Environmental Risk Assessment Report for Exploratory drilling in 10 wells in On-shore, NELP-VI, Block CY-ONN-2004/2 of Cauvery Basin, Ariyalur District, Tamil Nadu

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2014
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Risk Assessment and Mitigation Measures
1.0 Risk Assessment and Mitigation Measures

Risk assessment is a process in which hazards associated with process/operations are identified with the aim of reducing, controlling and eliminating the identified hazard. Hazards identification assists in recommendation of safeguards for either prevention of an event from occurring or reduce the consequences, if the event occurs.

Risk assessment process involves identification of risks, rational evaluation of them based on their significance and outlining preventive and mitigation measures.

The objective of Risk Assessment is to formulate risk mitigation or reduction measures for the major risks prioritized based on the consequence of the identified hazards.

1.1 Total Risk Management (TRM)

Total Risk Management encompasses the hazard identification, evaluation, prioritisation, consequence analysis and formulation of risk mitigation and reduction measures.

1.1.1 The TRM Process

The process involved in Total Risk Management is as indicated at Figure 1.1.1.1

**Fig 1.1.1.1 Risk Management Process**
The TRM involves the following steps:

**Step 1: Identifying the problems/Hazards and associated Risks:**

Identify and analyse the anticipated problems/Hazards and the associated risks predicted for all the project phases of well execution.

**Step 2: Qualify and Quantify risks:**

Evaluate the risks based on the experience, operating knowledge, uncertainties, based on existing data and Risk Metrics.

<table>
<thead>
<tr>
<th>RISK METRICS &amp; RISK MATRIX EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RISK METRICS</strong></td>
</tr>
<tr>
<td><strong>PROBABILITY (P) x CONSEQUENCE (C)</strong></td>
</tr>
<tr>
<td>&lt; 1 hr, 1 bbl spill</td>
</tr>
<tr>
<td><strong>1 (ALARP)</strong></td>
</tr>
<tr>
<td>1 IN 30 WELLS</td>
</tr>
<tr>
<td><strong>2 (LOW)</strong></td>
</tr>
<tr>
<td>1 IN 10 WELLS</td>
</tr>
<tr>
<td><strong>3 (MEDIUM)</strong></td>
</tr>
<tr>
<td>1 IN 5 WELLS</td>
</tr>
<tr>
<td><strong>4 (HIGH)</strong></td>
</tr>
<tr>
<td>&lt; 1 IN 2 WELLS</td>
</tr>
</tbody>
</table>

**Fig 1.1.1.2 Risk Metrics and Risk matrix Evaluation**

**Step 3: Prioritise Risks:**

Based on results from step 2 prioritise the risks identified and compile project phase wise.
Step 4: Mitigation Measures:

State the mitigation measures to be implemented to remove, prevent and/or reduce risks.

Step 5: Review and Record

Review the process utilising the outputs from steps 1-4 during the course of the well execution, at the end of the project and record lesson learnt for use in the future projects.

TRM process need to be conducted for each task/activity for the tasks. Typical activities are listed in Table 1.1.1.1. This process results in TRM sheets that can be used at the rig-site by personnel prior to the activity, i.e. to review, re-assess the risks and mitigations prior to execution of each task/activity. During this process additional changes or improvement actions or mitigations may be required, based on the actual set of conditions existing at the site.

<table>
<thead>
<tr>
<th>Rig start up &amp; Mobilisation</th>
<th>Running of BOP and riser</th>
<th>Evaluating 8 ½ “ well bore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor Drilling</td>
<td>Geological risks and uncertainties</td>
<td>Running and cementing 7” liner</td>
</tr>
<tr>
<td>Conductor Casing</td>
<td>Drilling &amp; Tripping 12 ¼ “ and 8 ½ “ wellbore</td>
<td>Suspending well bore</td>
</tr>
<tr>
<td>Conductor Cementing</td>
<td>Running and cementing casing</td>
<td>Demobilising rig</td>
</tr>
</tbody>
</table>

Table 1.1.1.1 Typical activities for drilling operations

Any lesson learnt during the above process needs to be recorded and risk process documents need be updated for use in future for risk management.

Table 1.1.1.2 and Table 1.1.1.3 represent indicative templates for risk management and an indicative risk management process chart respectively.
Table 1.1.1.2 Typical template for risk management

<table>
<thead>
<tr>
<th>Step</th>
<th>Job breakdown sequence</th>
<th>Potential hazards</th>
<th>Risk Rating</th>
<th>Precautions/ Risk Reducing measures</th>
<th>Action / Responsibility</th>
</tr>
</thead>
</table>
| h    | Drilling 12 ¼" well bore | Well bore quality | 6          | 1. Minimise flow rate in the clay group to avoid washout  
                                               2. Monitor cuttings shape, size & quality trend  
                                               3. Stop and circulate hole clean with rotation  
                                               4. Implement correct drilling practice  
                                               5. Ensure good mud filter cake forming properties |                         |

Table 1.1.1.3 Indicative risk management process chart
1.2 Anticipated Hazards

Major problems or risks involved in Drilling for oil exploration are

- Blow outs
- H2S exposure
- H2S induced blow outs
- Oil Spills

Some of the problems involved in Exploratory drilling are

- Differential sticking
- Problems due to geo pressure
- Unconsolidated formation
- Fracture or Faulted zone
- Under gauge hole
- Key seating
- Reactive formations &Mobile formations
- Collapsed casing
- Junk in the hole
- Cement related problems
- Poor Hole Cleaning
- Hole geometry
- Wellbore geometry

One has to have a complete idea of the drilling problems and this will reduce the Non-Productive Time.

1.2.1 Blowout

One of the major risk factor in exploratory drilling is the well blowout.

Blowout is defined as the uncontrolled flow of formation fluids. This happens when the wellbarriers are not in position to stop the influx from the formation.

The probability of failure of the well barriers resulting in the blowout depends on a number of risks. These risks are specific to the reservoir underground conditions and the operational aspects.

Twelve risk factors are identified among these factors are the operating margin namely the pore pressure window,pore pressure, the stability of the formations or the seismic quality and uncertainties. For e.g. the smaller is the operating margin higher the chance of loosing the primary well barrier with the loss of drilling fluid to the formation poor seismic quality can lead to improper well design which will
lead to higher blowout risks. Risk factor relating to rig riser and well include crew experience and water depth

Operation related risk factor involves also have a marked influence on blowout risks. Tripping too fast resulting in swabbing. Higher the number of trips means higher the risk for blowout.

Kick precedes the Blowout. Kick is defined as the influx of formation fluids into the wellbore causing reduction in the Hydrostatic pressure. Two Types of kicks are observed the underbalance kick and induced kick.

**Under Balance Kick**

It is caused by an increase in formation pressure above wellbore hydrostatic pressure. It may be caused when permeable zone drilled with mud weight insufficient to control formation pressure. Indications of such situations can be observed in offset well data and mudlogger. It can be prevented by adjusting the mud weight.

**Induced Kick**

It is caused by a decrease in hydrostatic pressure below the formation pressure of the permeable zone. Indications of such situation is loss of mud during operations and can be prevented by appropriate mud weight and ensuring the hole is full of mud.

### 1.2.1.1 Risk factors

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir and underground</td>
<td>Number of Reservoirs and Targets</td>
</tr>
<tr>
<td>conditions</td>
<td>Challenging Drilling Formations</td>
</tr>
<tr>
<td></td>
<td>Pressure Margin</td>
</tr>
<tr>
<td></td>
<td>Pore pressure</td>
</tr>
<tr>
<td></td>
<td>Over pressure</td>
</tr>
<tr>
<td></td>
<td>Borehole stability</td>
</tr>
<tr>
<td></td>
<td>Permeability</td>
</tr>
</tbody>
</table>
Table 1.2.1.1.1 Risk factors associated with Blow out

A single blowout can lead a range of potential hydrocarbon flow rates. Blowout scenario represents the different potential origin and flowpaths for a blowout.

Figure 1.2.1.1.1 represents the parameters characterizing the blowout scenario.
1.2.1.2 Causes of Blowouts

The causes can be subdivided into two sections

- Causes under the control of management
- Causes under the control of subordinate personnel

1.2.1.2.1 Causes under the control of management:

- Use of Improper drilling fluid
- Failure to provide ample supply of reserve mud
- Inadequate mud pumping equipment
- An Inadequate casing program
- Inadequate, obsolete or worn-out control equipment
- Lack of periodic inspection of vital equipment and Failure to authorize necessary repairs
- Failure to give complete concise instruction to subordinates and insufficient supervision
- Lack a practical educational safety program

1.2.1.2.2 Causes under the control of subordinate personnel:

- Drilling gas sands too fast
- Pulling drill pipe off bottom rapidly
- Balling up bit or drill collar by crowding in sticky formations
- Using too large diameter drill collar
- Pulling out of the hole before the mud is in proper condition
- Failure to run fill up frequently while pulling out the drill pipe from the hole
- Use of low pressure in high pressure control manifolds
- Procrastination in making rig repairs
- Continuing to drill or circulate during heavy rain
- Failure to maintain supply of reserve mud in condition for use
- Lack of general vigilance for unmistakable sign of gas
- Failure to obey specific instructions

1.2.1.3 Prevention of Blowout

There are three methods for controlling blow out

1. Primary Control
2. Secondary control
3. Tertiary control
1.2.1.3.1 Primary control:

Primary control involves the use of Drilling fluid to balance the formation pressures by varying density of the fluid and thereby the influx of formation fluids are prevented.

Fig 1.2.1.3.1.1 Schematic Diagram showing the methods of Controlling Blow out

1.2.1.3.2 Secondary control:

The use of mechanical devices to prevent the flow of formation fluids to surface. When the exploratory well flows without the pumps on a decision is taken immediately to close the Blowout preventer and to start well control operations.

Mechanical device used to prevent the influx reaching surface and to keep the well under safety is called Blowout preventer.

BOP’s are mounted directly to the wellhead in combinations called the BOP stack. Such a stack will normally contain several of the two basic BOP types: ram and annular. In special situations, a third BOP type-the rotating BOP-can also be used in combination with rams and annulars.
Diverters are safety systems which are used to divert the flow of formation fluids due to low fracture gradient where Blowout preventers cannot be used

1.2.1.3.3 Tertiary control:

**Stripping and Snubbing**: When the drill string is out of the hole the control of Blowout needs special technique called stripping and snubbing. Stripping requires the running of Drill pipes to bottom when the well already started kicking out formation fluids to the surface. Stripping under pressure is referred to as snubbing and is usually done with a snubbing unit.

**Stripping**: This is an emergency well control procedure. This requires proper training execution. The objective is to maintain a hydrostatic pressure more than the formation pressure while stripping the annulus pressure increases and if too much mud is bled off the pressure

Mud to fill up the string = Pipe Capacity X Length

Mud to bleed off = (Internal Capacity + Displacement) X Length

**Snubbing**: Snubbing involves of movement of pipe under pressure through a snubbing unit. The snubbing unit is a mechanical or hydraulically operated one. The difference between the string and snubbing operation is that the pipe is run not by its own but by induced pressure

Typical shut in Decision tree for onshore Drilling Rigs is presented at Fig 1.2.1.3.3.1

1.2.2 Hydrogen Sulphide (H2S)

Hydrogen sulphide is a colourless, flammable, extremely hazardous gas with a “rotten egg” smell. Some common names for the gas include sewer gas, stink damp, swamp gas and manure gas. It occurs naturally in crude petroleum, natural gas, and hot springs. In addition, hydrogen sulphide is produced by bacterial break down of organic materials and human and animal wastes (e.g., sewage). Industrial activities that can produce the gas include petroleum/natural gas drilling and refining, wastewater treatment, coke ovens, tanneries, and craft paper mills. Hydrogen sulphide can also exist as a liquid compressed gas.
SHUT-IN PROCEDURES -- Kill Circulation Decision Tree

Monitor DP/CSG Pressures

is pipe on bottom?

Strip to bottom

NO

YES

Doubt

YES

Wait and Weight

Driller’s Method

Line up surface facilities:
- Poorboy/trip tank
- Blow down line
- Glycol injected unit
- Cement unit for Glycol injection

Start circulation at selected SCR

influx 7 ft. from BOP

Are hydrates predicted at BOP

YES

Start injecting glycol at ? gal/min down

NO

U/S Choke temp.

Gas at choke

YES

Start injecting glycol into CM at ? gal/min

NO

Start pumps and restart at lower SCR

Restart pumps at lower SCR

Shut choke Stop pumps Open vent line

Exceeding ? psi

Monitor Buffer Tank Pressure

Approaching ? psi

Stop pumps. Select lower SCR

R/U to heat manifold to clear plug

Exceeding Trip Tank gauge Pressure

Monitor Poorboy Pressure

Approaching Trip Tank gauge Pressure

Stop pumps Monitor Pressure

Clear BOP Circulate riser Open well

0 psi

Perform further circulation

Fig 1.2.1.3.3.1 Shut in Decision Tree
High concentrations can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death. Effects can occur within a few breaths, and possibly a single breath. Contact with liquid hydrogen sulphide causes frostbite. If clothing becomes wet with the liquid, avoid ignition sources, remove the clothing and isolate it in a safe area to allow the liquid to evaporate.

**1.2.2.1 Health effects of H2S exposure**

Hydrogen sulphide is both an irritant and a chemical asphyxiate with effects on both oxygen utilization and the central nervous system. Its health effects can vary depending on the level and duration of exposure. Repeated exposure can result in health effects occurring at levels that were previously tolerated without any effect. Low concentrations irritate the eyes, nose, throat and respiratory system (e.g., burning/tearing of eyes, cough, shortness of breath). Asthmatics may experience breathing difficulties. The effects can be delayed for several hours, or sometimes several days, when working in low-level concentrations. Repeated or prolonged exposures may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss. Moderate concentrations can cause more severe eye and respiratory irritation (including coughing, difficulty breathing, accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability.

**1.2.2.2 Hazardous properties of H2S gas**

Hydrogen sulphide is heavier than air and may travel along the ground. It collects in low-lying and enclosed, poorly-ventilated areas such as basements, manholes, sewer lines, underground telephone vaults and manure pits. For work within confined spaces, use appropriate procedures for identifying hazards, monitoring and entering confined spaces. The primary route of exposure is inhalation and the gas is rapidly absorbed by the lungs. Absorption through the skin is minimal. People can smell the “rotten egg” odour of hydrogen sulphide at low concentrations in air. However, with continuous low-level exposure, or at high concentrations, a person loses his/her ability to smell the gas even though it is still present (olfactory fatigue). This can happen very rapidly and at high concentrations, the ability to smell the gas can be lost instantaneously. Therefore, **DONOT** rely on your sense of smell to indicate the continuing
presence of hydrogen sulphide or to warn of hazardous concentrations. In addition, hydrogen sulphide is a highly flammable gas and gas/air mixtures can be explosive. It may travel to sources of ignition and flash back. If ignited, the gas burns to produce toxic vapours and gases, such as sulphur dioxide.

1.2.2.3 Protection against H2S exposure

Before entering areas where hydrogen sulphide may be present:

1. Air must be tested for the presence and concentration of hydrogen sulphide by a qualified person using air monitoring equipment, such as hydrogen sulphide detector tubes or a multi-gas meter that detects the gas. Testing should also determine if fire/ explosion precautions are necessary.

2. If the gas is present, the space/area must be ventilated continually to remove the gas.

3. If the gas cannot be removed, the person entering the space/area must use appropriate respiratory protection and any other necessary personal protective equipment, rescue and communication equipment.

Entering dangerous H2S atmospheres A level of H2S gas at or above 100 ppm is immediately Dangerous to Life and Health (IDLH). Entry into IDLH atmospheres can only be made using: 1) a full face piece pressure demand self-contained breathing apparatus (SCBA) with a minimum service life of thirty minutes, or 2) a combination full face piece pressure demand supplied-air respirator with an auxiliary self-contained air supply. If H2S levels are below 80 ppm, an air-purifying respirator may be used, assuming the filter cartridge/canister is appropriate for hydrogen sulphide. A full face piece respirator will prevent eye irritation. If air concentrations are elevated, eye irritation may become a serious issue. If a half mask respirator is used, tight fitting goggles must also be used. Workers in areas containing hydrogen sulphide must be monitored for signs of overexposure. NEVER attempt a rescue in an area that may contain hydrogen
sulphide without using appropriate respiratory protection and without being trained to perform such a rescue.

1.2.2.4 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 H_2S 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 H_2S 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 unauthorized person
1.2.3 Hydrogen Sulphide Well Blowout

In the case of wells with the influx being Hydrogen Sulphide the well control turns to Bull heading which means sending the influx back to the formation. In this case the injectivity of the formation and the breakdown strength is calculated before bull heading is carried out. The Bull heading Decision tree is given at Fig 1.2.3.1.

**SHUT-IN PROCEDURES -- Bullheading Decision Tree**

- Decision made to Bullhead
  - Pipe hung off in U-Rams
  - Upper Choke Line F/S’s
  - Open Choke Closed
  - Allow Pressure to Stabilise
  - Line up Surface Equipment to Kill Pump
  - P/T Surface Lines to Bullhead
  - Down Kill Line
  - Start Kill Pump
  - Bring up to Speed at Low Rate
  - Start Bullheading at Constant Rate
  - Plot Injection Pressure/Volume Relationship
  - Monitor DP and CGS Pressures

- Continue bullheading
- Is Fluid being Injected
  - Yes
    - Go to Well Kill Circulation
  - No
    - Is Injection Pressure at Maximum
      - Yes
        - Increase injection pressure
      - No
        - Go to Well Kill Circulation
- Is Injection Pressure Decreasing
  - No
    - Go to Well Kill Circulation
  - Yes
    - Stop Pumps Shut In Allow Pressure to Stabilise
- Is SICP < Original SICP
  - No
    - Is Pressure trapped in Well
      - Yes
        - Bleed off Trapped Pressure
      - No
        - Go to Well Kill Circulation
  - Yes
    - Go to Well Kill Circulation
- Is SIDP = SICP
  - Yes
    - Go to Well Kill Circulation
  - No
    - Bullhead required influx Volume

**Fig 1.2.3.1 Shut in Decision Tree**
1.2.4 Oil spill

Oil spills may occur during testing, pipeline leakage etc. and may vary in size ranging from few litres to thousands of liters. It requires a timely and coordinated response to such an emergency and needs significant planning and training.

1.2.4.1 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, pressure vessel, storage tank etc. to avoid leakage, sabotage.
➢ To have adequate facilities for testing of well.

1.2.4.2 Mitigation Measure

➢ Monitoring of pipe line, oil storage tank
➢ Using mechanical and chemical method, fresh oil will be lifted in tanker and sent to nearby GGS. Contaminated oil (if mixed with water) will be collected in the tanker and will be sent to nearby effluent treatment plant and oil is separated from water by using skimmers and chemical.
➢ Biological methods will be used for cleaning up contaminated soil.

1.3 Risk Analysis of Blow outs

1.3.1 Blowout Frequency

As per the data base of Alberta Energy and Utilities Board for onshore blow outs, frequency of blow out is \(4.9 \times 10^{-4}\) blowouts per well. The Frequency of blow out for the proposed activity is given in below:

\[
\text{Frequency of blow out occurrence for the proposed project} = (NW) \times (F) = 10 \times 4.9 \times 10^{-4} = 4.9 \times 10^{-3} \text{ per well drilled}
\]

For the proposed project of 10 exploratory wells the frequency of blow out occurrence is \(4.9 \times 10^{-3}\) per well drilled and can be considered as negligible
1.3.2 Ignition Probability

SINTEF’s blow out data provides early ignition probability as 0.09. Based on this the ignition probability is as given below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Scenario</th>
<th>Weather Category</th>
<th>Maximum Damage Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>37.5 kW/m²</td>
<td>12.5 kW/m²</td>
</tr>
<tr>
<td>1</td>
<td>Blow out of Well</td>
<td>2F</td>
<td>5.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3D</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5D</td>
<td>21.24</td>
</tr>
</tbody>
</table>

The probability of ignition of blow out releases of hydrocarbons for this project will be about $0.44 \times 10^{-3}$ and can be considered negligible.

1.3.3 Consequence Analysis

Space constraint exists at drill rig and because of this the low frequency occurring accidents such as blow out, oil spill etc. may turn out be highly hazardous.

The frequency of occurrence for blowout is $4.9 \times 10^{-3}$ per well drilled and probability for ignition is $0.44 \times 10^{-3}$

In Exploratory drilling activity, it is difficult to predict the amount of gas/oil release from the blowout incidents. Hence the blow out scenarios for similar exploratory drilling activities carried out using Wind speeds as 2m/s for class F and 3m/s&5 m/s for Class D had been compiled and are as given Table 1.3.1

**Table 1.3.1 Heat Radiation Effects due to Blowout of Well**
Annexure

Contingency & Disaster Management Plans
CONTINGENCY PLANS

Bomb threat Contingency Plan
Earth Quake Contingency Plan
Fire Contingency Plan
Flood Contingency Plan
Pipeline / Flow leakage (Oil Spill) Contingency Plan
Blowout Contingency Plan
Tsunami Contingency Plan

**BOMB THREAT CONTINGENCY PLAN**

- **BOMB THREAT**
  - **DISTRICT POLICE CONTROL ROOM**
  - **RADIO ROOM**
  - **RADIO ROOM NAVY**

**IC, SECURITY**
- Inform District Authorities
- Bomb Disposal Squad
- Rush to Site with Additional Security
- Deploy Fire Tender with Additional Fire Personnel

**SHIFT IN-CHARGE**
- Inform Security at Gate to keep watch on movement of men, materials & equipments
- Send all contractors out of the installation
- Keep WMT team in readiness
- Look for any suspicious looking material equipment inside installation along with shift crew / security
- In case any timer like object found inform SFM / SAM and on clearance activate shut down of that area
- If localized shut down will not be sufficient then activate total shut down plan

**SFM**
- Rush to Site
- Camp at site till bomb threat is cleared
- Give clearance for start up of plant

**SAM**
- Safety Officer
- HHSE

**SURFACE MANAGER**
- IC HR / ER

**ASSET MANAGER**

**HHSE** - Head - Health, Safety & Environment

**ICM** - Surface Field Manager; **SAM** - Surface Area Manager; **SM** - Surface Manager; **AM** - Asset Manager;
EARTH QUAKE CONTINGENCY PLAN

TREMOR / EARTH QUAKE FELT

SHIFT INCHARGE

INFORM DISTRICT CONTROL ROOM

ACTIVATE TOTAL SHUT DOWN PLAN DEPENDING ON SITUATION WITHOUT ABANDONING IF POSSIBLE OBTAIN CLEARANCE FROM SFM / SAM

SFM

SAM

SM

HEAD SUPPORT

HES

AM

HHSE

SFM - SURFACE FIELD MANAGER ; SAM - SURFACE AREA MANAGER ; SM - SURFACE MANAGER ; AM - ASSET MANAGER ;
HES - HEAD ENGINEERING SERVICES ; LM (W) - LOCATION MANAGER (WORKS) ; LM (M) - LOCATION MANAGER (MAINTENANCE)

PIPE LINE / FLOW LINE LEAKAGE (OIL SPILL) CONTINGENCY PLAN

RESIDENT ENGINEER / SHIFT I/C. RECEIVES INFORMATION ON LEAKAGE FROM VILLAGER / LAND OWNER / FARMER / LINE WALKERS / SURFACE PATROLLING TEAM

RADIO ROOM

RADIO ROOM INNERAVY

MINOR LEAKAGE

MAJOR LEAKAGE

SFM

SAM

I/C. C&M

SFM

SAM

AM

RUSH TO SITE

TO DEPLOY AGENCY AND ENGINEER FOR CARRYING OUT REPAIR

I/C. SECURITY

I/C. HR / ER

HES / LM(W) / I/C. C&M

HHSE

- DEPLOY SECURITY TENDER WITH CREW
- INFORM DISTRICT AUTHORITIES - ASSESS DAMAGE TO ARRANGE FOR COMPENSATION
- TO DEPLOY AGENCY AND ENGINEERS FOR CARRYING OUT REPAIR

- CLAMP THE LEAK POINT
- IF IT IS NOT POSSIBLE FLUSH THE LINE WITH WATER
- CUT AND REMOVE LEAKING PORTION
- WELD WITH NEW PIECE
- WAIT FOR COOLING OF WELDED PIPES
- RESUME FLOW, OBSERVE FOR LEAKAGE AT CLAMPED / REPLACED PORTION
- IF NO LEAKAGE BACK FILL

SFM - SURFACE FIELD MANAGER; SAM - SURFACE AREA MANAGER; SM - SURFACE MANAGER; AM - ASSET MANAGER;
HES - HEAD ENGINEERING SERVICES; LM(W) - LOCATION MANAGER (WORKS); LM(M) - LOCATION MANAGER (MAINTENANCE)
Environment Management in ONGC

ONGC’s HSE Policy:
ONGC demonstrates its proactive environmental management through its well defined environmental policy. ONGC formulated its environmental policy in 1983. As Health, Safety and Environment were integrated in ONGC’s vision and mission, all three aspects are incorporated in new integrated HSE policy.

Environmental Clearances and regulatory compliance:
Environmental Clearance is a statutory requirement for the initiation of the any new project or modification in the existing project. As part of clearance procedure Environmental Impact Assessment studies, Disaster Management Plan and Risk Analysis etc are carried out. Competent third party agencies/consultants are hired for carrying out these studies. ONGC has also developed studies for select projects. The environmental clearance application along with these study reports are submitted to MoEF which inturn grants environmental clearance along with stipulations to be monitored. These stipulations are conscientiously complied and compliance reports are submitted half yearly before 1st June and 1st December every year to MoEF.

Environmental Management System:
Environmental protection is regarded as one of the priority business functions. To achieve and sustain the best environmental management practice, environmental management system is in place which is based on ISO 14001.

Integrated HSE management system (QHSE) based on ISO 14001, ISO 9001 and OSHAS 18001 has been implemented in all installations and facilities. Internal team of about 300 environmental lead auditors and the core team of QHSE contributed in achieving this goal. EMS is based on precautionary principles and takes care of all the significant environmental attributes of the organization. QHSE’s implementation and maintenance entails achieving levels beyond compliance. Achieving QHSE certification for all installations was the first ever in India by any industry in any sector.

Air Environment:
Sources of air pollution are mainly technical gas flaring, flue gases from DG sets and cogeneration plants. Real time monitors at major installations and mobile ambient air quality monitoring vans are in use to keep track of air pollutants. Air monitoring is also carried out by third parties who are duly approved by the respective state pollution control boards. Noise pollution levels are measured through in house facility as well as through agencies registered under state pollution control board.

A principal target for emission reduction is flaring which constitutes the most significant source of air emission. Flare gas recovery is being implemented and we have already achieved zero flaring in some of the installations.

Heat recovery system to heat the therm oil and crude oil by way of heat exchange from flue gases are available at many installations.
Noise Environment:
Acoustic enclosure is available in co-generation plant to contain noise pollution. High noise areas have been identified and boards displaying noise level and safe operating practices are in place.

GHG emission:
ONGC is commitment to reduce emission. Almost 83% of our total energy requirement is met with clean fuel natural gas. We have achieved reduction (as of 2006) of 42% in technical flaring from 2001 levels.

Water Environment:
Water co-produced with crude oil is generated as oil field effluent during the processing of crude oil. Waste water is also generated at drill sites as a result of washing of cuttings, washing of derrick floors and drill pipes during drilling and tripping etc. We have a total of 21 Nos. of onshore effluent treatment plants with an approximate treatment capacity of 70,000 m$^3$/day in operation to treat produced water as per laid down standards. Part of the treated effluent is injected in the reservoir for water flooding in order to maintain reservoir pressure.

In offshore process platforms, we have Produced Water Conditioners (PWC) which are compact systems to treat produced water before disposing off. Various technologies like Corrugated Plate Interceptors, Dissolved Gas Flotation, hydro cyclones are used for the treatment and help achieve treated effluent standards.

Monitoring of oil wells and work over operations of sick well (producing more water) are undertaken regularly to maintain health of oil wells as well in reducing quantity of free water generated from oil wells.

Mobile ETPs, predominantly in Assam Region are engaged to treat the wastewater emanating from drilling rigs.

Spent oil, slop oil are recycled back into the process system.

Oil Spill Response:
ONGC is well equipped to handle exigencies of oil spill crisis. To deal with the oil spill of low magnitude (100 tons), organization has its own equipments and facilities. We have membership of Oil Spill Response Limited (OSRL) to manoeuvre large scale emergencies (> 100 tons) who shall assist with required infrastructure and resources to combat and mitigate the crisis. We have owned as well as hired fleet which is always on alert to respond to any emergency.

Solid Waste Handling:
Chemical sludge and tank bottom sludge are the major solid waste falling in the hazardous waste category. Chemical sludge is collected in lagoons having leachate collection facility wherein the water is drained to reduce the quantity of sludge. This chemical sludge is disposed off by land filling in accordance with the norms of state pollution control board. To treat tank bottom sludge which is mainly organic in content, bioremediation techniques are employed, ONGC is one of the very few organization which has employed bioremediation successfully to treat hazardous waste and render it non hazardous.

Biomedical waste is disposed off by incineration using organization’s own incineration facilities and by using respective municipal board facilities.
Bioremediation:

Major environmental research and development work has been in the area of bioremediation of oily waste, oily sludge, spilled oil, oil content in liquid effluent, were undertaken in Mehsana Asset, Ahmedabad Asset, Assam & Assam Arakan Basin and Uran plant. ONGC has taken advantage of eco-friendly bio-remediation technique by application of “Super Oil Zapper”. Degradation of various fractions of crude oil in soil at various locations ranged from 30 – 90% in one month’s time.

Tree/ Mangrove Plantation:

As a responsible corporate citizen, we have ensured regular tree plantation in order to emphasize our commitment towards environment. The barren Dronagiri hills near Uran Plant have now been converted into lush green forest with over 2.5 lakh full grown trees.

Besides, thousands are trees are planted at all the installations every year. In Mumbai large scale mangrove plantation was successfully carried out in 2001 where in an area of five hectares was planted with 25000 mangrove plants and their successful survival was ensured.

HSE Organogram
H2S Contingency Plan for Drilling Rigs

OIL AND NATURAL GAS CORPORATION LIMITED
CAUVERY ASSET
FOREWORD

With the advancement in industrial activities and adoption of modern technologies, the overall industrial growth has been phenomenal; the Oil industry being no exception to it. Every activity related to exploration and exploitation of hydrocarbons is highly hazardous in nature; the incidents of emergency situation such as H2S Leakage, fire and explosion hazards are likely to occur during the operations of ONGC. Necessary safety practices are a must.

A well-organized H2S Contingency Plan for Drilling rigs is a compilation of duties and responsibilities, action plan to combat and mitigate the consequences of H2S incident.

H2S contingency Plan also fulfils the legislative requirement in this regard, viz.

1. Oil Mines Regulations, 1984
2. Environment Protection Act 1986

To sum-up, the document gives an exhaustive coverage of action plan to combat and mitigate the consequences of H2S incident during drilling operation by Drilling rigs of ONGC, Cauvery Asset.

V.RAJAGOPLAN

DGM, HEAD HSE
## CONTENTS

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Introduction</td>
</tr>
<tr>
<td>2.0</td>
<td>Process description of Drilling Operation</td>
</tr>
<tr>
<td>3.0</td>
<td>H2S Contingency Plan</td>
</tr>
<tr>
<td>4.0</td>
<td>Duties and responsibilities in the event H2S Emission/ Leakage at rig</td>
</tr>
<tr>
<td>5.0</td>
<td>Guidelines for terminating the action:</td>
</tr>
<tr>
<td>6.0</td>
<td>Plan for training of personal &amp; Drills:</td>
</tr>
<tr>
<td>7.0</td>
<td>Annexure-A (List of Contact Numbers)</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

Cauvery Asset of Oil & Natural Gas Corporation has Base office at Karaikal, Pondicherry and operational activities in TamilNadu. Various exploration and production activities of Cauvery Asset are spread over four Districts (Nagapattinam, Tiruvarur, Cuddalore and Ramanathapuram) of TamilNadu.

The inherent risk in the oil well drilling is well known and the management of the risks calls for systematic planning, adopting engineering practices and positive attitude towards safety & environment protection. Among these risk factors the exposure of the workers to H2S is very important.

Hydrogen Sulfide (H2S) is a dangerous deadly gas. Its effects are controllable and generally reversible, provided appropriate action is taken in time and exposure are within limits. It was therefore, necessary to develop a Hydrogen Sulfide Contingency Plan to facilitate necessary actions to meet emergency scenarios.

1.1 NEED

**Statutory Requirements**

1. Compliance of environmental Clearance Conditions
2. Oil Mines Regulation, 1984 of Mines Act 1952

1.2 SCOPE

The scope of the H2S Contingency Plan is to evaluate the danger in leakage of H2S that can occur at Drilling mine drilled by rigs E-760-3, E-760-14, E-1760-15, E-760-16, E-1400-9 and E-1400-19 including oil storage tanks / storage facilities, vehicles, Oil tankers and plants / machineries etc available at the drilling mine.

1.3 PURPOSE

a) To evolve a preplanned methodology for fighting various leakages of H2S.

b) To prepare detailed duties and responsibilities during leakage

c) To train operating personnel by means of mock drills, so as to make them well acquainted with the response action
### 1.4 EFFECTS OF H2S ON PERSONNEL

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Concentration in PPM</th>
<th>Effect on Personal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.13 to 4.6</td>
<td>No effect. Only unpleasant smell.</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>Eye irritation threshold limit value and 8 hrs shift permissible.</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>American Conference of Government Industrial Hygienists (ACGIH) Short term exposure limit (STEL) averaged over 15 minutes.</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>Burning sensation in eye and irritation of the respiratory tract after one hour or more exposure.</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>Loss of smell in 25 minutes or more, one hours exposure may give headache, dizziness, eye irritation or eye damage.</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>Coughing, eye irritation, loss of smell in 3-25 minutes, pain in eye, Drowsiness in 15-20 minutes, throat irritation after one hours.</td>
</tr>
<tr>
<td>7</td>
<td>300</td>
<td>Conjunctivitis respiratory tract irritation. Immediately dangerous to life.</td>
</tr>
<tr>
<td>8</td>
<td>500</td>
<td>Unconsciousness after short exposure, immediate first aid by giving cardiopulmonary resuscitation (CPR) otherwise cessation of breath, loss of sense of reasoning, balance.</td>
</tr>
<tr>
<td>9</td>
<td>700</td>
<td>Unconscious, breathing stops, death if immediately CPR is not applied.</td>
</tr>
<tr>
<td>10</td>
<td>1000</td>
<td>Unconscious at once permanent brain damage, death may result, prompts CPR to be applied.</td>
</tr>
</tbody>
</table>
2.0 PROCESS DESCRIPTION DRILLING OPERATIONS:

Drilling operations can be carried out using an onshore rig. Drilling unit for drilling of oil and gas wells consists of a derrick at the top of which is mounted a crown block and a hoisting block with a hook. From the swivel is suspended a Kelly stem passes through a square or hexagonal Kelly bush which fits into the rotary table. The rotary table receives the power to drive it from an electric motor. The electric motor rotates the rotary table which passes through the Kelly bush and the rotations are transmitted to the bit as the drilling progresses, the drill pipe singles of length around 9 meters are added to continue the drilling process. At the end of the bit life, the drill pipes are pulled out in stands and stacked on the derrick platform. After changing the bit, the drill string is run back into the hole and further drilling is continued. This process continues till the target depth is reached.

During the course of drilling, cuttings are generated due to crushing action of the bit. The mud from the pump discharge through the rotary hose connected to stationery part of the swivel, the drill string and bit nozzles. The mud coming out of the bit nozzles pushes the cuttings up hole and transports them to the surface through the annular space between the drill string and the hole. The mud not only carries away crushed rock from the bottom of the hole but it also cools the bit as it gets heated due to friction with formation while rotating. The mud also helps in balancing subsurface formation pressures and by forming a cake on the walls of the well diminishes the possibility of crumbling or caving of the well bore.

At the surface, the mud coming out from well along with the cuttings falls in a trough, passes through the solids control equipments i.e. shale shaker, de-sander / de-silter and mud cleaner. These equipments remove the solids of different sizes which get mixed with the mud during the course of drilling. The cleaned mud flows back to the suction tanks to be again pumped into the well. The drilling mud / fluid circulation is thus a continuous cyclic operation.

Once the drilling operations are completed, and if sufficient indications of hydrocarbons are noticed while drilling, the well is tested by perforation in the production casing. If the well is found to be a successful hydrocarbon bearing structure, it is seated off for future development, if any.

**PROCESS FLOW DIAGRAM/ DRILLING RIG**

- Release of location by customer and Preparation location by Civil
- Rig Dismantling
- Transportation
- RigBuilding
- Spudding of well
- Drilling of well (Product Realisation)
- Casing lowering & cementation
- Coring as desired by the customer
- Kick off and deviation as per plan
- PT of well
- Handover well to the customer
- Transportation Fleet outsourced
- Preparation and maintenance of mud per GTO
- Electro logging and Mud logging outsourced
- Rig Electrical and Mechanical equipment maintenance
3.0 H2S CONTINGENCY PLAN – DRILLING

- CLOSE THE WELL
- STOP DRILLING ACTIVITY
- EVACUATE CREW AND NEAR BY VILLAGERS

- RUSH TO SITE WITH FIRE FIGHTING PERSONNEL, FIRE TENDER & FIRE FIGHTING EQUIPMENTS

- NOTE: FOR LIST OF CONTACT NUMBERS REFER ANNEXURE-A
4.0 DUTIES AND RESPONSIBILITIES IN THE EVENT OF H2S EMISSION/ LEAKAGE AT RIG

4.1 Person who detects the H2S:

A person who detects the H2S should shout and communicate the event to all the people around. He should also communicate the same to Shift I/C and Radio Room.

4.2 Tool Pusher / Shift I/C:

- Close the well
- Stop Drilling activity
- Evacuate crew and near by villagers, depending on situation.

4.3 Radio Officer / Radio Operator:

- Intimate Rig In charge and Area Manager.
- Intimate Drill site Medical officer.
- Intimate Radio room Neravy and other Key persons
- Intimate incident to nearest Fire station and call for help / fire fighting
- Intimate In charge Security.
- Keep a constant record of messages received & transmitted

4.4 Asset Manager:

On receiving the message, shall set-up a control room and keep constant communication with site team

4.5 Head Drilling Services:

On receiving the message, take over charge of the situation.

4.6 Head HSE & I/C HR/ER

Intimate the incident to Director of Mines Safety (DGMS) and District authorities.

4.7 I/C Fire, I/C Security, I/C Safety, Rig Manager & Area Manager:

Rush to the site on information and arrange for

- Breathing Apparatus
- First aid for the injured
- Rescue accident victims
- Safe withdrawal of persons not required for fire fighting.
- Coordinate movement of ambulance.
4.8 Head Support Services:

On receipt of the message

- Arrange for transport of men & materials
- Deployment of medical facilities & medical doctors
- Arrangement of additional man power for radio room with additional common facilities.

4.9 Fire Staff:

On receiving the call

- Fire Staff should proceed to the spot immediately along with fire equipments
- Assistance of the fire tenders from the nearest Fire stations can be sought, if necessary.

4.10 Security Staff:

On receiving the call, Security staff should press on all visitors to evacuate the site. The petroleum tanker if any positioned inside the site should be sent outside. Also should prevent entry of the outsiders in the premises. They should allow free movement of vehicles like ambulances, Fire tenders, water tenders water pumpers etc., without loss of time.

4.11 Drivers:

All the drivers particularly of the light vehicle and fire tenders should be alert and proceed as per requirement of crew concerned without any loss of time.

5.0 GUIDELINES FOR TERMINATING THE ACTION:

Once the leak of H2S is under control, all clear signal / alarm will be given by I/C Safety Drilling Services.

- Intimation of same shall immediately be given to Asset Manager / Senior most officer of Asset from drill site by I/C Safety
- Duty roster shall be prepared by I/C HR/ER for attending / extending necessary help to accident victims / causalities.
- Necessary incident reporting will be done by Head HSE within and outside ONGC as per requirements of various authorities.

Note: After combating the H2S all personnel involved will gather at safe place for briefing
6.0 PLAN FOR TRAINING OF PERSONAL & DRILLS:

➢ To achieve effective results during actual event of emission of H2S, mock drills shall be conducted at drill sites as per OMR and record of same shall be maintained.

➢ An H2S training program is conducted for all the employees who are working in the different drilling sites.
Annexure-A

7.0 LIST OF CONTACT NUMBERS

1. RADIO ROOM, NERAVY : 04368 238715
2. ASSET MANAGER : 9442593786
3. I/C SECURITY : 94430 09682
4. I/C FIRE : 94430 09682
5. AREA MANAGER 1 : 94425 93566
6. AREA MANAGER 2 : 94425 93590
7. I/C SAFETY, DRILLING SERVICES : 94425 00590
8. HEAD ENGINEERING SERVICES : 94430 09613
9. HEAD SUPPORT SERVICES : 94430 09602
10. HEAD DRILLING SERVICES : 94430 09603
11. HEAD HSE : 94430 09623
12. LOCATION MANAGER(WORKS) : 94430 09615
13. LOCATION MANAGER(MAINT.) : 94425 00808
14. I/C LOGISTICS : 94430 09602
15. I/C INFOCOM : 94430 09626
16. I/C MEDICAL : 94430 09642
17. I/C HR/ER : 94430 09631
18. I/C CIVIL : 94430 09615
19. NEAREST FIRE STATION : AVAILABLE AT RADIO ROOM OF EVERY DRILLING RIG
RA Report for Exploratory Drilling of 10 wells in Onshore, NELP VI Block Cy-ONN-2004/2 of Cauvery Basin, Ariyalur District, Tamil Nadu.

DISASTER MANAGEMENT PLAN ARIYALUR DISTRICT

Oil and Natural Gas Corporation Limited
Cauvery Asset, Neravy Office Complex, Karaikal - 609 604
Ph: 04368 238222, Mobile: +91 94425 00566    Fax: 04368 238126
FOREWORD

With the advancement in industrial activities and adoption of modern technologies, the overall industrial growth has been phenomenal; the Oil industry being no exception to it. Every activity related to exploration and exploitation of hydrocarbons is highly hazardous in nature; The incidents of emergency situation such as fire, explosion and other Environmental hazards are likely to occur during the operations of ONGC. Necessary safety practices are a must.

A well-organized Disaster Management Plan for Drilling rigs and Production installations of Ariyalur District is a compilation of various emergency scenarios, the probable impact on ‘Off the Site’ and the action plan to combat and mitigate the consequences of an accident or a disaster situation. It presents a multifaceted approach covering the Disaster Management Plan.

Disaster Management Plan also fulfills the legislative requirement in this regard, viz.

1. Oil Mines Regulations, 1984
2. Environment Protection Act 1986

To sum-up, the document gives an exhaustive coverage of the hazards involved in the production operations in the Cauvery Onshore Asset and plans to combat & mitigate the consequent effects of any accident or disaster.

V.KUMARESAN
# INDEX

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Introduction</td>
</tr>
<tr>
<td>1.1</td>
<td>Need</td>
</tr>
<tr>
<td>1.2</td>
<td>Purpose of the Plan</td>
</tr>
<tr>
<td>1.3</td>
<td>Scope of the Plan</td>
</tr>
<tr>
<td>1.4</td>
<td>Process Descriptions</td>
</tr>
<tr>
<td>1.4.1</td>
<td>Group Gathering Station - Narimanam</td>
</tr>
<tr>
<td>1.4.2</td>
<td>Gas Collecting Station –Kuthalam</td>
</tr>
<tr>
<td>1.4.3</td>
<td>Early Production System – Tiruvarur # 6</td>
</tr>
<tr>
<td>1.5</td>
<td>Drilling Operations</td>
</tr>
<tr>
<td>1.6</td>
<td>Work-over Operation.</td>
</tr>
</tbody>
</table>

## Section-1

2.0 Disaster Management Preparedness
2.1 Nature of Emergencies
2.2 Emergency Organization
2.3 Onsite emergency organization
2.4 Functions & Responsibilities of various Coordinators
2.4.1 Chief emergency coordinator (CEC)
2.4.2 Assistant emergency coordinator (AEC)
2.4.3 On-scene coordinator (OSC)
2.4.4 Key personnel
2.5 Responding to an emergency
2.5.1 Guidelines for all on hearing fire siren / emergency message
2.5.2 Assembly point
2.5.3 Specific firefighting procedures
2.5.4 Evacuation
2.6 Drilling and work over operations
2.6.1 Responding to an emergency
2.6.2 Assembly point....
2.6.3 Emergency procedures in the event of blowout
2.6.3.1 Functions of On-Scene Coordinator
2.6.4 Emergency procedure for control of kick
2.6.4.1 Duty guidelines of rig operational crew
2.6.5 Well Kick Shut in procedure for On Land and Jack up Rigs.

## Section-2

## Section-3

### OFFSITE EMERGENCY PLAN

3.1 Flammable hazard distances
3.2 Toxic hazard distances
3.3 Assessment of hazard leading to offsite emergency
3.3.1 Hazard in flow lines
3.3.2 Hazard in transportation of crude oil by tankers
3.3.3 Hazard due to man-made causes
3.4 Action plan
3.4.1 District emergency committee.................................
            Organization chart for Off-site Emergency management.......  
3.4.2 Functions and responsibilities of emergency committee.....
3.4.2.1 Responsibilities of chairman of district emergency committee
3.4.2.2 Responsibility and duties of members of Service group...........
3.5 Mock drill for onsite and offsite emergency management.............
3.6 Mutual aid with CPCL.................................................................
3.7 Review of the plan......................................................................

Section-4

4.0 DATA DIRECTORY

4.1 Fire fighting system........................................................................
4.1.1 GGS – Narimanam.................................................................
4.1.2 GCS – Kuthalam.................................................................
4.1.3 EPS – Tiruvarur#6.................................................................
4.1.4 Fire fighting facilities available in drilling rigs.........................
4.2 Meteorological data........................................................................

ASSNEXURE

Annexure-1: Telephone Numbers of Cauvery Asset 58
Annexure-2: Nearest fire station for installations in Ariyalur district 59
Annexure-3: Important Telephone numbers of Ariyalur district 60
Annexure-4: Telephone numbers of hospitals 61
Annexure-5: Telephone numbers of OISD and DGMS authorities 62
1.0 Introduction

Oil & Natural Gas Corporation Ltd. is the National Oil Company presently engaged in the production of crude Oil & Natural Gas from Offshore & Onshore fields. In the southern part of India Cauvery Asset is setup to produce crude oil and natural gas from onshore fields.

Cauvery Asset of Oil & Natural Gas Corporation has Base office at Karaikal, Puducherry and operational activities in Tamilnadu. Various exploration and production activities of Cauvery Asset are spread over Six Districts of Tamilnadu.

1. Ariyalur
2. Tiruvarur
3. Cuddalore
4. Ramanathapuram
5. Thanjavur
6. Ariyilur

Operational infrastructure of Cauvery Asset is:

- Drilling rigs - 09 Nos
- Major production installations - 09 Nos.
- Extended production Testing facilities - 09 Nos.
- Effluent Treatment Plant - 02 Nos.
- Cementing units - 09 Nos
- Logging units - 04 Nos
- Work over Rigs - 04 Nos
- WSS Units - 08 Nos.
- Crude oil trunk pipeline - 65 Kms
- Flow lines/pipelines - 650 Kms

1.1 Need for DMP

The inherent risk in the oil well drilling & production are well known and the management of the risks calls for systematic planning, adopting engineering practices and positive attitude towards safety & environment protection. It was therefore, necessary to develop a Disaster Management Plan (DMP) to facilitate necessary actions to meet emergency scenarios.

Statutory Requirements

- Oil Mines Regulation, 1984 of Mines Act 1952
  Contingency plan for Fire shall be prepared for any oil installation – OMR 72.

- Environment Protection act and the rules:
1.2 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.

This plan therefore aims:

d) To visualize the possible emergency scenario that are likely to occur
e) To evolve a preplanned methodology of carrying out various emergency combating plans
f) To prepare detailed responses for each type of emergencies
g) To train operating personnel by means of mock drills, so as to make them well acquainted with the response action
h) To minimize the damage to the environment during emergency.

1.3 Scope of Plan

The DMP includes On-site Emergency Preparedness plan and Off-site emergency preparedness plan.

The scope of the DMP On-site Emergency Preparedness Plan is to evaluate the various types of emergencies that can occur at (Drilling and Production activities) in Ariyalur District, and to formulate emergency plans and procedures that can be implemented by ONGC in house. Should the contingency exceed in dimension beyond ONGC’s capability, the off-site Emergency plan shall be activated concurrently with the help of District administration.

Also as per need few drilling rigs and work-over rigs shall be deployed for operational purpose in Ariyalur district. The anticipated emergency situations are listed below:

Disasters due to Natural Causes

- Floods
- Hurricane
- Tornado
- Tsunami
- Earthquake
- Lightning

Disasters due to Man-made Causes (operational)

- Fires
- Oil/gas well blowouts
- Toxic gas releases
- Hydrocarbon Release
- Oil/Chemical spills
- Explosions(unconfined, confined, BLEVE ,dust explosion)

Disasters due to Man-made Causes

- Civil disturbances
- Terrorist Attack
- Bomb threats
1.4 PROCESS DESCRIPTIONS

1.4.1 GROUP GATHERING STATION – NARIMANAM

Introduction

ONGC has set up Narimanam (NRM) Group Gathering Station (GGS) at Kuthalam Village, Nagapattinam District. GGS sprawls over an area of about 5 hectares. Narimanam is one of the major Oil and Gas fields in Cauvery Basin.

Site Description:

GGS-Narimanam is surrounded by the following villages:

- North: Iravancherri
- South: Narimanam
- East: Gopurajapuram
- West: Turayur

The GGS Narimanam site is 20 Kms away from Karaikal and 15 Kms from Nagapattinam. Nearest Railway station is Nagore and nearest Airport is Thiruchirappalli.

GGS-Narimanam was commissioned with an aim of processing crude oil from Narimanam field, collecting crude oil from satellite fields, storing the crude oil and dispatching crude oil to refinery of CPCL at Panangudi after maintaining quality standards acceptable to the refinery. Moreover a gas grid was established by GAIL from Narimanam connecting all Satellite fields catering to the CPCL refinery, TNEB and other consumers around the area.

From GGS Adiyakkamangalam (AKM), 28 km 4” dia trunk line connecting Kamalapuram (KMP), AKM - NRM is used for pumping oil from satellite fields to Narimanam. Remaining oil from Satellite field is brought to GGS through road tankers. From EPS TVR#6, another oil transporting trunk line is connected to GGS NRM. An 8” diameter 5.5 km trunk like connects with CPCL refinery which is used for crude oil dispatch to refinery.

PROCESS DESCRIPTION

GGS, NRM has facilities to process sweet and sour crude produced from Narimanam oil field.

Sweet Crude Processing

Well fluid of each well from Narimanam oil field is flowed through separate flow lines, passes through a well manifold and finally gets separated at the three stage separators of the GGS. There are four headers in the well manifold to segregate the fluid into four categories viz:

1. Pure oil header
2. Emulsion header
3. Low-pressure oil header
4. Test well header.
There are three batteries of separators, each battery consisting three separators operated at different pressures. Emulsion collected in emulsion header of the well manifold is passed through first battery. Pure crude from pure oil header is passed through second battery. Liquid collected in the low-pressure header is passed directly, through third stage of either emulsion or pure battery depending on the crude character. Whenever, a well is required to be tested, it is diverted through third battery from test header.

Pure oil after gas separation is collected in any one of the storage tanks through a tank manifold. Two storage tanks (T5 & T9) are used as wash tank to knock out free water from the bottom and pure oil from top. Water is collected in effluent pit of 300 m³ capacity. Oil is taken in any of the storage tanks along with other pure oil stream.

In case of hard emulsion, emulsion oil is diverted from 2nd stage itself to heater treater. Heater treater is used to break hard emulsion using heating system in the vessel. Oil separated from heater treater is mixed with main pure oil stream and water drained is collected in effluent pit.

Gas separated from II and I stage separator are supplied to consumers through GAIL. Gas separated from III stage is flared as it produced low pressure and quantity is also insignificant.

Sour Crude Processing

Well fluid containing H₂S gas is called SOUR crude. SOUR wells are flowed separately to a manifold, which is having four headers. First, Second, Third stage and Test headers. Total sour crude from 3rd stage is received in 6 stabilizing tanks of 45 M³ each.

Gas separated from all the sour separators is flared. Water knocked from separators is collected in effluent pit inside GGS.

Residual H₂S gas in sour crude is neutralized by adding 200 ppm caustic solution before the crude enters the stabilizing tanks. Treated and stabilized crude is pumped to main storage tanks.

Crude received in storage a tank is then pumped to refinery after checking water content in the crude (it should not exceed 0.2 %).

Effluent received in effluent pond is pumped to ETP for further processing and disposal. Oil particles floating over the water is skimmed and pumped to tank.

1.4.2 GAS COLLECTING STATION – KUTHALAM

Introduction

ONGC has set up Gas Collecting Station (GCS) at Kuthalam about 55 km from Cauvery Asset Office, Neravy.

GCS Kuthalam is connected to Mayiladuthurai and Kumbakonam by road as well as by rail route. As Kuthalam field is mainly producing gas, many industries are developed in this area; Tamilnadu Electricity board has set up a Gas Turbine power plant 10 km away from GCS. This power plant consumes gas at the rate of 4.5 lakhs m⁹/day and produces 101 MW power.

Gas Collecting Station (GCS) is designed for processing of Oil and Gas. The gas is being supplied to M/s. GAIL for onward supply to different consumers like TNEB power plant, PPN power plant etc. The
separated liquid is being transported to NRM-GGS by road tankers for further processing and pumping to CPCL refinery at Panangudi.

Site Description

GCS - Kuthalam is surrounded by the following villages

- North: Kadalangudi, Thirumanancheri
- South: Kshetra Balapuram
- East: Kshetra Balapuram
- West: Thiruvalankadu

The GCS - Kuthalam site is located on Mayiladuthurai - Kumbakonam National highway. The nearest railway station is Mayiladuthurai and nearest Airport is Thiruchirappalli.

PROCESS DESCRIPTION

- All well fluids from the wells are fed to GCS well manifold header through their individual flow lines only.
- Three well manifold headers are provided to receive the well fluids.
  - a) H.P Header
  - b) MP Header
  - c) Test Header
- All the wells are to be connected to all the headers with isolation valves for interchangeability.

Process Flow

- Flow lines from individual wells are connected to well manifold at GCS. The well manifold is connected to HP header. The HP header operates at 40 kg/cm². All wells flowing to this header and from this header gas/liquid flows to 1st stage HP separator (V-101). Low pressure wells may directly be flown in separator (V-102) at 16 kg/cm².

- Gas from 1st stage HP separator flows to 2nd stage separator (V-102) which is maintained at 16.0 kg/cm². Before the 2nd stage separator inlet, and also at (V-101) inlet, the methanol injection provision is provided to take care of any hydrate formation. Gas from 2nd stage separator flows to gas scrubber (V-103) which will be operating at 12.0 kg/cm². From gas scrubber the liquid free gas is supplied to the consumers at 10 kg/cm² through M/s GAIL after measurement.

- The liquid from V-101 and V-102 flows to oil separator (V-104) through their respective LCV’s. This vessel is maintained at a pressure of 14.0 kg/cm² and the evolved gas flows to V-103. The liquid from the oil separator (V-104) flows to the oil stabilizer (V-105) which is operating at 2.5 kg/cm². Liquid from the gas scrubber (V-103) if any, will also flow to (V-105). The oil from V-105 flows to oil storage tanks T-101A/B.
• The gas of V-105 is routed to flare header.

• For testing of wells from test header, the gas comes to the test separator (V-106) which is operated at 40.0 kg/cm². The gas from V-106 flows to V-102 or gas scrubber after being measured through orifice flow meter and liquid flows to V-107. and finally oil goes to Test Oil Tank T-102 A(50 M³ capacity). The test separator designed for 40 kg/cm², can be operated at 16 kg/cm² also, in view of less testing time required for gas wells for stability. More over methanol injection provision is also to be provided to take care of hydrate formation.

• All the vessels are having their individual safety relief valves set at the vessels 10% above the operating pressure. Over pressurization if any, will be released to flare header through these safety valves. During depressurization of vessels, depressurizing valves may be used to depressurize the individual vessels.

• Flare gas flows to the flare knock out drum (KOD) and after that gas flows to flare stack and is burnt out to take care of the pollution measures.

• PCV-108 is to be provided for releasing gas to flare during process upset or reduction of gas consumption by the consumers.

• For a better process flexibility the following modifications have been incorporated. The test separator has been sized at 40 kg/cm² and can be used as group separator when V-101 is under shut down. Test separator parallel loops have been provided for gas, oil and effluent water handling for both cases when it operates as group or as test.

• Similarly the gas of test separator is to be routed through V-102. The liquid is to be routed through V-104 or V-107 (liquid stabilizer for testing). During by passing of V-105, V-107 can be taken in line with reduced capacity.

• Test oil is taken in the test tank for measuring purpose.

• A small pit for collecting effluent water of the test tank is provided near test tank to measure the produced water quantity from the well under testing.

• By pass provision is given for the vessels V-102, V-103, V-104, V-105 so that during any maintenance of above vessels, process flow can be routed accordingly.

VALUE ADDED PRODUCTS (VAP) PLANT

Within the premises of GCS- Kuthalam, a Value Added Products (VAP) unit is established to separate Naphtha, Kerosene and Heavy cut (LDS) from condensate. Following are the facilities of VAP unit.

• Fractionation Columns : 2 Nos.
• Storage Systems : 8 Nos.
• Pumping Systems : 4 Nos.
• Hot Oil Systems : 1 No.
• Cooling Systems : 1 No.
Fire Fighting Systems : 1 No.
Products Loading Systems : 1 No.

Feed stack to the VAP unit is Condensate (150 TPD) which is produced along with gas. The by-products from the unit are Naphtha (105 TPD), Kerosene (35 TPD) and Heavy cut (10 TPD)

1.4.3 EARLY PRODUCTION SYSTEM – TIRUVAUR#6

Introduction

Early Production System (EPS) – Tiruvarur is located in village Kadambangudi, Kilvelur Taluk of Nagapattinam district. EPS is surrounded by the Orkudi, Thenangudi and Amur villages.

EPS - Tiruvarur is 35 Kms away from Karaikal and 20 Kms from Nagapattinam. The nearest railway station is Kizhvelur and nearest Airport is Thiruchirappalli.

Process Description

EPS Tiruvarur has following facilities to process well fluid to separate gas from Crude oil emulsion.

Well Fluid Manifold

There are 13 well fluid manifolds to receive well fluid from wells. This manifold has four headers namely Group 1\textsuperscript{st} stage header, Group 2\textsuperscript{nd} stage header, test header and Narimanam GGS. Wells can be routed to any header as per the process requirement. At present 10 wells are connected to the manifold.

Separators

There are 2 batteries consisting of 4 vertical separators (S\textsubscript{1}, S\textsubscript{2}, S\textsubscript{3}& S\textsubscript{4}). From the group header manifold well fluid is diverted to 1\textsuperscript{st} stage separator (S\textsubscript{1}) which is operated at 16 KSC. After separation of oil and gas in the separator, oil flows to NRM GGS / 2\textsuperscript{nd} stage separator (S\textsubscript{2}) and gas is supplied to GAIL.

From the well fluid manifold low pressure wells if any can be diverted to 2\textsuperscript{nd} stage separator and it is mixed with liquid from 1\textsuperscript{st} stage separator and it is operated at 2 to 6 KSC. The separated gas from this separator is flared due to low pressure. Crude oil emulsion from 2\textsuperscript{nd} stage separator is flown and stored in 7 Nos. of horizontal oil storage tanks for transportation by tanker.

Any well can be diverted from well fluid manifold to test header for periodical testing. Test battery is having two separators S\textsubscript{3} & S\textsubscript{4} and it operates at the same pressure as of S\textsubscript{1} & S\textsubscript{2} respectively. Gas from S\textsubscript{3} separator is supplied to GAIL Line / flared depending on the gas requirement and oil emulsion is flown to NRM GGS line / 2\textsuperscript{nd} stage separator. Low pressure gas from S\textsubscript{4} separator is flared and Crude oil emulsion is flown and stored in horizontal oil storage tank.

Oil Storage Tanks and Loading System

The oil emulsion from 2\textsuperscript{nd} stage separator and test separator are collected in 7 Nos. of cylindrical horizontal storage tanks (capacity 45m\textsuperscript{3} / each tank). This oil emulsion is loaded in road tankers by gravity for transporting to NRM GGS.

Flare Stack
Low pressure gas from 2nd stage separator and excess gas from 1st stage and test separator is flared through a flare stack of 6" dia and 15 m height.

**Generator**

The electric power requirement for the EPS is generally met from the TNEB power feeder. One 31.5 KVA diesel engine driven generator is existing at EPS to meet the power requirement of EPS for lighting and running water pumps in case of TNEB power failure.

**1.5 DRILLING OPERATIONS**

**Introduction**

Drilling operations can be carried out using an onshore rig. Drilling unit for drilling of oil and gas wells consists of a derrick at the top of which is mounted a crown block and a hoisting block with a hook. From the swivel is suspended a Kelly stem passes through a square or hexagonal Kelly bush which fits into the rotary table. The rotary table receives the power to drive it from an electric motor. The electric motor rotates the rotary table which passes through the Kelly bush and the rotations are transmitted to the bit as the drilling progresses, the drill pipe singles of length around 9 meters are added to continue the drilling process. At the end of the bit life, the drill pipes are pulled out in stands and stacked on the derrick platform. After changing the bit, the drill string is run back into the hole and further drilling is continued. This process continues till the target depth is reached.

During the course of drilling, cuttings are generated due to crushing action of the bit. The mud from the pump discharge passes through the rotary hose connected to stationery part of the swivel, the drill string and bit nozzles. The mud coming out of the bit nozzles pushes the cuttings up hole and transports them to the surface through the annular space between the drill string and the hole. The mud not only carries away crushed rock from the bottom of the hole but it also cools the bit as it gets heated due to friction with formation while rotating. The mud also helps in balancing subsurface formation pressures and by forming a cake on the walls of the well diminishes the possibility of crumbling or caving of the well bore.

At the surface, the mud coming out from well along with the cuttings falls in a trough, passes through the solids control equipments i.e. shale shaker, de-sander / de-silter and mud cleaner. These equipments remove the solids of different sizes which get mixed with the mud during the course of drilling. The cleaned mud flows back to the suction tanks to be again pumped into the well. The drilling mud / fluid circulation is thus a continuous cyclic operation.

The most suitable clay for mud preparation is bentonite which is capable of forming highly dispersed colloidal solutions. Various other chemicals are also used in mud preparation as per requirements dictated by the temperature / pressure conditions of the wells. The mud is continuously tested for its density, viscosity, yield point, water loss, pH value etc. to ensure that the drilling operations can be sustained without any down hole complications.

Once the drilling operations are completed, and if sufficient indications of hydrocarbons are noticed while drilling, the well is tested by perforation in the production casing. If the well is found to be a successful hydrocarbon bearing structure, it is sealed off for future development.
Process flow diagram

General requirements of drilling

A. Drilling mud

For drilling hydrocarbon well a specially formulated mud is used. Mud is prepared with earth materials like bentonite, barite in water with several additives to give mud weight, fluidity and filter cake characteristics while drilling. The drilling muds have several functions like lubrication and cooling of the drill bit, balancing subsurface formation, bringing out the drill cuttings from the well bore, thixotropic property to hold cuttings during non-operations, formation of thin cake to prevent liquid loss along well bore etc. Several additives are mixed into the mud system to give the required properties.

B. Power generation

The drilling process requires movement of drill bit through the draw works which require power. The power requirement of the drilling rig is generally met by using the Diesel Generator sets.
drilling rig requires about 4-6 MWh with a diesel consumption of about 8 Kl / day. The exhaust stacks of the DG sets vent the emissions at an approximate height of 4-5m from the main deck.

C. Water requirements

The water requirement in a drilling rig is mainly meant for preparation of drilling mud apart from washings and domestic use. While the former consumes the majority of water requirement, the water requirement for domestic and wash use is very less.

D. Solids removal

The rock cuttings and fragments of shale, sand and slit associated with the return drilling fluid during well drilling are separated using linear motion shale shakers and other solids removal equipment like desanders and desilters. The recovered mud is reused while the drill cuttings and waste water are collected in waste pit.

E. Chemical and materials storage

Drilling rig has normal storage facilities for diesel, required chemicals and the necessary tubular and equipment. The storage places will be clearly marked with safe operating facilities and practices.

F. Manpower

The onshore drilling rig is operated by approx. 35 - 40 persons on the rig at any time. The manpower will operate in shifts (two) with continuous operations on the rig.

1.7 WORKOVER OPERATION

Work-over Services is a Service provider to the Sub-surface team for carrying out well maintenance jobs in Cauvery Asset. Work Over services is a unit of Well Services equipped with four Work Over rigs (two of 100 ton capacity and one of 50 ton capacity) The Rigs are equipped with Rig trailer, Mast, Substructure, Mud pump, Mud tanks, Generator sets, Bunk houses for Rig crew’s welfare, other Operational Stores & Small machineries.

The major Well Servicing activities are:

- Zone transfer
- Servicing of Artificial lift system
- Abandoning of non producing wells
- Conversion of non-potential wells into water injection wells
- Fishing
- Dual completion
- Water / Gas shut off
- Casing / Channel repair

During work over operations following jobs may be required to be performed:

1. Rig building / dismantling onshore mobile rigs.
2. Well subduing
3. Perforation and logging
4. Running in / Pulling out of tubular
5. Cementing
6. Well stimulation
7. Well activation / Well testing.
2.0 DISASTER MANAGEMENT PREPAREDNESS

The key to mitigation of an emergency is to have a documented emergency preparedness plan, practiced regularly through mock drills for taking timely and effective actions in case of an emergency.

2.1 Nature of Emergencies

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

1. A unit specific emergency (ERP)
2. On-site emergency (On-site DMP)
3. Off-site emergency (off-site DMP)

A Unit Specific Emergency Response Plan (ERP)

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

On-Site Disaster Management Plan

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

Off-Site Disaster Management Plan

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

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

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

The off-site emergency requires mobilization of resources beyond ONGC capabilities such as TNFS and other government agencies.

Communication to Corporate Disaster Management Group (CDMG):

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

Corporate DMP will be activated by CMD, ONGC as and when in his opinion, a National level intervention is required for handling the crisis.

2.2 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 (figure-1 below) 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 Cauvery Asset.

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

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

The 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.

<table>
<thead>
<tr>
<th></th>
<th>officials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chief Emergency Coordinator (CEC): Under the charge of Asset Manager, Cauvery Asset</td>
</tr>
<tr>
<td>2</td>
<td>Assistant Emergency Coordinator : Surface Manager / Head Drilling Services / Head Well Services</td>
</tr>
<tr>
<td>3</td>
<td>On-Scene coordinator (OSC) : Shift In-charge in the initial phase and Installation Manager / RIC in the intermediate phase.</td>
</tr>
<tr>
<td>4</td>
<td>Logistics Coordinator : In-charge Logistics</td>
</tr>
<tr>
<td>5</td>
<td>Safety Coordinator : Head HSE</td>
</tr>
<tr>
<td>6</td>
<td>Material Coordinator : Support Manager</td>
</tr>
<tr>
<td>7</td>
<td>Medical Coordinator : In-Charge Medical Services</td>
</tr>
<tr>
<td>8</td>
<td>Finance Coordinator : In-charge Finance</td>
</tr>
<tr>
<td>9</td>
<td>Security Coordinator : In-charge-Security</td>
</tr>
<tr>
<td>10</td>
<td>Fire Safety Coordinator : In-charge Fire Services</td>
</tr>
<tr>
<td>11</td>
<td>Communication Coordinator : In-charge Infocom Services</td>
</tr>
<tr>
<td>12</td>
<td>Public Relation Coordinator : In-charge Corporate Communication</td>
</tr>
<tr>
<td>13</td>
<td>Welfare Coordinator : In-charge Industrial Relations</td>
</tr>
</tbody>
</table>
2.3 ONSITE EMERGENCY ORGANISATION

Figure 1

2.4 FUNCTIONS & RESPONSIBILITIES OF VARIOUS COORDINATORS

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

2.4.1 Chief Emergency Coordinator (CEC)

As per the organization chart for On-site Emergency, Asset Manager will be the Chief Emergency Coordinator for all the Emergency Management activities at the Emergency Control Centre located at Neravy Complex.

All the information which are to be given to Press, Public and Government Agencies are to be approved by the Chief Coordinator. Depending on the situation, he will make efforts to augment the force for combating the situation. He will declare the state of emergency, besides he shall organize the following:
Establish a control centre and will be In-charge of the entire on-site emergency operation.

Passing on information to relevant persons and agencies and also warning and advising people who are likely to be affected.

Convene an emergency meeting of all coordinators to discuss issues such as Rescue operations, Evacuation, Mobilizing the foods and also plans to augment the manpower.

Get feedback from all coordinators on the latest developments, other information and requirements at frequent intervals to decide on the future course of action.

Arrange to operate Mutual Aid Scheme through Head HSE. In case of Major Fire / Explosion he has to get mobilized force and appliance from State / Municipal Fire Service.

In case On-site emergency is escalating and speeding to an off-site emergency, the matter to be informed to the District Collector to enable them trigger off-site emergency plan activities to combat emergency.

2.4.2 Assistant Emergency Coordinator (AEC)

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

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

2.4.3 On-Scene Coordinator (OSC)

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

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

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

2.4.4 Key Personnel

The prime function of the plan is to get together Key Personnel from the necessary disciplines who have the knowledge and experience to assess the situation and give directions as per objectives. Key personnel for respective services, depending upon the nature of the emergency shall arrive at the site to take charge of their respective positions. Key personnel of management in case of an emergency are indicated in the chart.
Logistics Coordinator

Logistic coordinator will report to AEC and would take care of

- Transport of materials and required personnel to the emergency site
- Transport of emergency materials from other sources
- Transport of personnel who do not have any role to play in emergency to safe location.
- Coordinate for all types of logistics support.

Safety (HSE) Coordinator

Head HSE, Cauvery Asset will function as Safety Coordinator. Responsibilities are to intimate the incident to Director of Mines Safety, OISD, Pollution Control Board as per requirement of statutory authorities. Head HSE or his representative will be available at the site. He will assist in post emergency enquiries and draw out corrective measures based on the experience gained from the situation.

Respective Safety officer will rush to the scene of emergency and report to the Assistant Emergency Controller. He will ensure availability of necessary safety equipments / Personnel Protective Equipments such as Aprons, Gloves and others.

Finance Coordinator

Finance coordinator will assist in mobilizing funds for purchasing all emergency materials, services from abroad if required. He will assist in documentation and interaction with external agencies on commercial matters such as insurance claim etc.

Materials Coordinator

He will assist in mobilizing equipments / services and material from internal sources and placement of commercial orders. He / She will coordinate with external agencies like customs, port authorities and others for quick arrangement of materials.

Communication Coordinator

Communication coordinator will set up emergency communication facilities at the Site Control Room (SCR) round the clock basis. Also arrange for additional communication equipments like walkie-talkies, VHF sets etc as per requirement.

Public Relation Coordinator

The press and media will be regularly briefed on the current situation of the disaster and the on-going action plan. The briefs will be prepared on the basis of the management reports mentioned above and will be released to the press by the Public Relations Coordinator after it is approved by the CEC.

Welfare Coordinator

Welfare coordinator will verify the crew list / attendance register for head count and identify the missing personnel. Inform the next of kin of affected personnel in case of accident / death. Also make arrangement for financial compensation, hospitalities etc.

Medical Coordinator

He will co-ordinate for

- Arrangement of ambulance and other facilities
- Procurement of medicines / drugs if required
- Mobilizing first aid team to the emergency site
- Establishing medical centre
- Sending the injured to nearest hospitals

**Security Coordinator**

The security coordinator will handle all security aspects concerning emergency situation such as cordon off the affected area, mob control and co-ordinate with agencies like Police department etc.

**Fire Coordinator**

Fire officer with his crew members will reach the site in a fire tender and report to the On-scene Emergency coordinator. Takeover charge of all fire fighting appliances and equipments and carryout all necessary steps for putting off the fire. Until then, Shift In-charge will assume full responsibility of fire fighting. If required he may take assistance from Tamilnadu Fire Service to mitigate emergency.

**Emergency Control Room (ECR) at Base office**

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

### 2.5 RESPONDING TO AN EMERGENCY

#### 2.5.1 Guidelines for all on Hearing Fire Siren / Emergency message

1. All hot work jobs within the installation must be stopped immediately.
2. Do not panic.
3. Use of firewater for other purposes shall be stopped.
4. All contract people shall assemble at nearby assembly points after stopping the jobs, making their equipment safe and ensuring that it does not obstruct emergency operation.
5. All employees working in installation on hearing fire siren shall assemble at near by assembly point if they do not have any special role assigned to them.
6. At assembly point, wait patiently for further instruction. Do not make noise; do not leave assembly point unless instructed or all clear siren is blown. Always keep good discipline so that instructions can be communicated to all.
7. All employees who do not have any direct role in emergency management and present in their work spot shall be available at their respective location till further instruction or till all clear siren is blown.
8. Keep intercom / BSNL Telephone lines free for emergency instructions and communications.

#### 2.5.2 Assembly Point

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

#### 2.5.3 Specific fire fighting procedures

**A. Fixed roof tank fire (Crude)**

1. Spill Fires only
In case of spill fires within the tank dyke, use foam for extinguishing thereby reducing the heat input to adjacent tank contents.

- Cool the adjacent tanks (contents of which have not ignited but are exposed to radiation heat) by means of water spray and jet applied to shell to prevent excessive vaporization and to reduce the danger of fire spreading to other areas.

2. Fire in tank also
   - Apply foam inside the tank through the semi fixed foam arrangement
   - Actuate fixed spray system or apply cooling water to other adjoining tanks exposed to radiation heat from fire.
   - Arrange to discard the water from dyke to safe area if loading of tank dyke occurs.

B. Road tanker fire

1. Stop all pumping / loading operations
2. Close block valves on pipelines connecting tanker and tank.
3. Isolate the burning tanker from other tank trucks, not yet involved in the fire.
4. Apply cooling water spray from fixed water monitors as well as hose lines to cool the tanks trucks completely.
5. Protect adjacent tank trucks with cooling water stream.
6. When the fire is contained with the help of water spray streams, apply foam to extinguish flames.
7. Apply cooling water even after the flame extinguishers until all danger of re-ignition from hot surfaces has been eliminated.
8. Salvage as much un-burnt oil as possible.

C. Pump fire

1. Isolate the affected pump out of service.
2. Drain or de-pressurize the equipment and connecting lines if conditions permit.
3. Use DCP fire extinguishers on the fire.
4. If portable extinguisher is inadequate, blanket the fire area with jets of high pressure water fog in to the source of fuel until the flow of fuel is stopped.
5. Apply foam on the ground / trenches in which burning oil may accumulate covering the sewer drain to prevent fire entering the sewers.
6. Maintain adequate drainage of fire area.

D. Trench or pit fire

1. Locate and stop the source of leak in to the trench or pit.
2. Apply carbon-di-oxide or DCP to the fire area. If this is not successful, apply foam covering the sewer drain as possible.
3. Apply high pressure water fog or spray to prevent damage to adjacent equipment.
4. Avoid overflowing trenches or pits with water since this may cause spread of fire.

E. Fire at installation GGS/GCS/EPS

Duty guidelines for Rig / Operational crew

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

A person who detects the fire should shout “FIRE FIRE FIRE” and communicate the event to the people around and to resident engineer/shift-in-charge and radio room by using fire alarm/bell and by shouting. If the fire is small in nature, attempt to extinguish the fire with nearest available and suitable fire extinguisher till the fire-fighting team arrives.
<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| **SHIFT IN-CHARGE (SIC)/Resident Engineer** | Stop all Hot works.  
Isolate the area of fire  
cut off power to the area.  
Start fire-fighting operations |
| **Assistant SIC / Radio officer / Radio operator** | Intimate the incident to the nearest Fire station and call for help / fire-fighting.  
Intimate radio room Neravy and other key persons  
Keep constant record of messages received and transmitted. |
| **Asset Manager** | On receiving the message, shall set up a control room and keep constant communication with installation team.  
Shall inform the concerned director and CMD of ONGC depending on the severity of the incident  
Media briefing, if required. |
| **Surface Manager** | On receiving the message, take over the charge of the situation and keep constant touch with fire-fighting team and other related persons. |
| **In-charge HR / ER** | Intimate the incident to District collector, Supdtt. of Police, and other district authorities. |
| **Head HSE** | Intimate the incident to DGMS, OISD, CHSE, Pollution control Board authorities depending on the severity of the incident |
| **I/C Fire, I/C HSE(ST/DS), SFM and Area Manager** | Rush to the site on information and arrange  
First aid to the injured and rescue accident victims  
Ensure sufficient quantities of PPE(s) at site  
Safe withdrawal of persons who are not required for fire-fighting.  
Co-ordinate ambulance movement.  
Maintain running record of instructions and line of action for fire-fighting. |
| **Head Support Services** | Arrange for transportation of men and materials.  
Deployment of Doctors and medical facilities.  
Arrangement of additional man-power for radio room with additional common facilities.  
Arrangement of food and other basic amenities at site. |
| **Head Engg. Services** | Make arrangement for water supply at site.  
Make arrangement for camp set-up.  
Make arrangement for deployment of C&M team at site. |
| **Head Maintenance** | Make arrangement for power supply and lighting.  
Make arrangement for mechanical related jobs. |
| **Security Section** | Ensure that no unauthorized person enter the site.  
Ensure that no villagers assemble near the gate, which restricts vehicular movement.  
Ensure that there is no open fire near by.  
Ensure visitors, petroleum tankers and unskilled workers are sent out of installation. |
| **OTHERS** | Assemble near the bunk house or storehouse within full view of SIC so that any of them is summoned by SIC at the time of need.  
They should also ensure that there is no open fire at the site and near by area. |
F. Pipe line Leakage

Duty guidelines for operational crew

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

Any oil leakage information received from villager/land owners/farmers/line walkers/security or surface patrolling team is immediately passed on to resident Engineer/Shift-in-charge, who rushes to the site for assessment. And depending on the type of hazard envisaged action is taken.

| SHIF IN-CHARGE (SIC)/Resident Engineer | • Receives the information and rushes to the site.  
• Assess the leakage and declares minor/major and informs radio room.  
• Identify the well and shuts off or identify the trunk line and stops pumping in the line.  
• De-pressurize the line at installation.  
• Make arrangement for recovering the oil from the leakage point area. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant SIC / Radio officer / Radio operator</td>
<td>• Details of leakage is passed on to Neravy room, which in turn will be passed on to SFM, SAM, SM, I/C C&amp;M, HHSE and Asset Manager.</td>
</tr>
</tbody>
</table>
| Asset Manager | • On receiving the message, shall set up a control room and keep constant communication with installation team.  
• Shall inform the concerned director and CMD of ONGC depending on the severity of the incident.  
• Media briefing, if required. |
| Surface Manager | • On receiving the message, take over the charge of the situation and keep constant touch with C&M section, fire and other related persons and apprise Asset Manager. |
| In-charge HR- ER | • Intimate the incident to the District collector, Supdtt.of Police, and other district authorities. Arrange damage assessment for compensation. |
| Head HSE | • Intimate the incident to DGMS, OISD, Pollution Control Board authorities & CHSE depending on the severity of the incident |
| I/C Fire, | Rush to the site on information and  
• Ensure readiness of Fire-fighting equipment and man-power.  
• Deployment of security personnel to cordon off the area. |
| SFM , Area Manager and I/C HSE(ST), | Rush to the site on information and  
• Ensure removal of spilled oil if any and clamping/repair and hydro-test of the pipeline  
• Remove the contaminated soil and Ensure its safe disposal  
• Back fill with fresh soil. |
| I/C C & M | • Make arrangement for deployment of C&M team at site for clamping the leak point.  
• If not possible, flush the line with water.  
• Cut and remove the leaking portion, weld with new pipe and hydro-test the line. After completing the jobs as per SOP, resume the flow and ensure no leakage. |
| Security Section | • To ensure that no villagers assemble near the leakage spot, that can hamper work.  
• Ensure that there is no open fire near-by |
G. Fire at Pipe Line Leakage at GGS/GCS/EPS

Duty guidelines for operational crew

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

Any oil leakage/fire information received from villager/land owners/farmers/line walkers / security or surface patrolling team is immediately passed on to resident Engineer/Shift-in-charge, who rushes to the site for assessment. And depending on the type of hazard envisaged, action is taken.

<table>
<thead>
<tr>
<th>Role/Position</th>
<th>Task</th>
</tr>
</thead>
</table>
| **SHIFT IN-CHARGE** (SIC)/Resident Engineer | - Rushes to the site on receipt of information.  
- Informs radio room. Stop all Hot works. Identify the source of oil/gas leak and shuts off or identify the trunk line and stops pumping in the line.  
- De-pressurize the line at installation. Starts the fire-fighting with the available resources from the nearest installation. |
| **Assistant SIC / Radio officer / Radio operator** | - Details of fire at pipe line leakage is passed on to Neravy room, which in turn will be passed on to SFM,SAM, SM, I/C C & M HHSE and Asset Manager. |
| **Asset Manager**                           | - On receiving the message, shall set up a control room and keep constant communication with installation team.  
- Shall inform the concerned director and CMD of ONGC depending on the severity of the incident.  
- Media briefing, if required. |
| **Surface Manager**                         | - On receiving the message, takes over the charge of the situation and keep constant touch with Fire section, C&M section and other related persons and apprise Asset Manager. |
| **In-charge HR / ER**                       | - Intimate the incident to the District collector, Supdtt of Police and other district authorities. Arrange damage assessment for compensation. |
| **Head HSE**                                | - Intimate the incident to DGMS, OISD, CHSE and Pollution control Board Authorities depending on the severity of the incident. |
| **I/C HSE (ST), SFM and Area Manager**      | - Rush to the site on information and arrange  
- Deployment of security personnel to cordon off the area  
- Sufficient Fire-fighting equipment and man-power with adequate PPEs  
- First aid to the injured and rescue accident victims if any and co-ordinate ambulance movement.  
- Safe withdrawal of persons who are not required for fire-fighting.  
- Maintain running record of instructions and line of action for fire-fighting.  
- After fire is put off, ensure removal of spilled oil if any and clamping/repair and hydro-test of the pipeline  
- Ensure removal of the contaminated soil, its safe disposal and back fill with fresh soil |
| **Head Support Services**                   | - Arrange for transportation of men and materials.  
- Deployment of Doctors and medical facilities.  
- Arrangement of additional man-power for radio room with |


additional common facilities.

- Arrangement of food and other basic amenities at site.

<table>
<thead>
<tr>
<th>I/C C &amp; M</th>
<th>• Make arrangement for deployment of C&amp;M team at site for damage assessment and repair the leak point.</th>
</tr>
</thead>
</table>
| I/C Fire        | • Rush to the site and assess the situation and arrange for more Fire-fighting equipment and man-power, if required.  
                  • Ensure right kind FF material is used and ensure that the fire is extinguished. |
| I/C Security    | • Ensure that no villagers should assemble near the leakage spot, this can hamper work.  
                  • Ensure that there is no open fire near-by. |

### 2.5.4 EVACUATION

1. Non-essential personnel, contract personnel and visitors will be evacuated from the incident area and also from adjacent areas.

2. The Assistant Emergency Coordinator as deemed fit, will order evacuation of all road tankers, trucks and other vehicles from inside the plant.

3. Depending upon the gravity of the situation, the Assistant Emergency Coordinator will order evacuation of areas around the incident site.

4. If the Assistant Emergency Coordinator anticipates a further deterioration of the situation and expects a serious explosion of fire or BLEVE he will recommend to On-scene Coordinator to order evacuation of personnel from process area as well as from within the buildings.

5. At the worst possible situation, when the lines of the emergency arrangement crew themselves are threatened, the Main Controller will order for evacuation of them from the emergency area at once and continue the emergency management activities remotely if possible or from a distance.

6. Security will be assisting the evacuation operation as needed by the Assistant Emergency Coordinator.

7. During the emergency period, entry at the gates will be restricted to resources arriving from outside for emergency management only.

### 2.6 DRILLING AND WORK OVER OPERATIONS

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

#### 2.6.1 Responding to an emergency

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

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

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

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

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

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

2.6.3 Emergency procedures in the event of blowout

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

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

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

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

2.6.3.1 Functions of On-Scene Coordinator (OSC)

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

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

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

1. Well condition.
2. Position of drill string / Tubing string in the well.
3. Last tubing and annulus pressure recorded.
4. Number, Name and Designation of persons at site, measures initiated to meet the situation, details of injury / casualty, if any.
2.6.4 Emergency procedure for Control of Kick

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

2.6.4.1 Duty guidelines for Rig operational crew

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

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

<table>
<thead>
<tr>
<th>SHIFT IN-CHARGE (SIC)</th>
<th>Stand on brake and control as necessary. Supervise all activities to control the situation.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Ensure functioning of BOP and choke manifold lines.</td>
</tr>
<tr>
<td></td>
<td>- Ensure help is provided to Chemist in order to maintain mud parameters as directed by authorities.</td>
</tr>
<tr>
<td></td>
<td>- Ensure safe removal of records, men and materials to safe and secure place.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSISTANT SIC</th>
<th>- Be available at control panel of BOP to operate as per direction of RM / SIC / AE(D) / AEE(D) and the guidelines issued to close BOP, install Kelly cock etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Keep watch on pressure on discharge line, stand pipe and annulus pressure and increase in mud volume in the pit / tanks.</td>
</tr>
<tr>
<td></td>
<td>- Help Chemist in preparation of mud and maintaining mud parameters as required.</td>
</tr>
<tr>
<td></td>
<td>- Ensure operation of degassing unit, if any. Also keep watch for rise in mud level in the suction tank.</td>
</tr>
<tr>
<td></td>
<td>- Work on choke line / kill line of BOP.</td>
</tr>
<tr>
<td></td>
<td>- Keep watch on the float in the mud pit for loss or gain of mud and inform SIC the status and request SIC to alert site personnel of impending danger.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOP MEN</th>
<th>Both of them will work on choke-line and valves.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIG MEN</td>
<td>They will help the SIC in fitting NRV / Kelly etc. and will be available at derrick floor.</td>
</tr>
<tr>
<td>RIG ENGINEER (M)</td>
<td>To be near the engine waiting for directives from SIC.</td>
</tr>
<tr>
<td>FITTER</td>
<td>To be available near the pump and will give pump connection as and when advised by SIC / Chemist.</td>
</tr>
<tr>
<td>RIG ENGINEER (E)</td>
<td>To be available near BOP panel board and will attend electrical work if any needed for charging the accumulators.</td>
</tr>
<tr>
<td>CHEMIST</td>
<td>To liaison with SIC and calculate kill mud weight as per available data and take necessary steps to prepare mud as per requirement. It must be ensured however, it should be checked at the time of kick control and SIC should be informed of condition.</td>
</tr>
<tr>
<td>GEOLOGIST</td>
<td>To keep contact with the SIC and keep him abreast of possible...</td>
</tr>
</tbody>
</table>
reservoir condition and convey the data recorded at Mud Logging Unit.

SECURITY GUARD
To see that no unauthorized person enter the site. He should remain at the drill site and not allow the villagers to assemble near the gate. He should ensure that there is no open fire near by.

OTHERS
To assemble near the bunk house or storehouse within full view of SIC so that any of them is summoned by SIC at the time of need. They should also ensure that there is no open fire at the site and near by area.

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

2.6.5 Well Kick Shut in procedure for On Land and Jack up Rigs
A well kick shut in procedure for On-land and Jack up rigs as listed below is adopted from OISD STD 174

a. Shut in procedure while drilling

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

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Soft Shut – in</th>
<th>Hard Shut – in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Open hydraulic control valve (HCR valve) / manual valve on choke line.</td>
<td>Close Blowout Preventer. (Preferably Annular Preventer)</td>
</tr>
<tr>
<td>2.</td>
<td>Close Blowout Preventer.</td>
<td>Open HCR/Manual valve on choke line when choke is in fully closed position.</td>
</tr>
<tr>
<td>4.</td>
<td>Allow the pressure to stabilize and record SIDPP, SICP and Pit gain.</td>
<td>---------</td>
</tr>
</tbody>
</table>

SIDPP – Shut In Drill Pipe Pressure
SICP – Shut In Casing Pressure
FOSV - Full Opening Safety Valve

b. Shut in procedure while tripping

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

Following methods are recommended for shut-in the well as shown in table - 2.

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

c. Shut in procedure when string is out of hole
1. Close blind/shear ram.
2. Close adjustable/ remotely operated choke and open HCR valve.
3. Record shut in pressure.

3.0 OFFSITE EMERGENCY PLAN

The OFF-SITE Emergency Plan for Drilling rigs, Cauvery Asset is a compilation of various emergency scenarios. It also includes the probable impact on ‘off the site’ due to emergency and the action plan to combat / mitigate the consequences of a disaster situation.

3.1 Flammable Hazard Distances

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Postulated Maximum Credible Accident Scenario Description</th>
<th>Hazard distances (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Thermal Radiation / Blast over pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 KW/M² / 1 psig</td>
</tr>
<tr>
<td>1</td>
<td>Gas Lift Manifold / Separator Area:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Catastrophic rupture of Gas Lift separator leading to a fire ball.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Leakage from Gas Manifold / Separator leading to a Jet fire.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>284</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>105</td>
</tr>
<tr>
<td>2</td>
<td>Sweet well Manifold / Separator Area:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Leakage from Sweet well Manifold/Separator leading to a Jet fire.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Leakage from sweet well manifold leading to a Pool fire.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>87</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>Tank farm (2000 M³) Area:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Catastrophic rupture of tank leading to a Vapor cloud explosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Leakage in Tank / Manifold leading to a Pool fire.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>189</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>Tank farm (2000 M³) Area:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Catastrophic rupture of tank leading to a Vapor cloud</td>
<td></td>
</tr>
<tr>
<td></td>
<td>153</td>
<td>76</td>
</tr>
</tbody>
</table>
### 3.2 Toxic Hazard Distances

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Postulated Maximum Credible Accident Scenario Description</th>
<th>Hazard distances (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ERPG – 3 (100 ppm)</td>
</tr>
<tr>
<td>1</td>
<td>Sour well manifold / Separator area:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Leakage from the H.P. sour well manifold / separator leading to toxicity.</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>b. Leakage from the M.P sour well manifold / separator leading to toxicity.</td>
<td>609</td>
</tr>
</tbody>
</table>
Leakage of oil / gas which may result in fire if source of ignition is present. Once, detected, the emergency procedure will be activated and remedial action will be taken to control the leak, spread of fire etc. Moreover, no major evacuation is required as pipelines are passing through non populated areas.

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

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

Types of Terrorist Attack

Not only could terrorists target almost any location, the attack could potentially come in a wide range of forms, depending on the means and objectives of the responsible group.

Officials fear that terrorists are currently attempting to acquire and use weapons of mass destruction (WMD), including chemical, biological, nuclear, and radiological weapons (“dirty bombs”), for similar ends. Any of the threats described can create an emergency situation and cause significant disruption to company operations and its normal functions.

Preparing for Terrorist Attacks:

(A) IED Attack:

*Primary rule*

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

*Secondary rule*

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

(B) Chemical Attacks

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

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

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

**Evacuation**

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

**Shelter in Place**

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

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

**(C)Biological Attacks**

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

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

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

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

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

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

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

There are three basic ways to reduce your exposure:

1. Reduce the time near the source of radiation,
2. Increase the distance from the source of radiation,
3. Increase the shielding between person and the source of radiation. Shielding is anything that puts distance and mass between person and the radiation source.

Evacuation

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

Shelter in Place

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

3.4 Action Plan - Reporting of an Off-Site Emergency

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

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

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

The off-site emergency requires mobilization of resources beyond ONGC capabilities such as TNFS and other government agencies.

In case of an off-site emergency, the On-site Chief emergency coordinator (ED - Asset Manager, Cauvery Asset) will report the matter to the District Collector of Ariyalur District who is Chairman of District emergency committee. Further, the Chairman will mobilize other members of District Emergency committee as per the organization Chart for an Off-site emergency management (figure-2).

Communication to Corporate Disaster Management Group (CDMG)

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

The District Collector - Chairman
Deputy Chief Inspector of Factories - Member Secretary

Members

1. Superintendent of Police
2. District Revenue Officer
3. Regional Transport Officer
4. District Health & Medical Officer
5. Revenue Divisional officer
6. District Environmental Engineer, TNPCB
7. Divisional Fire Officer
8. Executive Engineer (TNEB)
9. Sr. Regional Officer, TNCSC
10. Joint Director Agriculture
11. Executive Engineer, TWAD
12. Joint Director Animal Husbandry

ORGANISATION CHART FOR AN OFF-SITE EMERGENCY MANAGEMENT

Figure 2
a) Inform the District Police, Fire Personnel to combat the emergency. Arrange if necessary, for warning and evacuating the public from the villages by the Superintendent of Police.

b) Inform the team of Doctors headed by District Health & Medical Officer; also help and support from nearby hospitals may be called for.

c) Inform the Regional Transport Officer to arrange for transportation of victims and evacuation of people trapped within the hazardous zone.

d) Inform the TNEB Executive Engineer to give uninterrupted power supply or de-energize power supply, as required.

e) Inform the Revenue Divisional Officer (RDO) and District supply officer to provide safe shelter, food and other life-sustaining requirements for the evacuees.

3.4.2.2 Responsibilities and duties of members of Service group

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

<table>
<thead>
<tr>
<th>District Collector</th>
<th>Press and Public Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Superintendent of Police</td>
<td>Warning &amp; Advice to the public security measures, Rescue &amp; Evacuation</td>
</tr>
<tr>
<td>2. District Revenue Officer</td>
<td>Coordinates Transport, Civil Supplies, Health, Medical and other services.</td>
</tr>
<tr>
<td>3. Revenue Divisional Officer</td>
<td>Rallying post</td>
</tr>
<tr>
<td>4. Regional Transport Officer</td>
<td>Provide transport</td>
</tr>
<tr>
<td>5. Sr. Regional Manager, TNCSC</td>
<td>Catering to the evacuees and others involved in the relief measures</td>
</tr>
<tr>
<td>6. Deputy Director Health</td>
<td>To take care of Public Health &amp; Preventive medicines</td>
</tr>
<tr>
<td>7. District Medical Officer</td>
<td>Treatment of affected persons</td>
</tr>
<tr>
<td>8. Divisional Fire Officer</td>
<td>Help in fire fighting operations &amp; rescue.</td>
</tr>
<tr>
<td>9. District Environmental Engineer</td>
<td>Advice for protection of environment and reduction in environmental losses</td>
</tr>
<tr>
<td>10. Joint Director, Animal Husbandry</td>
<td>Taking care of cattle in the affected area.</td>
</tr>
<tr>
<td>11. Joint Director, Agriculture</td>
<td>Taking care of standing crops</td>
</tr>
<tr>
<td>12. Executive Engineer, TNEB</td>
<td>Ensuring uninterrupted powers supplies or de-energizes power supply as required.</td>
</tr>
</tbody>
</table>

A. Superintendent of Police

S.P or Police Commissioner is the officer In-charge for warning and advising the affected population through unambiguous, reliable and rapid public announcements. The public to be advised to

- Stay indoor : keep the doors and windows closed, (in certain cases)
- Lock houses and be prepared for evacuation to the nearest evacuation center for a stay of two or three days. Buses will come and pick you up. Police will guard your houses and belongings. The termination of the emergency shall also be announced similarly.

B. Regional Transport Officer

The Transport Officer shall arrange for the dispatch of vehicles (with fuel at full tank level) to reach the parking yard indicated therein, immediately on receipt of request from ONGC. There should not
be any delay on any score. He shall contact the Officer In-charge of parking yards regarding evacuation of public during emergency period & apprise him of the dispatch of the buses. The vehicles so dispatched shall be at the disposal of the officer In-charge of the parking yard, until the release orders are issued.

C. Officer – In charge of Parking Yards (DSP or Representative)

An officer not below the rank of the Deputy Superintendent of police shall be in full charge of handling the emergency situation at parking yards, supervising dispatch of vehicles to evacuate people in the villages. He shall appoint Village Administrative Officer (VAO) as convey officer for maintaining proper account of incoming vehicles, crews involved in for evacuation, vehicles numbers, time of their arrival, names of crew members and officer In-charge of the vehicles for transport of the evacuees. VAO will be assisted by the Head Constables, Constables, Health Visitors, Medical attendants with stretchers.

D. Officer – In charge of Rallying Post (Revenue Divisional officer or Representative)

An officer in charge of cadre of Revenue Inspector shall be in-charge of rallying posts. He shall maintain a record of the evacuees (under the heads men, women and children) and he shall be solely responsible till termination of emergency is announced. The following facilities shall be provided by the Department concerned, at the Rallying Posts: Sanitation, Water and Lights.

E. Senior Regional Manager (TN Civil Supply)

The Taluk Supply Officer under the overall supervision of the District Supply Officer shall ensure to provide food and clothing to the evacuees till they are rehabilitated. He and the District Supply Officer shall arrange in such a way that sufficient quantity of food is made for immediate distribution.

F. Deputy Director (Health)

The district Health & Family Welfare officer under leadership of Deputy Director (Health) shall make necessary arrangements for distribution of preventive medicines in the affected area and for their administration. Adequate stock of medicines, procured through the help of Districts Authorities are maintained properly and renewed periodically. He shall arrange for supply of sanitary items such as soap, phenyl, lime etc. He shall deploy his personnel for providing precautionary treatments to prevent Epidemics etc. He shall organize well trained medical personnel to handle patients in affected areas requiring medical attention and also arrange for medical care for people at Rallying Posts. First Aid center shall be set up at the Rallying Posts.

G. District Medical Officer

Upon receipt of information from District Collector about the emergency, he shall extend the facilities at the hospital under his control & make available the services of the trained Doctors to provide necessary care for Emergency Medical cases. He will ensure that the primary health centers & Municipal Dispensaries are equipped with required quantities of Drugs and equipments. He will also secure assistance of medical and paramedical personnel.

H. Divisional Fire Officer

He shall be responsible for preparing an action plan for handling fire and rescue operation in the affected areas. Also he will be In-charge of operation in moving the disabled, handicapped and the deceased persons to the rallying posts.
I. District Environmental Engineer

If the emergency is affecting environment, then DEE, TNPCB or his representative will take necessary steps towards environment protection and initiate actions that minimize environmental degradation. For example steps for avoiding spilled oil mixing with natural source of water, etc.

J. Joint Director (Animal Husbandry)

He shall appoint as many persons as required (taking in to account the number of cattle, especially mulching animals in the affected areas) to look after the welfare of the cattle & protect lives by applying precautionary measures. He shall select and prepare a list of areas for utilization as cattle shelter during the emergency. He shall also be responsible for arranging fodder for the cattle during emergency.

K. Joint Director (Agriculture)

He will take an action to protect food grains and standing crops in the emergency affected areas.

L. Executive Engineer (TNEB)

He will ensure uninterrupted power supply to the industry concerned and help in their emergency management operations. When he receives specific requests for de-energizing power to the industry concerned or a part thereof, he shall immediately comply with the request. He shall also ensure that the safety of the electrical installations meant for power distribution system located at the emergency site are not threatened because of the emergency in that particular vicinity.

3.5 MOCK DRILL FOR ONSITE AND OFF-SITE EMERGENCY MANAGEMENT

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

Once in every year this plan will be practiced on field mock exercise involving dramatized scenarios to test the communication system, action plan and response of all Key agencies within ONGC and Government officials. Such on field mock exercise will be selected from high risk areas and near real approach of actual fire fighting / evacuation operations will be undertaken. An emergency will be alerted through different types of Siren Sound Code example fire, explosion, toxic release etc. Siren codes as per OISD STD 116 reproduced here in Format-I will be followed. During mock drill exercise observers would be appointed in key areas to take note (as per format-II) of individual responsibilities, response time and lapses. Every mock exercise will be followed by “post – mock-drill meeting” to discuss the findings of observers and shortcomings. The lessons learnt from such exercises will be summarized in the form of a report to improve upon the overall preparedness and will also be used as inputs for updating the plan to the extent necessary.

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

3.6 MUTUAL AID WITH CPCL

A mutual aid agreement is a pre arranged agreement developed between interested parties to render assistance to each other at the time of crisis.

Accordingly, a mutual aid agreement between CPCL – CBR, Pannangudi, Ariyalur and ONGC, Cauvery Asset has been signed. The objective of this mutual aid scheme is to help / control / mitigate the
emergency in the premises of either of the parties by providing timely assistance in terms of mobile fire
fighting system / equipment, deploying suitably trained personnel within shortest possible time and supply
required consumables (on returnable basis) for fire fighting.

The following fire crew personnel and equipment shall be made available by CPCL – CBR &
ONGC – Cauvery Asset as indicated below.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Mutual aid arrangement</th>
<th>CPCL-CBR</th>
<th>ONGC-Cauvery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fire crew</td>
<td>3 Personnel</td>
<td>3 Personnel</td>
</tr>
<tr>
<td>2.</td>
<td>Foam tenders</td>
<td>1 No.</td>
<td>1 No.</td>
</tr>
<tr>
<td>3.</td>
<td>Trailer pump 1800LPM</td>
<td>1 No.</td>
<td>1 No.</td>
</tr>
<tr>
<td>4.</td>
<td>Foam compound (AFFF 3%)</td>
<td>3600 Ltrs.</td>
<td>3600 Ltrs.</td>
</tr>
<tr>
<td>5.</td>
<td>Dry chemical powder</td>
<td>1000 Kg</td>
<td>1000 Kg</td>
</tr>
<tr>
<td>6.</td>
<td>B.A.sets</td>
<td>2 Nos.</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>7.</td>
<td>Fire hoses</td>
<td>10 Nos.</td>
<td>10 Nos.</td>
</tr>
</tbody>
</table>

3.7 REVIEW OF THE PLAN

The off-site emergency plan will be reviewed by ONGC and District Emergency Committee as per
requirement and updated accordingly. The changes from the master plan will be sent to all concerned.
The relevant papers may be replaced in the master document provided in a ring folder.

Table-1

Emergency Siren Codes

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

(Reference: OISD-STD 116, page 26)

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

## DMP Mock-Exercise Format

(Onsite / Off-site)

### Name of the Installation / Plant

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Part-A: Pre-Drill Checks

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether the Unit/Installation is Running normal?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether Emergency equipments are in position, in case of any abnormally during the drill?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether alternate power supply is available, if power supply is to be disconnected?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether Transport arrangements have been made?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether there is any abnormality in nearby units or any Civil unrest in and outside the plant like road blockage etc?</td>
<td></td>
</tr>
</tbody>
</table>

### Part-B: During the Mock-drills:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. of employees present within the Installation/plant</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Location of Drill</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scenario(s) specified for the Drill</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Time when somebody was informed, if so when?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether fire station was informed, of so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>6</td>
<td>Whether appropriate siren sounded, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>7</td>
<td>Whether Mutual-aid agencies were informed, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>8</td>
<td>Whether Emergency Coordinators were informed, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>9</td>
<td>Whether Mutual aid agencies reached the site, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>10</td>
<td>Whether Emergency control room established, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>11</td>
<td>Emergency coordinators reached the location or the emergency control room (as the case may be), if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>12</td>
<td>Whether any other External agency reported, if so when?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>a) Police</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) City Fire Brigade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Media</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Statutory agencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Medical team etc.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Wind direction</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>14</td>
<td>Power supply switched off? If so when</td>
<td>Yes/No/NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>All hot jobs stopped near the area, if so, when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>16</td>
<td>Whether fire tenders (/ second turn out) reached the location, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td></td>
<td>a) First Turnout</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Second Turnout</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Fire pumps started at</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>18</td>
<td>Process Isolation done? If so, when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>19</td>
<td>Area Cordoned off? If so when</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>20</td>
<td>Whether adequate pressure achieved in the fire header?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>21</td>
<td>Time when First hydrant / monitor was started?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>22</td>
<td>Contractor men / visitors sent out of premises</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>23</td>
<td>Rescue/Fire team reached the spot, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>24</td>
<td>Medical team with stretcher and first aid reached the spot, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>25</td>
<td>Whether evacuation was attempted, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>26</td>
<td>Whether people reported at Assembly point, if so, when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>27</td>
<td>Whether ‘Mustering’ was done, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>28</td>
<td>Time when emergency was controlled?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>29</td>
<td>Whether ‘residual hazards’ were checked before re-entry, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>30</td>
<td>Whether ‘All clear’ signal was ordered, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
<tr>
<td>31</td>
<td>Whether ‘All Clear’ siren sounded, if so when?</td>
<td>Yes/No/NA Time</td>
</tr>
</tbody>
</table>

**Part-C: Post-Mock Drill Recordings & Efficiency Evaluation**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether Post-Mock-drill meeting conducted? No. of fire tenders, other appliances (vehicles) and consumables (DCP, Foam concentrate etc.) used including that of the Mutual aid and external agencies</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>2</td>
<td>Was the response, role played by individual/team satisfactory?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Fire combat team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Rescue/Medical team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Auxiliary team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Security group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Contractors Personnel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f) Mutual aid agencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g) Municipal fire Brigade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>h) Emergency Coordinators etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>3</td>
<td>Whether special rescue and fire appliances e.g. Breathing air set, fire entry suit, rescue equipments etc) were used?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>4</td>
<td>Whether fire pump started in AUTO/MANUAL MODE</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>a. No. fire pumps provided</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>b. No. of fire pumps started during the drill</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>c. No. of fire pumps in working condition?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>5</td>
<td>Did following safety devices function in AUTO mode?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>a. Power Supply Tripping system</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>b. Sprinkle system (if provided)</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>c. Fire hydrant and monitors (manual)</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>6</td>
<td>Was the fire siren audible to all?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>7</td>
<td>Fire tank water level: Full / Exact level</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>8</td>
<td>a. Any rupture of fire hydrant hoses, snapping of monitor nozzles and improper? Functioning/leaks of hydrant / monitor valves?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>b. Was the throw of water jet from hydrant points / monitors sufficient?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>9</td>
<td>Whether search for causalities done and injured given</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>10</td>
<td>Whether site people used portable fire extinguishers initially</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>11</td>
<td>No. of people evacuated</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>12</td>
<td>Whether any discrepancy found during ‘head count’?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>13</td>
<td>Whether the performance shared with the employees?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>14</td>
<td>Whether records of all actions taken against observed deficiencies have been recorded?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>15</td>
<td>Whether attendance taken in the post-Mock-drill meeting?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>16</td>
<td>Any shortfall of equipment /manpower/consumables observed?</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>17</td>
<td>Any other deficiencies observed with respect to the fire Order/ERP/onsite DMP/Offsite DMP</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>18</td>
<td>Remedial actions suggested</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>19</td>
<td>Note-worthy points observed</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>20</td>
<td>Overall lessons learned</td>
<td>Yes/No/NA</td>
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</table>

Note: the above checklist is generic for use in all types of mock-drills. Tick the points which are not applicable for a particular type of drill.
4.1 Fire Fighting System at GGS Narimanam, GCS Kuthalam and EPS Tiruvarur

4.1.1 GGS Narimanam

Since there is always a risk of Fire accident in handling CRUDE OIL, adequate and suitable facilities for fighting fire have been provided as per standards suggested by OISD. A brief description of the facilities provided in GGS-Narimanam is as follows.

**Fire Water**

Water is stored in One static water tank and pumped to any point in the GGS through the Ring main (Grid lines). Thus water for fighting fire is made available at a pressure of 7 kg/sq.cm at any place in the GGS. All the fixed roof tanks have been provided with fixed foam connection as well as water sprinkler system. The details of the Fire water tank are as follows.

**Capacity of the tank** : 1400 M$^3$

**Replenishment source** : Tube well at site

**Details of the fire water pumps**

**No. of pumps available** : Two

**Capacity** : 300 m$^3$/ hr

**Discharge pressure** : 9.8 Kg / cm$^2$

**No. of jockey pumps** : Two

**Capacity** : 10.8 M$^3$/ hr

**Discharge pressure of jockey pump** : 11 kg/ cm$^2$

**Fire water system**

**Ring main total length** : 1368 meters

**Double hydrants** : 34 Nos

**Single hydrants** : Nil

**Fire water monitors** : 10 Nos

**Foam monitors** : 09 Nos

1. **Multipurpose fire tender (25 tons)** : 02 Nos

   **Tank Capacity**

   - **Water** : 7000 Litres
   - **Foam** : 1000 Litres
   - **DCP** : 800 kg

   **Multipurpose fire tender (7 tons)** : 02 Nos
6. Other accessories

- Gun Metal branch pipes in 5/8", 1" : 30 Nos.
- Diffuser branch nozzle : 08 Nos.
- Fog nozzles : 30 nos
- Revolving nozzles : 10 nos
- Fire Man Axe (with rubber handle) : 03 nos
- Asbestos Blankets (2 M X 1 M) : 02 nos
- Manila Rope 50 Feet : 02 nos
- Aluminum suit : 08 nos
- Ultra high pressure jeep
  - Water : 500 Litre
  - Foam : 50 Litre

4.1.2 GCS Kuthalam - Firefighting facilities

- Fire fighting system has been designed as per OISD-117 specification. Fire fighting system is designed for four hours continuous fire fighting.

- Following are the facilities for fire fighting system.
  - Two nos. of R.C.C ground storage tanks – 700M³ each capacity.
  - Suitable fire water header layout as per OISD-116.
  - The fire header will be pressurized at 7.0 kg/cm² with the help of Jockey pump.
  - 02 nos. of diesel engine driven pumps of 300 m³/hr capacity.
  - Oil storage tanks provided with foam pourers & sprinklers.
  - Fixed fire monitors and fire hydrants provided as per OISD-116.
  - A mobile foam generator provided in the installation
  - CO₂ fire extinguishers 8 Nos.
  - 10 Kg DCP extinguishers 11 Nos.
150 Kg DCP extinguisher 1 No.

4.1.3 Early Production System Tiruvarur#6

A 4" fire header is provided to cover strategic location of entire EPS by installing 3 Nos. of fire hydrants. Fire water is supplied from a fire water reservoir of capacity 250 M$^3$ with the help of mobile fire trolley pump of capacity 1800 LPM at a discharge pressure of 7 Kg/cm$^3$.

Fire extinguishers

The following different types of Fire Extinguishers are available at EPS.

1. Trolley mounted 150 kg capacity DCP tank - 1 No. actuating system & delivery hose etc.
2. Mobile foam generator 900 ltrs - 1 No.
3. Foam extinguishers 45 ltrs capacity - 2 Nos.
4. DCP extinguishers 10 kg capacity - 6 Nos.
5. CO$_2$ extinguisher 6.8 Kg capacity - 7 Nos.
6. Mechanical foam extinguisher 9 ltrs - 5 Nos.
7. Fire bucket - 6 Nos.
8. Fire bell - 1 No.

4.1.4 Fire Fighting Facilities available in Drilling Rigs

<table>
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<tr>
<th>FIRE FIGHTING EQUIPMENT</th>
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<th>E-760-14</th>
<th>E-760-15</th>
<th>E-760-16</th>
<th>E-1400-9</th>
<th>E-1400-19</th>
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<td>D.C.P (Trolley) 150 Kg</td>
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<td>CO$_2$ 6.5 Kg</td>
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<td>Fire Trailer pump 1800 LPM</td>
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4.2 Meteorological Data

A collection of meteorological Data of the Kuthalam area is made to evaluate appropriate atmospheric and environmental factors as given below:

i. Atmospheric Temperature
   Mean daily maximum 'C : 31.9
   Mean daily minimum 'C : 25.2
ii. Atmospheric Pressure
   Mean daily maximum, mb : 28.2
   Mean daily minimum, mb : 27.0

iii. Humidity
   Mean daily maximum % : 73
   Mean daily minimum % : 71

iv. Wind Velocity
   Mean km/hr. : 13.2
   Mean km/hr. : 20

v. Rainfall
   Maximum mm/day : 396.2

vi. Height above sea level m : 12

CLASSIFICATION OF ATMOSPHERIC STABILITY

Atmospheric stability is a very important factor predicting the dispersion characteristics of gases / vapor’s in atmosphere.

The stability classification is given below:

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<th>Stability Class</th>
<th>Atmospheric Condition</th>
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<tr>
<td>A</td>
<td>Very unstable</td>
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<tr>
<td>B</td>
<td>Unstable</td>
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<tr>
<td>C</td>
<td>Slightly unstable</td>
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<tr>
<td>D</td>
<td>Neutral</td>
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<tr>
<td>E</td>
<td>Stable</td>
</tr>
<tr>
<td>F</td>
<td>Very stable</td>
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The seasonal variations of atmospheric stability and wind direction at the plant site are as follows:

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<th>SEASON</th>
<th>CLASS</th>
<th>WIND DIRECTION</th>
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<tr>
<td>Nov-Feb</td>
<td>Neutral</td>
<td>NE-SW</td>
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<tr>
<td>Mar-Oct</td>
<td>Stable to very stable</td>
<td>NE</td>
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</table>
## Important telephone numbers in Cauvery Asset

**BOARD NOS.:** 238601, 238578, 238178, 238525, 238113, 238973, 238625, 238824, 238139, 238201  
**Fax:** 04368 238126, 04368 238082 (AM office)  
**STD CODE-** 04368

<table>
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<tr>
<th>Designation</th>
<th>Tel. No.</th>
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<tr>
<td>ED-Asset Manager</td>
<td>238890</td>
<td>94430 09600</td>
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<tr>
<td>GGM-Surface Manager</td>
<td>238056</td>
<td>94425 00462</td>
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<tr>
<td>GM-Support Manager</td>
<td>238186</td>
<td>94430 09610</td>
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<td>238245</td>
<td>94430 09626</td>
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<td>GM-Head Drilling Services</td>
<td>238316</td>
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<td>238150</td>
<td>94425 00808</td>
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<td>GM-Sub Surface Manager</td>
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<td>235017</td>
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<td>238222</td>
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<td>238118</td>
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<tr>
<td>Chief Manager-Incharge Fire</td>
<td>238759</td>
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<td>Chief Manager-Incharge Security</td>
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<td>Incharge Instrumentation</td>
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Nearest Fire Station for Drilling rigs in Ariyalur District

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<th>Nearest Fire Station</th>
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<tr>
<td>Ariyalur</td>
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<tr>
<td>Jayankondam</td>
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04329 - 222100
04329 - 242399
04331 - 250359

Important Telephone Nos. of Ariyalur District (STD Code: 04329)

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<tr>
<th>Sl.No.</th>
<th>Authorities</th>
<th>Office</th>
<th>E-mail ID</th>
<th>Mobile</th>
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<tr>
<td>1</td>
<td>District Collector</td>
<td>04329 - 228336</td>
<td><a href="mailto:collrari@tn.nic.in">collrari@tn.nic.in</a></td>
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<td>04329 - 228831</td>
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<td>04329 - 228321</td>
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<td>6</td>
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<td>8</td>
<td>Superintendent of Police</td>
<td>04329 – 222243</td>
<td><a href="mailto:alrdtsp@gmail.com">alrdtsp@gmail.com</a></td>
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<td>25</td>
<td>Public Relation Officer</td>
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<td><a href="mailto:jpro.tnari@nic.in">jpro.tnari@nic.in</a></td>
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<td>26</td>
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<td>42</td>
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**TELEPHONE NUMBERS OF OISD AND DGMS AUTHORITIES**

**OIL INDUSTRY SAFETY DIRECTORATE**  
Noida-201301 (UP)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name</th>
<th>Office</th>
<th>Fax No</th>
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<tr>
<td>1</td>
<td>Executive Director</td>
<td>2593800 / 2593833</td>
<td>2593802 / 2593858</td>
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**DIRECTORATE GENERAL OF MINES SAFETY**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name &amp; Address</th>
<th>Telephone No.</th>
<th>Fax No.</th>
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<tbody>
<tr>
<td>1</td>
<td>Director General of Mines Safety</td>
<td>0326 2221000</td>
<td>0326 2221027</td>
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<td>2</td>
<td>Deputy Director General of Mines</td>
<td>080 25535971</td>
<td>080 25535972</td>
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<td>Safety, Bengaluru</td>
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<td>3</td>
<td>Director of Mines Safety, Chennai</td>
<td>044 26206771</td>
<td>044 26206770</td>
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