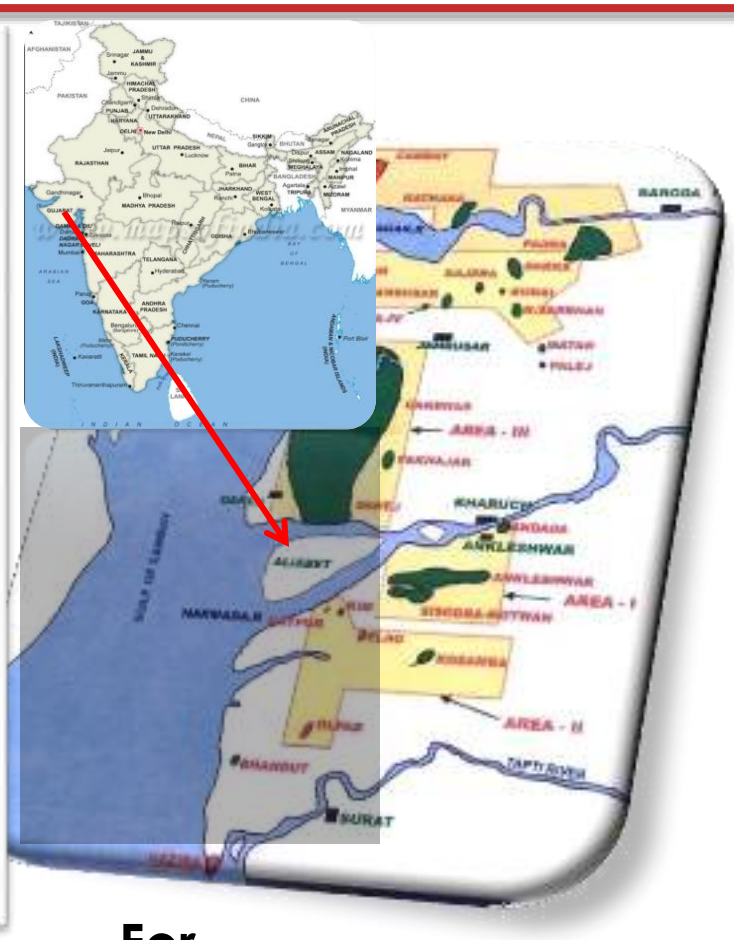
RA and DMP for Proposed Development Drilling (4 wells) under NELP V Offshore Block: CB-OSN-2003/1, Ankleshwar Asset, Gujarat



For

Oil And Natural Gas Corporation Limited
Ankleshwar Asset, Gujarat

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1.0 RISK ASSESSMENT

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

Hydrocarbon Operations are generally considered hazardous in nature by virtue of intrinsic chemical properties of hydrocarbons or their temperature or pressure of operation or a combination of them. Fire, explosion, hazardous release or a combination of these are the hazards associated with hydrocarbon operations. These have resulted in the development of more comprehensive, systematic and sophisticated methods of Safety Engineering such as Identification and Analysis of Hazards and Risk Assessment to improve upon the Integrity, Reliability and Safety of Hydrocarbon Operations.

Risk Screening

Some of the hazards associated with the drilling for hydrocarbons are:

- Fires and Explosions:
  - Non-process hydrocarbon leak (Diesel, fuel, oil etc.).
  - Non-process fire.
  - Control system failure including electrical failure in control room.

- Impact and Collisions:
  - Accidental falling of an object from crown block.

- Loss of Station Keeping / Loss of Stability:
  - Structural failure
  - Equipment failure

- External Hazards:
  - Failure due to earthquake, extreme weather, strong winds, floods, sabotage etc.

The primary emphasis in Safety Engineering is to reduce risk to human life and environment. Some of the more important methods used to achieve this are:

- **Risk Analysis:** Provides a relative measure of the likelihood and severity of various possible hazardous events by critically examining the proposed drilling and associated activities.

- **Work Safety Analysis:** The technique discerns whether the project site and operating procedures in practice have any inherent infirmities.

- **Safety Audit:** Takes a careful look at operating conditions, work practices and work environments to detect unsafe conditions.

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

Methodology

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

A) Level 1 – Risk Screening

The Top-Down Review of Worst-Case Potential Hazards / Risks, present in identifying drilling sites or location within blocks involves various screening factors which include the following:

- Inventory of Hazardous Materials
- Hazardous Material Properties
- Storage Conditions (e.g. Temperature and Pressure)
- Location Sensitivity (Distance to residential areas / Populace)
  The data / information from site (The results provide a relative indication of extent of hazards and potential for risk exposure)

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

The survey approach combines the site Inspection with established risk assessment techniques applied both in qualitative as well quantitative mode. The primary objective is to identify and select Major Risks at a specific location in the drilling site considering possible soft spots / weak links during construction / operation / maintenance. Aspects covered in the risk usually include:

- Process Hazards
- Process Safety Management Systems
- Fire protection and Emergency Response Equipments and Programs
- Security Vulnerability
- Impact of Hazards Consequences (Equipment damage, business interruption, Injury, fatalities)
- Qualitative Risk Identification of Scenarios Involving Hazardous Materials

Risk Reduction Measures

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

C) Level 3 – Quantitative Risk Assessment (Deterministic)

This is the stage of assessment of risks, associated with all Credible Hazards (scenarios) with potential to cause an undesirable outcome such as human injury, fatality or destruction of property. The four basic elements include:

- Hazards Identification utilizing formal approach (Level 2, HAZOP etc.)
- Frequency Analysis: Based on past safety data (incidents/ accidents), identifying likely pathway of failure and quantifying the toxic / inflammable material release
- Hazards Analysis to quantify the consequences of various hazards scenarios (Fire, explosion [due to release of natural gas], toxic vapour release [due to release of H_2S] etc.). Establish minimum value for damage (e.g. IDLH [Immediately dangerous to life and health], Over Pressure, Radiation Flux) to assess the impact on environment
- Risk Quantification: Quantitative techniques are used considering effect / impact due to weather data, population data, and frequency of occurrences and likelihood of Ignition / toxic release. Data are analyzed considering likely damage (in terms of injury / fatality, property damage) each scenario is likely to cause.

Thus, QRA would deal with systematic analysis of important risks involved in drilling of development wells and transfer of produced natural gas and condensate to the processing facility at Ankleshwar. Outcome of the QRA assists in integrating safety measures during project planning and incorporating measures to counter the identified risks in order to ensure the risks are below As Low As Reasonably Practicable (ALARP) during the project execution. The QRA also helps in judging risks during potential emergency situations such as blow out and fire and synthesize an effective Emergency Response Plan (ERP) to minimize damage to personnel, infrastructure and the environment.

Identification of Hazards in Drilling and Production Testing Operations

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

Minor Hydrocarbon Spill

There exists a possibility of hydrocarbon (gases / oil) getting released due to some unavoidable incidents during the Drill Stem Testing. Spillage may occur from lines, valves and separators or due to tank failure. Once the flow of oil / gas from the well is stopped, then onsite access for clean-up is possible.

Major Hydrocarbon Spill

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

Blowout

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

Primary:

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

Secondary:

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

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

Hydrogen Sulphide (H_2S)

Hydrogen Sulphide gas (H_2S) is extremely toxic; even very low concentrations can be lethal, depending upon the duration of exposure. Without any warning, H2S may render victims unconscious and death can follow shortly afterwards.

The Occupational Safety and Health Administration (OSHA) sets a 10 ppm ceiling for an eight hourly continuous exposure (TWA [Time-Weighed Average] limit), a 15 ppm concentration for Short Term Exposure Limit for 15minutes (STEL) and a Peak Exposure of 50 ppm for 10 minutes. The effect of H2S concentration on living being / human being & animal is given in **Table 1.1.**

Table 1.1: Symptoms of H_2S as per Concentrations

Concentrations	Symptoms/ Effects
100 ppm	Coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue). Altered breathing, drowsiness after 15-30 minutes. Throat irritation after 1 hour. Gradual increase in severity of symptoms over several hours. Death may occur after 48 hours.

Greater than 100 ppm	Loss of smell (olfactory fatigue or paralysis).
500-700 ppm	Staggering, collapse in 5 minutes. Serious damage to the eyes in 30 minutes. Death after 30-60 minutes.
700-1000 ppm	Rapid unconsciousness, "knockdown" or immediate collapse within 1 to 2 breaths, breathing stops death within minutes.
1000-2000 ppm	Nearly instant death

Proposed Development Drilling in Aliabet Field

The block is located in Gulf of Khambhat area and covers an area of 243 km^2. Land will be acquired on lease by State Government.

The fuel for the drilling rig, DG sets, other machinery and vehicles will be Diesel (HSD with low sulphur < 0.05%). Daily fuel requirement for diesel sets will be 3 KLD. HSD will be stored in closed tanks with storage limited to 18 KL.

QRA Approach

Identification of hazards and likely scenarios (based on Level-1 and Level-2 activities) call for detailed analysis of each scenario for assessment of Damage Potential, Impact Area (may vary with weather conditions / wind direction) and safety system in place. Subsequently each incident is classified according to Relative Risk Classification provided in **Table 1.2.**

Table 1.2: Risk Classification

Stage	Description
High (>1/100)	A failure which could reasonably be expected to occur within the expected life time of the well. Examples of high failure likelihood are process leaks or single instrument or valve failures or a human error which could result in releases of hazardous materials.
Moderate (1/100 to 1/1000)	A failure or sequence of failures which has a low probability of occurrence within the expected lifetime of the well. Examples of moderate likelihood are dual instrument or valve failures, combination of instrument failures and human errors, or single failures of small process lines or fittings.
Low (<1/1000)	A failure or series of failures which have a very low probability of occurrence within the expected lifetime of the well. Examples of 'low' likelihood are multiple instruments or valve failures or multiple human errors, or single spontaneous failure of tanks
Minor Incidents	Impact limited to the local area of the event with potent for 'knock – on- events'
Serious Incident	One that could cause: Any serious injury or fatality on/off site

	Property damage
Extensive Incident	One that is five or more times worse than a serious incident.

Damage Due to Explosion

The explosion of oil or gas (either as a deflagration or detonation) results in a reaction front moving outwards from the ignition source preceded by a shock wave or pressure front. After the combustible material is consumed the reaction front terminates but the pressure wave continues its outward movement. [In oil exploration the likely chances of explosion (due to blow out and consequential release of hydrocarbons) are low]. Blast Damage is based on the determination of the peak overpressure resulting from the pressure wave impacting on the object or structure. Damage estimates based on overpressure are given in **Table 1.3.**

Table 1.3: Damage due to Overpressure

S. No.	Overpressure (bar)	Damage
1.	0.04	Loud noise / sonic boom glass failure
2.	0.15	Typical pressure for glass failure
3.	0.5 - 1	Large and small windows usually shattered
4.	0.7	Minor damage to house structure
5.	1	Partial demolition of houses, made uninhabitable
6.	2.3	Lower limit of serious structure damage
7.	5 - 7	Nearly complete destruction of houses
8.	9	Loaded train box wagons completely demolished
9.	10	Probable total destruction of houses
10.	200	Limits of crater lip

Thermal Incidents/ Fire in Storage Area

The diesel storage on the drilling site is limited to 18 KL of storage tanks (2 Nos). Any fire in the tank area if not controlled in time (less chances/ unlikely) may soon spread in the drilling site. During blow out some natural gas coming out with some oil can also catch fire. However its thermal radiation impact (1st degree burn) will be limited (as the fuels are stored in remote place).

Minor spill can occur as various scenarios and may also catch fire. If fire is not controlled these can lead to domino effect as major scenarios. During the drilling for hydrocarbons some well water may come out which can be treated and disposed off or pushed back in the nonproducing well. The likely impact due to major scenario considered as given below in **Table 1.4.**

Table 1.4: Possible Major Scenarios

S. No.	Scenario	Impact Zone	Remarks

1.	HSD Tank failure, spillage & Fire (~ 5 m Pool fire)	~ 8.5 m	From edge of pool

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

H_2S and its Effects

Important characteristics of H_2S gas are given as below:

- H_2S is a toxic colorless gas heavier than air with an odour of rotten eggs.
- In concentrations greater than 100 ppm, it will cause loss of senses in 3 to 15 minutes and death within 48 hours.
- In concentrations greater than 600 ppm death occurs in less than 2 minutes.
- The safe concentration for a normal working period without protection is 10 ppm.
- In concentration greater than 10 ppm, the Olfactory Nerve sense to smell the gas is lost; the need for detectors is apparent.
- It attacks the body through the respiratory organs.
- It dissolves in the blood and attacks through the nervous system.
- It is very irritating for the eyes as it forms sulphurous acid together with water.
- The Occupational Safety and Health Act (OSHA) sets a 10 ppm ceiling for an 8 (eight) hour continuous exposure (TWA limit), a limit of 15 ppm for short term exposure limit for 15 minutes (STEL) and a peak exposure concentration of 50 ppm for 10 minutes.
- The best protection is breathing apparatus, with mask covering the whole face and a bottle containing breathing air.
- It burns with a blue flame to sulphur dioxide which is almost as dangerous as H_2S.
- It forms an explosive mixture with air at concentrations from 4% to 46%.
- Short exposure of high tensile steel to as little as 1 ppm in aqueous solution can cause failures.
- Concentrations greater than 15 ppm can cause failure to steel harder than Rockwell C-22. High stress levels and corrosive environments accelerate failures.
- When pH is above 9 and solubility is relatively high, it is readily soluble in mud and especially in oil Muds.
- The compressibility factor (Z) is higher than that for natural gas and H_2S will thus expand at rather lower pressures; or further up in the bore hole than natural gas.
- A 35% hydrogen peroxide solution will neutralize H_2S gas in the mud or 20 gallons of H_2O_2 per 100 barrels of mud.
- It occurs together with natural gas in all oil provinces of the world.
- In characteristic H_2S gas areas concentration above 42% in natural gas have been reported.
- Coughing, eye burning and pain, throat irritation, and sleepiness are observed from exposure to low concentrations of H_2S.

- Exposure to high concentrations of H_2S produces systems such as panting, pallor, cramps, paralysis of the pupil and loss of speech. This is generally followed by immediate loss of consciousness. Death may occur quickly from respiratory and cardiac paralysis.

The effect of H_2S concentration on Living Being/Human Being & Animal is given in **Table 1.5.**

Table 1.5: H2S Effect on Living Being/ Human Being

H2S Concentration	Effect on Living Being/ Human Being & Animal
<10 ppm	Safe for normal working period, without protection.
<10 ppm	Effect on Olfactory Nerves; results in loss of Sense to Smell.
>100 ppm	Loss of sense within 3 to 15 minutes Death within 48 hours
>600 ppm	Death within less than 2 minutes (Immediate)

Mitigation Measures

Control Measures for Major Hazards

Out of different hazards described in sections 6.2, occurrence of (a) Blowout and (b) Emission of Sour Gas (H_2S) are the two major hazards in drilling for oil & gas. Spillage HSD can be a hazard though of a lower magnitude considering the storage volume at the drill site. The first two possible incidents can have built in alarm and preventive measures (as more likely to occur if system fails). The third incident is more likely due to some domino effect caused by other incidents. Occurrence of H2S along with oil and gas, if detected in the well, is the major hazard during production testing of each well. Control measures for occurrence of blowout and Emission or Leakage of H2S gas are discussed in following subsections.

Blowout

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

A. Precaution against Blowout

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

- A Tank Level Indicator registering increase or reduction in the drilling mud volume and will include a visual and audio –warning device near the Driller Stand.
- A device to accurately measure the volume of mud required to keep the well filled at all times.
- A Gas Detector or Explosimeter at the Primary Shale Shaker and connected to audible or visual alarm near the Driller Stand.
- A device to ensure filling of well with mud when the string is being pulled out.
- A control device near Driller Stand to close the Mud Pump when well kicks.

(ii) BOP Drill will be carried out as per Oil Mines Regulations (OMR) & Oil Industry Safety Directorate (OISD).
(iii) BOP Control Unit will be available near the well which can be used in case of an emergency to control the Well.
(iv) When running in or pulling out tubing, Full Opening Safety Valve (FOSV) will be kept readily available at rig floor.

B. Precaution after Blowout

On appearance of any sign indicating the Blowout of well, all persons, other than those whose presence is deemed necessary for controlling blowout, will be withdrawn from the rig.
During the whole time while any work of controlling a blowout is in progress, the following precautions will be taken:
(i) A competent person will be present on the spot throughout.
(ii) An area within the 500 m of the well on the down wind direction will be demarcated as Danger Zone.

- All Electrical Installations will be de-energized.
- Approved safety lamps or torches will only be used within the Danger Zone.
- No naked light or vehicular traffic will be permitted within the Danger Zone.

(iii) A competent person will ascertain the condition of ventilation and presence of gases with an approved instrument as far as safety of persons is concerned.
(iv) Two approved type self containing Breathing Apparatus or any other Breathing Apparatus of approved type for use in emergency will be available at or near the drill site.
(v) Adequate Fire fighting Equipment will be kept readily available for immediate use.

Control Measures for H_2S Leakage /Emission during Drilling

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

A. H2S Detection System

A four channels H_2S gas detection system will be provided. Sensors will be positioned at optimum points for detection, actual locations being decided on site but likely to be:

- Just above Riser / Flow Nipple
- Shale Shaker

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

The Mud Logging will have a completely independent Detection System which is connected to an alarm in the cabin. This system will be adjusted to sound an Alarm at a concentration level

of 10 ppm H_2S as suggested in the Drilling and Production Safety Code for Onshore Operations issued by The Institute of Petroleum.

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

B. Small Levels of H_2S

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

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

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

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

C. High Levels of H2S

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

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

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

Natural Disaster and Hazards

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

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

Fire Fighting Facility

Fixed Fire Fighting System as per OISD Standard 189 will be in place.

Fire Water System

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

First Aid Fire Fighting Equipments at Drilling Rig

Portable Fire Extinguisher will be installed as per IS: 2190 on the drilling rig.

Occupational Health

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

Qualified doctor will be available 24 hr at the drill site for the immediate treatment and first aid. For serious injuries and diseases patient will be evacuated by the Emergency Vehicles exclusively meant for emergencies to the nearest medical centre.

Health Hazard Control will be done by adopting following measures:

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

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

During the proposed drilling operations, inspections of cleanliness will be carried out. First Aid Boxes will be provided at different strategic locations on the drilling rig. The Medical Officer on

board will regularly inspect the First Aid Boxes and ensures that their contents are in order. Majority of the employees on the drilling rig will be trained in First Aid. Regular Drills and Lectures on First Aid will be organized at the Rig. The Occupational Health Surveillance Program is summarized in **Table 1.6**.

Table 1.6: Occupational Health Hazards and Mitigating Measures

Cause of Health Hazard	Risk	Mitigation Measures
Noise (Generators, Cranes, Rig, Movement of Vehicles, etc)	Hearing loss	Use of PPEs in high noise area and written SOPs to be followed.
Handling of heavy equipment and material (Manual handling of material)	Back problem	Proper training to workers at the rig n handling heavy materials.
Handling of chemicals (Chemical stores, Chemical dosing areas, Chemical labs, etc)	Eye problems and chemical ingestion, dermal effect of chemicals	Procedures to be followed as per Material Safety Data Sheet (MSDS) of all hazardous chemicals for safe handling.

2.0 DISASTER MANAGEMENT PLAN (DMP)

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

Objective of Disaster Management Plan

The following are the main objective of Disaster Management Plan:

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

The following are the key elements of the Disaster Management Plan:

- Accident/ emergency response planning procedures
- Recovery procedure

Purpose of Disaster Management Plan

The purpose of the DMP is to effectively manage and control the emergencies occurring during project operations. This DMP ensures,

- Emergency response group is effective and adequate;
- Clear roles and responsibilities of key personnel and support groups;
- Availability and adequacy of emergency infrastructure and resources; and
- Efficient emergency communication

Emergency Classification

Not all emergency situations call for mobilization of same resources or emergency actions and therefore, the emergencies are classified into three levels depending on their severity and potential impact, so that appropriate emergency response procedures can be effectively implemented by the Emergency / Crisis Management Team. The emergency levels / tiers defined with respect to this project based on their severity have been discussed in the subsequent sections with 'decision tree' for emergency classification being depicted in **Figure 2.1.**

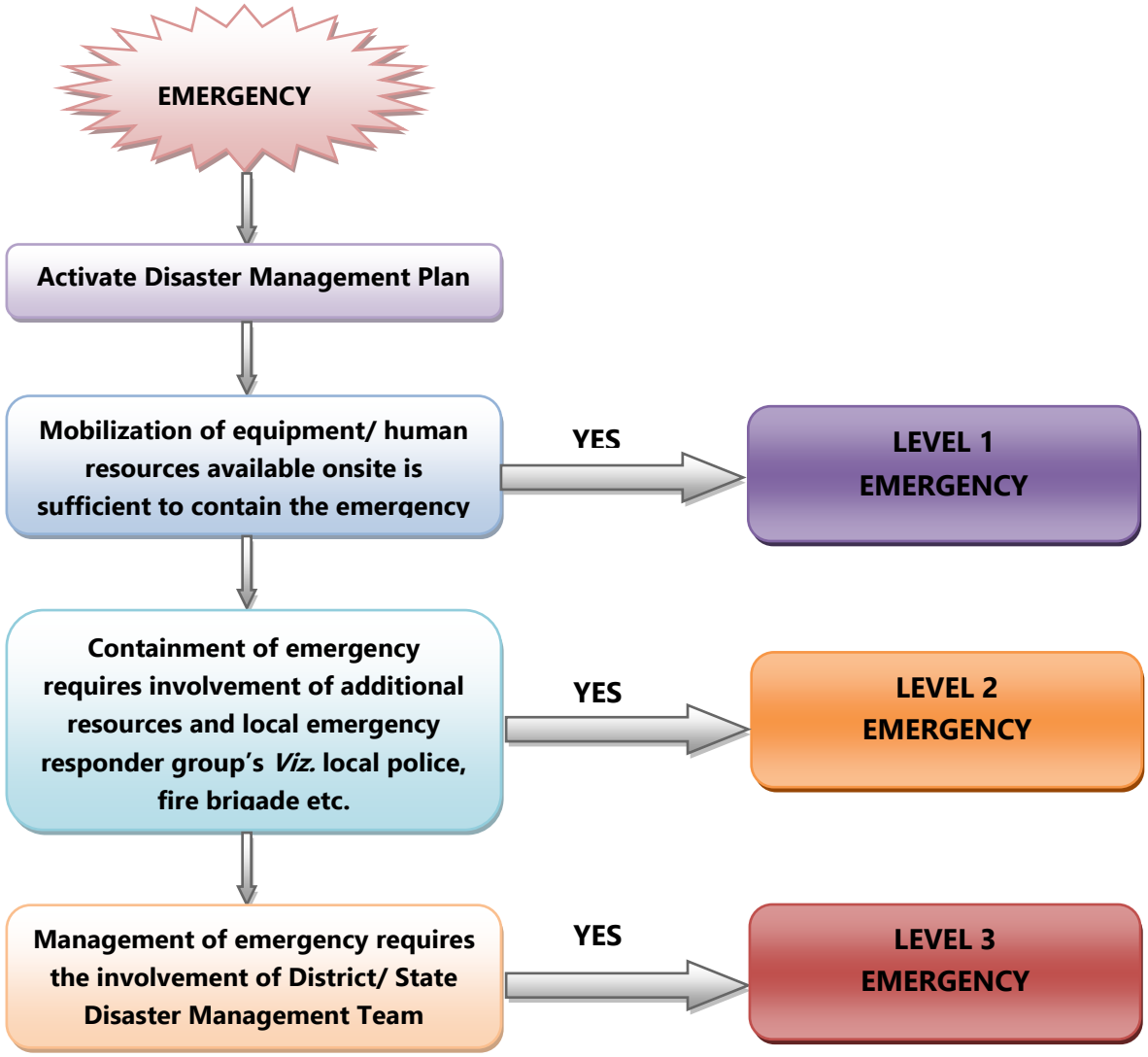


Figure 2.1: Emergency Classification" Decision Tree"

Level 1- Emergency

A local accident with a likely impact only to immediate surroundings of accident site, such as, local fires and limited release of inflammable material is considered as Level 1 Emergency. The impact distance may not be more than 15 m from the site of primary accident and may require evacuation of the site area where accident occurred and utmost the adjacent areas. The DMP and relevant procedures are activated; the Site Head is notified.

Level 2- Emergency

Level 2 Emergency is a major accident with potential threats to life and property up to 500 m distance requiring the evacuation of all personnel from the threatened area except the emergency response personnel. Larger fires, release of large quantities of inflammable materials may belong to Emergency Level 2. The DMP and relevant procedures are activated; local administrative bodies and Emergency Response Groups including ONGC India Corporate are notified.

Level 3- Emergency

An accident involving a very serious hazard and with likely impact area extending beyond the operational area of drilling, such as, major fire, very large release of inflammable material and big explosion are considered as Level 3 Emergency. Major fires will usually have the triggering effect resulting in the propagation of explosion. In a Level 3 Emergency, evacuation populations near the site area. Under such circumstances, the DMP is activated; ONGC India Corporate, District/State Administrative Authorities and other Emergency Response Groups are notified.

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

The criterion for classification of various levels of emergencies and associated response is presented in **Table 2.1.**

Table 2.1: Emergency Response Levels

Level	Type	Criteria for Classification
Level - 1	Small	• Minor medical or injury case requiring no external support. • Equipment damage without any significant impact on operation. • Minor fire without any personnel injury or plant damage. • Net negative financial impact of Rs <1 crore. • Small operational spills. • No potential impact on flora and fauna of identified eco-sensitive areas (if any). • Local stakeholder concern and public attention
Level - 2	Medium	• Fire and explosion which requires external assistance. • Requires evacuation of injured personnel and locals through assistance from local emergency groups. • Loss of corporate image and reputation. • Adverse impact on environmental sensitivities (if any) within a radius of 1km. • Medium sized spills. • Net negative financial impact of Rs 1 - 5crore.
Level - 3	Large	• Incident leading to multiples injuries or fatalities. • Requires assistance from District/State emergency responding groups. • Adverse impact on environmental sensitivities (if any) within a radius of>1km. • Major oil spill. • State/Nationwide media coverage. • Net negative financial loss of Rs >5crore.

ONGC Emergency Response/ Crisis Management Team

ONGC has in place an Emergency Response / Crisis Management Team to respond to fire, blow-out, spills, accidents and technical emergencies at their sites. These teams will be made up from operations personnel, who can be called upon 24 hours a day, supported by senior management field personnel as and when required. The emergency response teams will receive specific training for their roles and exercise on a regular basis. Specific roles and responsibilities of the officials are outlined below with the organizational structure being presented in **Annexure - XI.**

Action Plan for Fire Fighting

General

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

Installation Manager

Ensures regularly the working status of fire equipment / its maintenance through Fire Section and sees that they are kept in their respective places as per the need. As soon as, the fire accident is reported, rushes to site and take charge of the situation. Informs Mines Manger besides Area Manager as well Fire Manager.

Shift In-charge

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

Drilling Officials

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

Electrical Officials

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

Mechanical Officials

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

Transport Officials

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

Security at Gate

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

Fire Officials

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

Fire Control Room

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

Area Manager: (In Case of Major Fire)

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

EMERGENCY RESPONSE PLAN (ERP)

In case of emergencies (fire/leakage/failure), the Shift Field / Plant Operator shall immediately inform Shift Console Operator and the Control Room. The shift Console Operator shall inform Well Head Team Leader / Shift-in- Charge, Shift Maintenance Engineer and Fire Station and act on the basis information received from Shift Operator. The Well Head Team Leader/Resident Engineer acts as On- Scene Coordinator till the Head Operation reach the site.

If an emergency requires shut down the rig / plant and activate Disaster Management Plan (DMP) / Oil Spill Contingency Plan (OSCP). The Shift-in-Charge provides all necessary information regarding safe shutdown of the rig and ensure the availability of fire tender / ambulance depending on the situation. The shift in charge follows duties as per Fire Order and other requirements under the direction of the On Scene Coordinator (OSC). The Shift Security Officer informs the Central First Aid Facility and Traffic Control. The OSC coordinates with the

Shift Security Supervisor and the Resident Medical Officer and arranges the aid within ONGC and from outside agencies as per requirements. The Resident Medical officer ensures first aid facility and informs local doctors/hospitals to remain in readiness for attending to serious burns and gas poisoning cases.

The OSC maintains communication with the Asset Manager, which shall be the Chief Emergency Officer (CEC) and coordinates with I/C of Safety, Fire and Security. The CEC coordinate with OSC and other ECR (Emergency Control Room) members and informs the CMD, Director (HR)-CCEC, Director-Concerned and Director-I/C HSE on the situation. If required, the CEC activates off-site DMP and requests the intervention of Corporate Crisis Management Group for activation of corporate level DMP. The CEC gives technical and management advice to other coordinators and takes decision on partial or total evacuation of the site. The actions to be taken during emergency are given in **Figure 2.2**

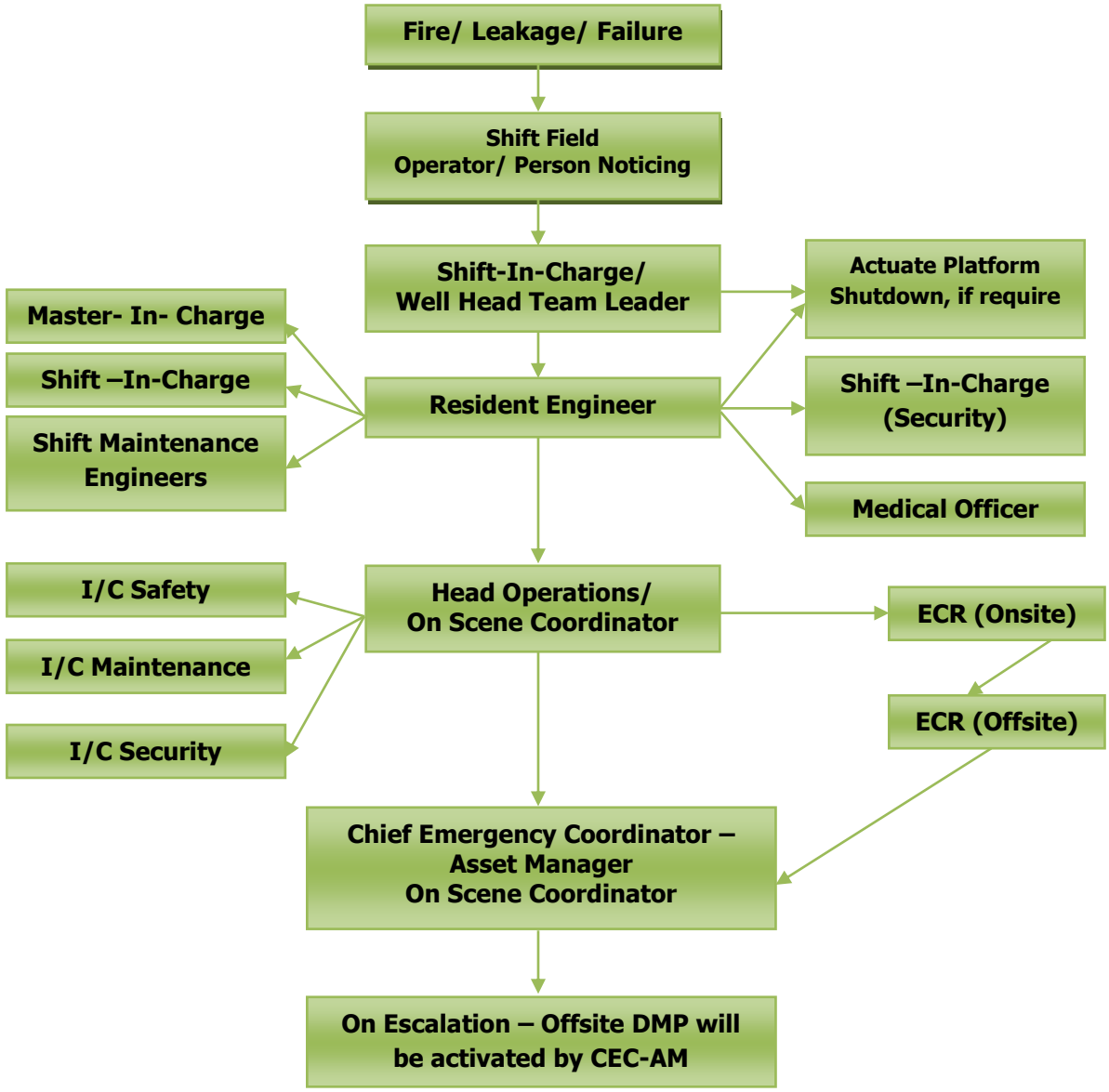


Figure 2.2: Action taken during Emergencies

On Scene Coordinator

Initial Phase:

In the initial phase someone close to the scene of emergency can exercise emergency coordination. Accordingly Well Head Team Leader or Resident Engineer will assume the role of OSC till On Scene Commander takes over.

Intermediate Phase:

The Chief Emergency Co-ordinator (CEC) at asset level may appoint a person, normally stationed at base to take over the task of OSC at the Site Control Room (SCR).

Function:

The OSC will make an assessment of the situation; the type and quantity of assistance required and communicate the same to the Asset ECR. The OSC will mobilize the resources available at scene, deal with the situation and take such actions as directed by the Chief Emergency Coordinator at the Asset/ Basin/ Plant. He will transmit situation reports (SITREPS) at regular interval prefixing a numerical sequence to each message.

Site Control Room

This temporary centre will be established at a suitable location nearby the rig or in any building at the base by the Head Operations, with the assistance and advice from the Emergency Control Room. Head operations will be the on Scene Coordinator. Other Coordinators at the location will be the Fire Fighting, Safety, Security and Maintenance Coordinators who will assist the On Scene Co Coordinator in discharging his duties at the site of emergency.

Communication

An effective communication is crucial for overall success of the operation. A communication flow-chart for such scenario is outlined in **Figure 2.3**. In the event of a terrorist act, timely, accurate communications will be critical for the success and survival. Timely response during emergency is extremely important.

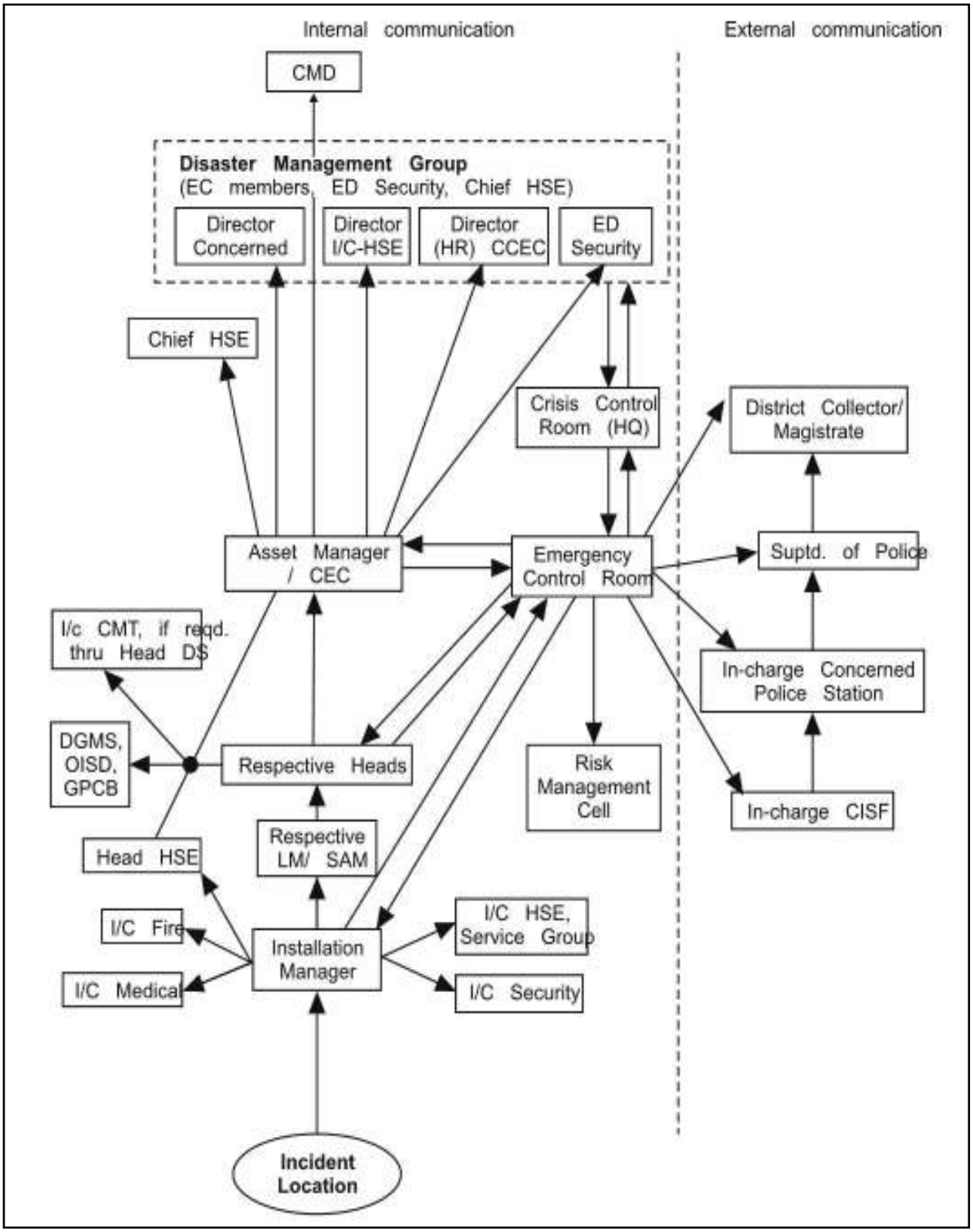


Figure 2.3: Communication Flow Chart

Communication with Employees

The Head Corporate Communication shall on behalf of the CCEC communicate with the ONGC employees through intranet or any other communication channel to apprise all them on the status of the incident. Chief ER on behalf of CCEC shall establish communication with the family members of the affected employees and contractors.

Communication with Media

The following shall be followed while communicating with the media

- CMD, CCEC or Head CC on their behalf shall interact with print/ electronic media. Head CC with the approval of the CCEC shall brief the press/ give press release.

- No other official at Corporate Office will interact with Media/ Press unless approved by CMD/ CCEC.

- The main purpose of Crisis communication with the media will be
- ✓ To give positive but factual messages with focus on action taking place
- ✓ To clarity further all messages delivered, if necessary
- ✓ To maintain consistency in all messages repeated
- ✓ To convey bias-free messages
- ✓ To correct any misinformation

Warning System

A high pitch warning system is available at site for announcing the emergency and giving the all clear signals. SMC will declare the emergency level and operational personnel and, if necessary, public in surrounding villages will be notified about the nature of the emergency by using alarm system in the following manner:

Level 1 Emergency – Single beep every five seconds
Level 2 Emergency – Double beep every five seconds
Level 3 Emergency – Continuous wailing of alarm

Emergency Procedures

Level 1 Emergencies

Accident is small and isolated and does not require the shutdown of evacuation of production fluids. Effort shall be made to arrest its propagation. Level 1 fire may be extinguished with water, sand or fire extinguishers. Level 1 hazardous chemical release, if any, can be contained and controlled quickly without requiring shut down the operation or the evacuation of persons working in the affected area.

Level 2 Emergencies

The affected unit will be brought to a safe shut down while continuing emergency supplies of water and power. Level 2 fires will be extinguished by mobilizing water and foam extinguishers. Level 2 hazardous chemical release, if any, will require evacuation of personnel including those working in downwind direction towards upwind or cross wind direction to minimize the injurious effect of hazardous gas release.

Level 3 Emergencies

It is a very serious hazard and with likely impact area extending beyond the operational area of drilling, such as, major fire, very large release of inflammable material and big explosion. In a Level 3 Emergency, evacuation of populations near the site area is warranted. ONGC India Corporate, District/ State Administrative Authorities and other Emergency Response Groups are notified.

Accident Site Clean Up

While cleaning the site after explosion and fire accidents, care shall be taken against the probability of leaving any hazardous / or any other materials (which may be dangerous to terrestrial and marine life or obstacle to terrestrial and marine operation) lying buried in the land. Information regarding the cleaning up of spills of hazardous materials, if used, is available in material safety data sheets.

Emergency Response Personnel Safety

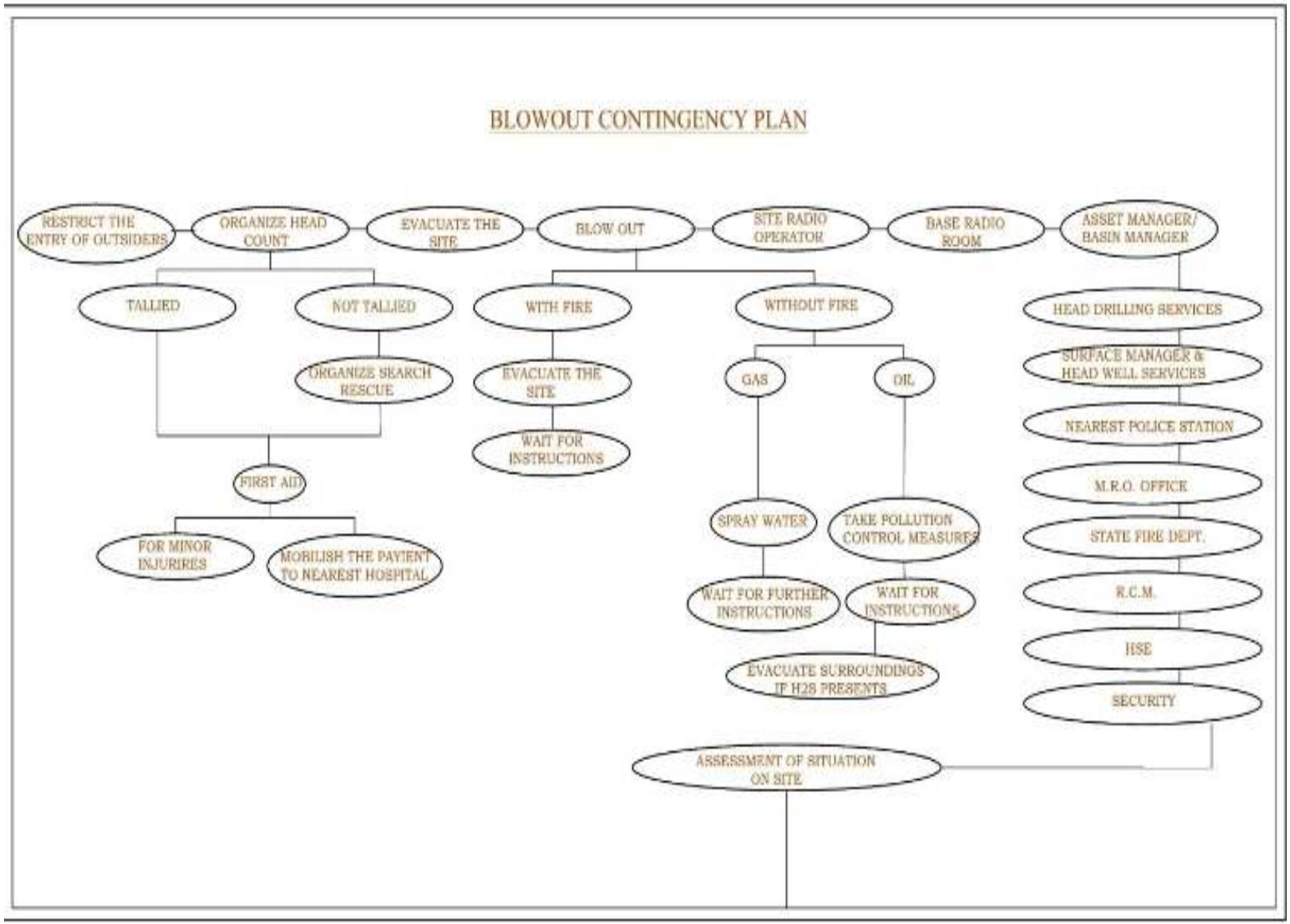
All emergency response personnel from the ONGC and outside agencies shall enter the accident site under instruction of SIC. These persons shall invariably wear appropriate protective gear, such as, fire suits, helmets, boots, respirators and gas masks, before entering the accident site.

All Clear Signal and Public Statement

For Level 1 and 2 emergencies Site Main Controller will authorize an all clear signal in the form of long high pitched alarm with intermittent pauses, say, two minutes alarm followed by one minute pause repeatedly. Public statements regarding the emergency will be issued only by the SMC.

REVIEW OF PLAN

The off-site emergency plan will be reviewed by ONGC and District Emergency Committee as per requirement and updated accordingly.
The Contingency Plan for Earthquake, Tsunami, Flood, Fire, Bomb Threat, Pipe Line/ Flow Line Leakage (Oil Spill) and Blowout is shown in **Figure 2.4 to 2.9**


BLOWOUT CONTINGENCY PLAN
RESTRICT THE ENTRY OF OUTSIDERS
ORGANIZE HEAD COUNT
EVACUATE THE SITE
BLOW OUT
SITE RADIO OPERATOR
BASE RADIO ROOM
ASSET MANAGER/ BASIN MANAGER
TALLIED
NOT TALLIED
ORGANIZE SEARCH RESCUE
FIRST AID
FOR MINOR INJURIES
MOBILISH THE PAYIENT TO NEAREST HOSPITAL
WITH FIRE
EVACUATE THE SITE
WAIT FOR INSTRUCTIONS
WITHOUT FIRE
GAS
OIL
SPRAY WATER
WAIT FOR FURTHER INSTRUCTIONS
TAKE POLLUTION CONTROL MEASURES
WAIT FOR INSTRUCTIONS
EVACUATE SURROUNDINGS IF H2S PRESENTS
HEAD DRILLING SERVICES
SURFACE MANAGER & HEAD WELL SERVICES
NEAREST POLICE STATION
M.R.O. OFFICE
STATE FIRE DEPT.
R.C.M.
HSE
SECURITY
ASSESSMENT OF SITUATION ON SITE

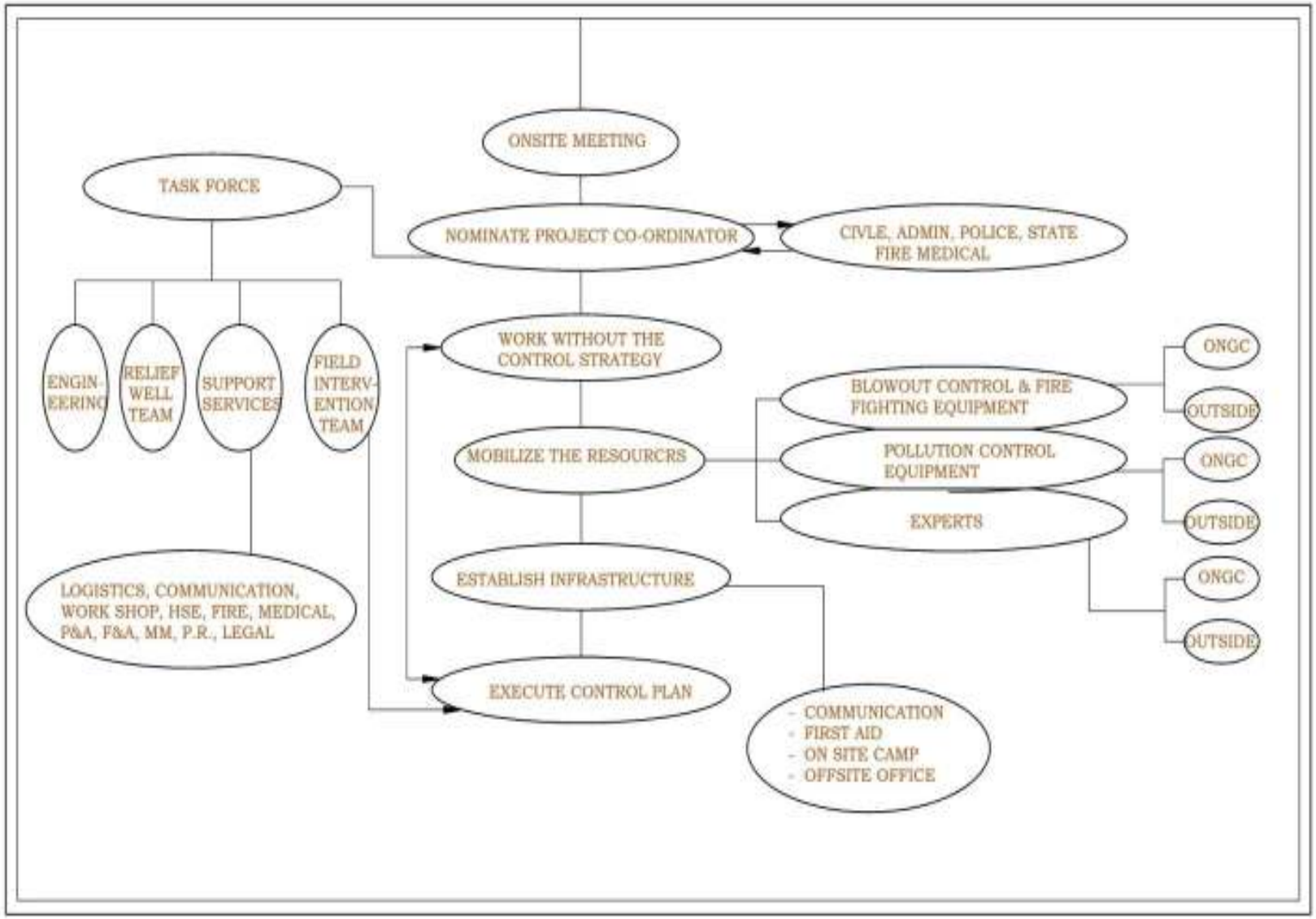


Figure 2.4: Blowout Contingency Plan

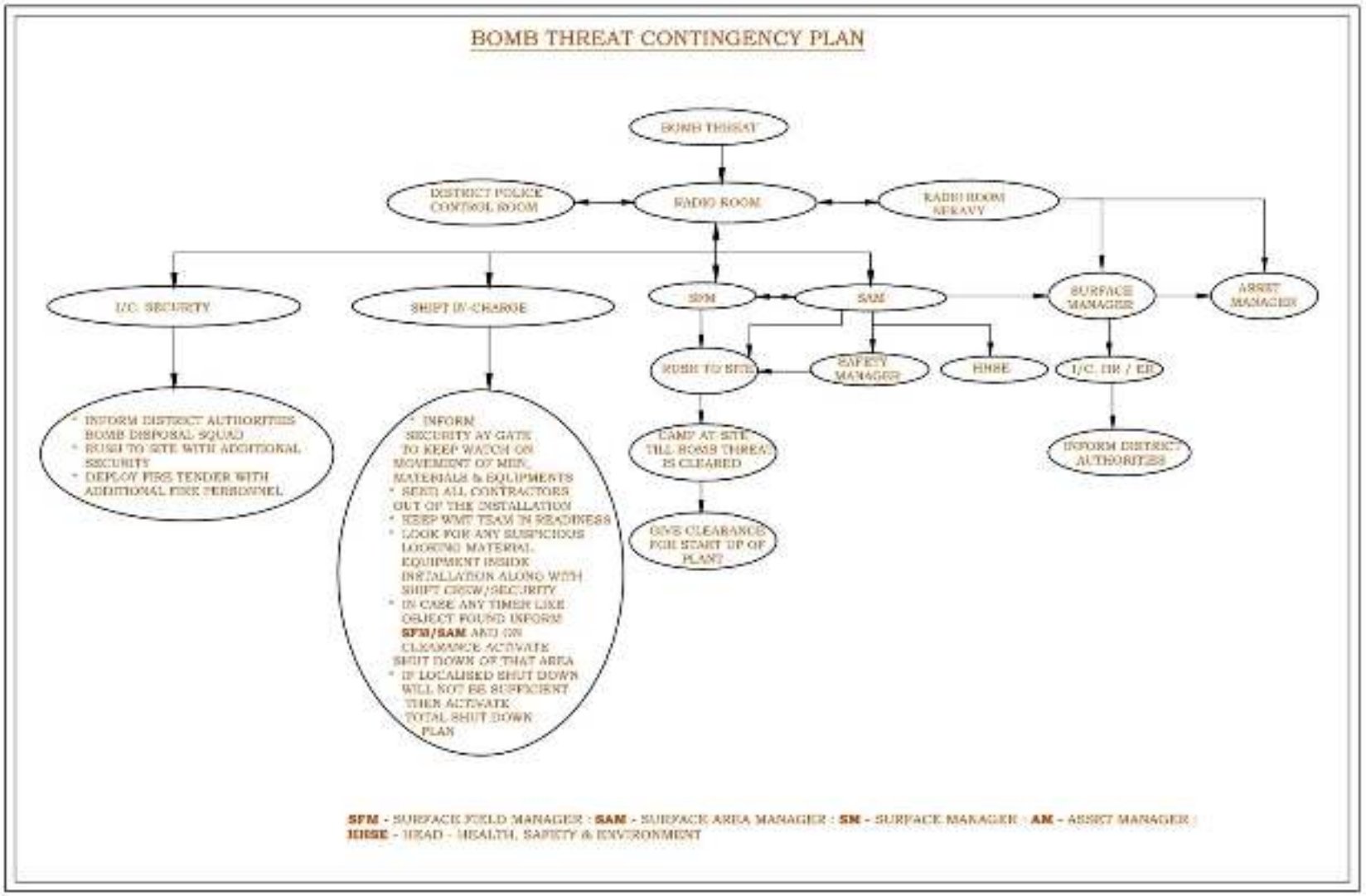


Figure 2.5: Bomb Threat Contingency Plan

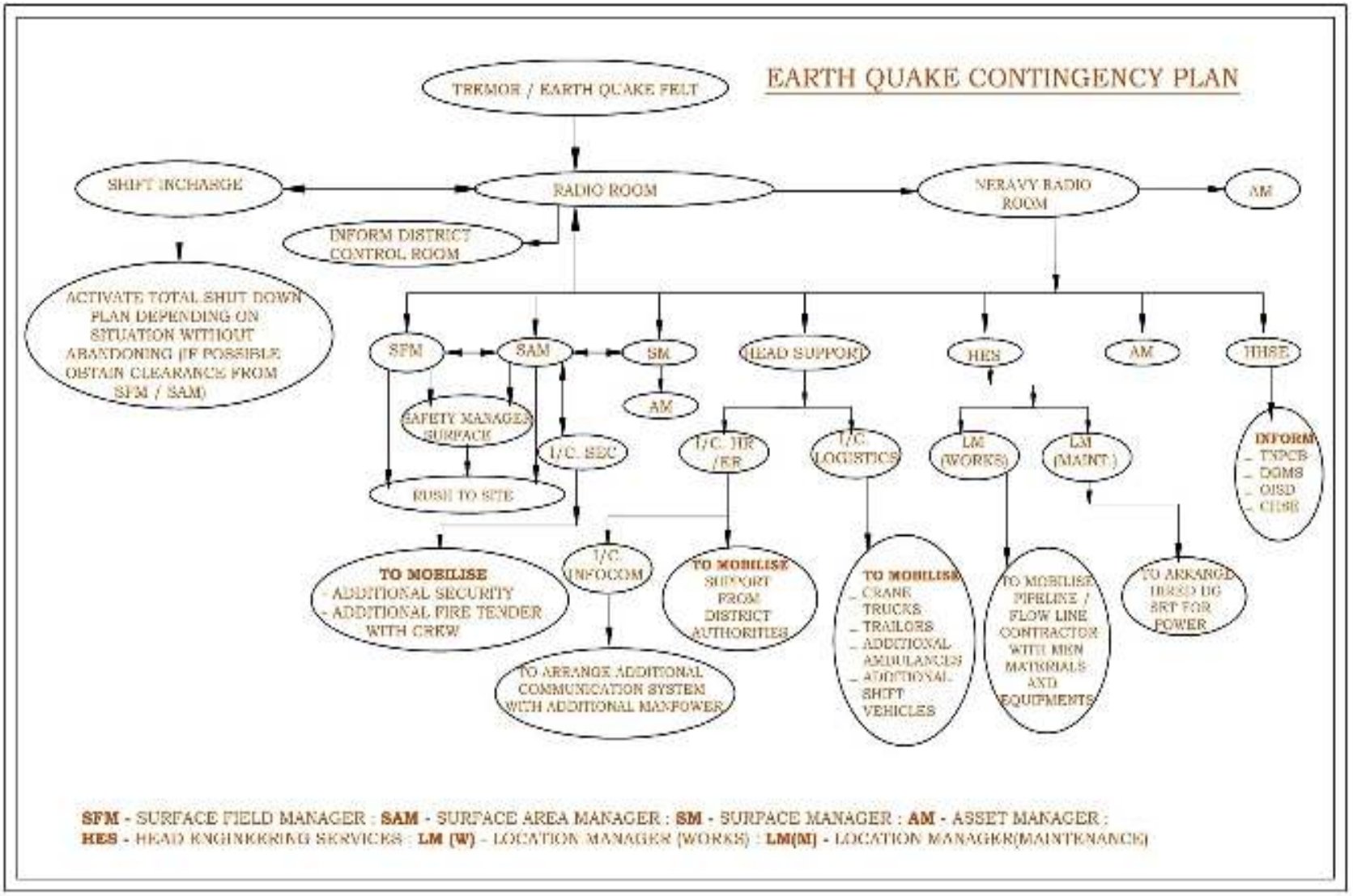


Figure 2.6: Earthquake Contingency Plan

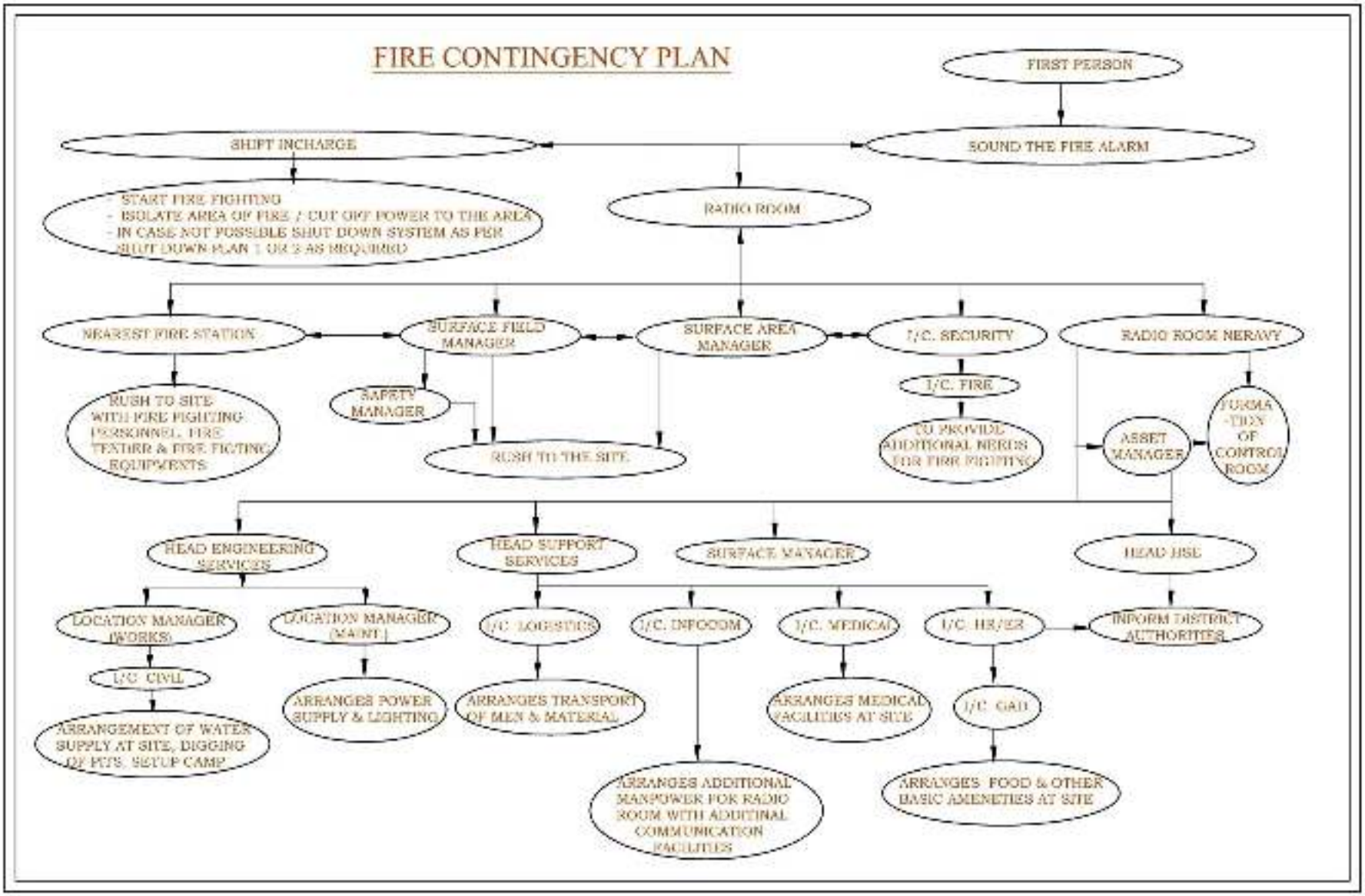


Figure 2.7: Fire Contingency Plan

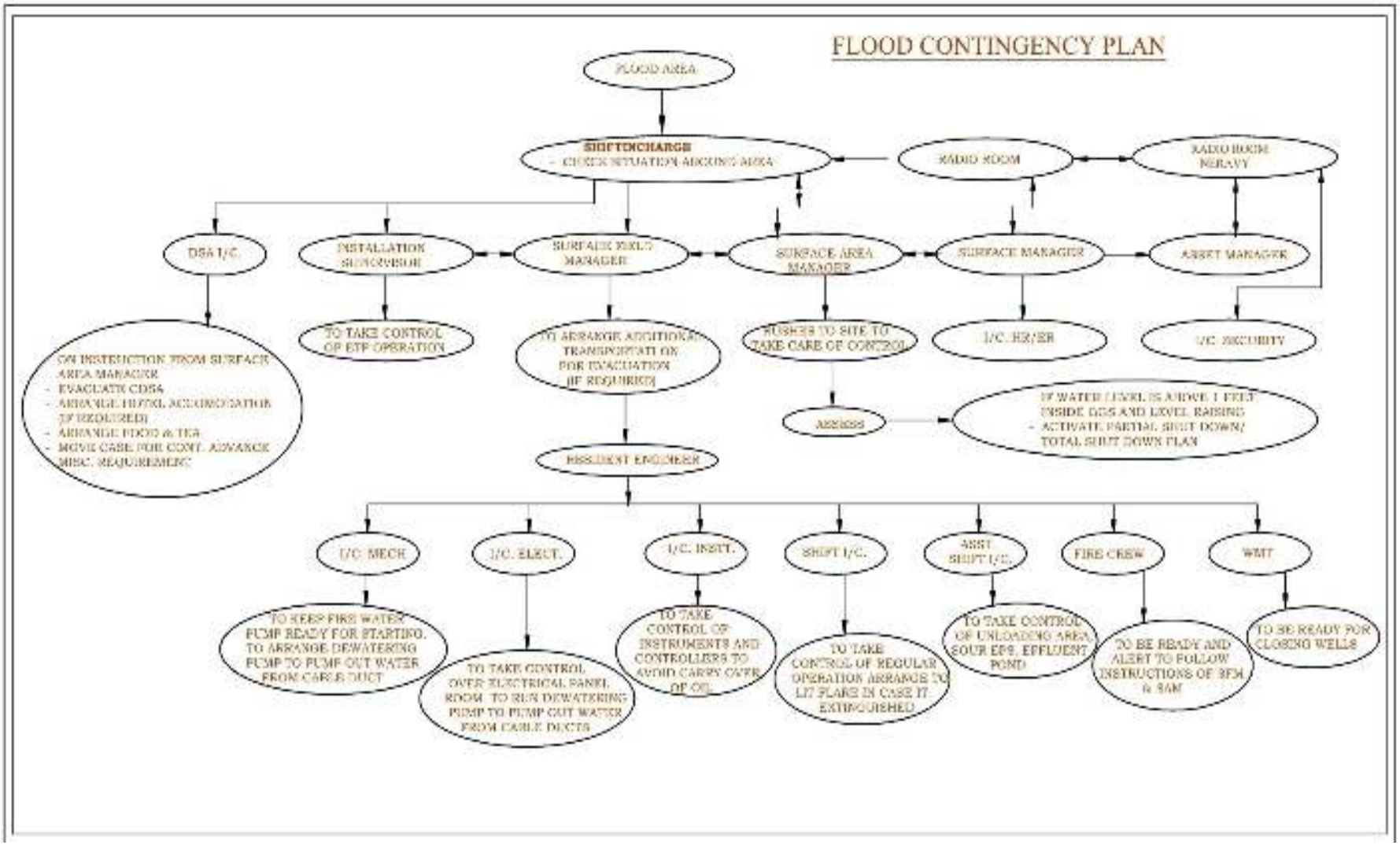


Figure 2.8: Flood Contingency Plan

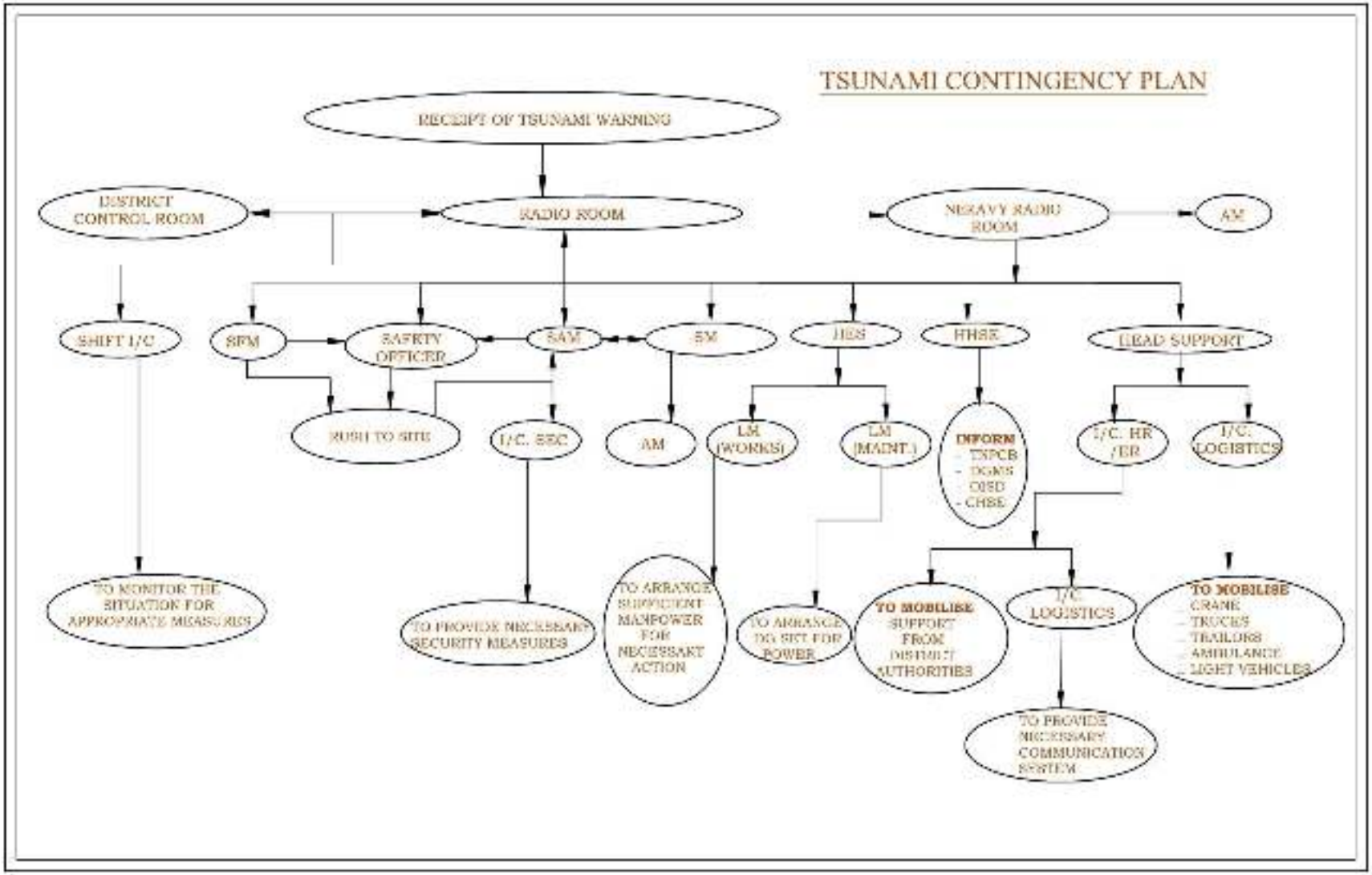


Figure 2.9: Tsunami Contingency Plan