be beyond control, then the help from the nearest agencies could be taken.

***Fire Control Room***

A fire control room will be set up for smooth functioning of firefighting/ rescue operations at the site of incident. Manager (F.S)/ one fire officer or senior most person of fire section will be I/C of that control room. Meanwhile one Fire officer will take charge of Control Room of Central Fire Station to assist/ back support for required fire equipments / man power. In charge control room of Central fire Station will be responsible for arranging of man power and equipments if required at site.

***Area Manager: (In Case of Major Fire)***

- Pre-identified source of additional water to be used for uninterrupted supply of water.
- If situation demands, pits be dug to store sufficient water, pipeline be laid to carry water from the sources to water pits.
- Maintenance party to remain to attend any problem. Besides special maintenance team be immediately sought from the workshop.
- Arrangements to provide flameproof lights at a safer distance.
- Arrangements to provide mud and chemicals necessary to control situation.
- Arrangements for food, water, temporary rest rooms or tents for the officials on the round the clock duty at site.
- To keep ready fleet of jeeps, tractors, crane to meet demand.

**Hydrogen Sulfide (H2S) and Natural Gas Leakage**

Hydrogen sulfide is a colourless, flammable, extremely hazardous gas with "rotten egg" smell.

***Effect of Hydrogen Sulfide gas to Health:***

Low concentrations irritate the eyes, nose, throat and respiratory system e.g. burning / tearing of eyes, cough, shortness of breath. Repeated or prolonged exposures may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss.

***Measures***

- Do not panic
- Check the wind direction and evacuate all personnel to safe breathing area.
- Put on 30 Min. breathing apparatus set
- Come back to that site in two (use buddy system), with portable H2S detector and monitor the $H_2S$ level in the atmosphere.
- Stop the source of leakage (i.e. close the well)
- Remove victim, if any to fresh air, if breathing, maintain victim at rest & administer oxygen, if available, if person is not breathing, start artificial respiration immediately or start mechanical/ automatic resuscitator. Call ambulance and sent victim to hospital or doctor.
- Avoid & extinguish all naked flames
- Pull out all inflammable material i.e. HSD, Gas Cylinders, Chemicals etc. from the premises of well / installation. .
- Warn nearby ONGC installation/ testing sites.
- Pull out all possible equipment to safe distances.
- Call for fire tender and start spraying water on the sources of leakage to dissolve H2S in water.
- Evacuate personnel in 500 mts area from down wind direction.
- Warn nearby inhabitants, if required.
- Keep in touch with control room for all instruction.
- Cordon off the area & do not allow entry of any unauthorised person.

***Effect of Natural gas on Human Health:***

- Colourless, odourless, flammable gas, mainly methane. May cause flash fire. Electrostatic charge may be generated by flow, agitation etc:
- No occupational exposure limits established.
- Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present.
- Eye Protection: Eye protection not required, but recommended.
- Clothing: Protective clothing is not required.
- Gloves: Wear appropriate chemical resistant gloves.
- Respirator: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use. For Unknown Concentrations or Immediately

**Contingency Plan for Oil Spill**

Oil spills occur despite prevention efforts. Oil spills happen on land and in water, during monsoon, testing, pipeline leakage etc. They vary in size, from just a few hundred liters to the thousand of liters. Preparing a timely and co-ordinated response to such an emergency of undefined magnitude that can happen anywhere, at any time, and in any kind of weather is an enormous challenge that requires significant planning and training.

***Action***

- When the information / disaster has been flown to all the designated components of the system. Every part has to function and coordinated goal shall be achieved according to the prescribed duties and responsibilities.
- Immediate step: As soon as the concerned personnel receive the alarm, all shall work simultaneously for the following steps to be taken to carry out the operation.
- First Information Report (FIR): Control room of surface team shall be treated as nodal point for converging / diverging the information in / from all the components of the system.
- Pumping: Concerned Installation Head shall take immediate steps for shut down or stopping of pumping / compressor unit and the affected pipeline sector shall be isolated. He shall inform HES, SM, ASM, and LM (W), I /C Security and I /C Fire.
- Search: Area Manager / Installation Manager shall organize for sending a search party of the skilled personnel to the site and the team shall coordinate with installation in-charge and communicate the data / information regarding location of accident/ disaster and magnitude of the same.
- Administration: Administration coordinator has to arrange for mobilization of fire brigade, safety and security team and medical team if required (as in case of red disaster). In case of red disaster, he has to take steps for evacuation and rescue operations.
- Firefighting: In-Charge Fire and Security section shall have to immediately assess the situation and mobilize fire fighting equipments from in-house resources and outside agencies if needed. The incident site should be cordoned off by the security to avoid any untoward incident.
- Repair operation: LM (W) shall coordinate and I/C maintenance in C & M division shall organize and supervise operation for repairing and restoring the normal operational conditions. The line should be buried in presence of security personnel.

***Control Room***

E & T control room of Asset will be the nodal point of converging / diverging the information. Duty officer shall coordinate the information flow between site and management team.

***Preventing Oil Spills***

- To have sufficient storage facilities to prevent the discharge of all kind of oil into the water.
- To have adequate facilities for inspection of pipeline, storage tank etc. to avoid leakage, sabotage.
- To have adequate facilities for testing of well.