

CHAPTER – 7

ADDITIONAL STUDIES

7.1 RISK ASSESSMENT

7.1.1 Introduction

Risk is the probability that a substance or situation will produce harm under specific conditions. Risk is a combination of two factors: the probability that an adverse event will occur and the consequences of the adverse event.

Risk assessment is a systematic, analytical method used to determine the probability of adverse effects. A common application of risk assessment methods is to evaluate human health and ecological impacts of chemical releases to the environment.

The risk assessment studies have been conducted for identification of hazards, to calculate damage distances and to spell out risk mitigation measures.

7.1.2 Scope of Study

The scope of study is to carry out risk assessment for the proposed project covering all the hazardous chemicals to be handled and stored at the site.

7.1.3 Objectives of Risk Assessment

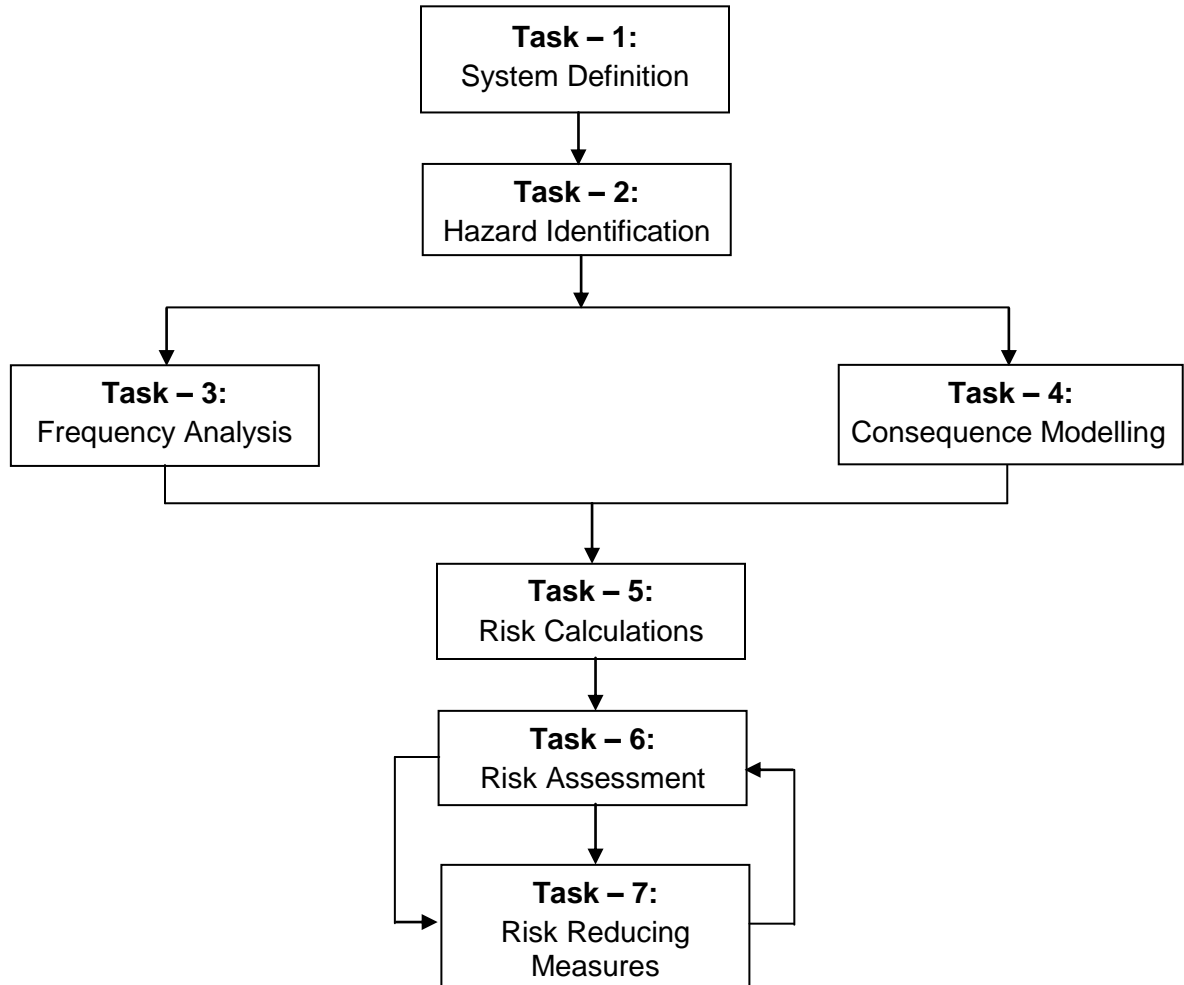
Risk assessment is carried out for the following objectives:

- To identify various hazards in the processes, and storages area of the unit.
- Assessing the various risks involved.
- To consider the consequential impact on nearby areas, population, etc. in case of any accidental emergency situation arising from the premises.
- To evaluate and quantify the available measures and resources for containing any eventuality.
- To study and suggest safety and control measure.

7.1.4 Methodology to Conduct Risk Assessment

Quantitative risk assessment (QRA) is a means of making a systematic analysis of the risks from hazardous activities, and forming a rational evaluation of their significance, in order to provide input to a decision-making process.

The term 'Quantitative Risk Analysis' is widely used, but strictly this refers to the purely numerical analysis of risks without any evaluation of their significance. The study has been conducted based on the premises of a traditional Quantitative Risk Assessment.



7.2 HAZARDOUS SUBSTANCES TO BE HANDLED AT PROJECT SITE

M/s. GSPC Limited is engaged in Exploration and Production of hydrocarbons (Oil & Gas). Crude oil is flammable liquid. Natural gas (Methane) is flammable gas which may come along with crude oil from the well.

HSD will be also stored at site which will be used as fuel in D. G set during drilling phase and EPS operation.

7.3 HAZARD IDENTIFICATION

Hazard identification is the process used to identify all the possible situations in the workplace where people may be exposed to injury, illness or disease. Identification of causes and type of hazards is the primary task for planning for risk assessment. Hazard can happen because of the nature of chemicals handled and also the nature of process involved.

A preliminary hazard analysis is carried out initially to identify the major hazards associated with storage and the process. This is followed by consequence analysis to quantify these hazards.

7.3.1 Identification of Hazardous Areas:

The procedure for QRA starts with identification of major risk area at site. At GSPC, major risk areas are as follows:

- ✓ Crude oil / HSD storage area

Storage and handling of flammable chemical will not pose any hazardous situation if these will be handled or stored correctly with adequate safety provisions and fire fighting facilities. Therefore, suitable safety measures will be provided at the site to attend any emergency due to accidental release of these chemicals.

7.3.2 Identification of Failure Cases for Hazardous Area:

The failure cases which may lead to release of hazardous substance will be as under:

- ✓ Leakage/Spill from Crude oil / HSD storage tank
- ✓ Leakage from pipeline

Various hazards associated with production of oil and gas is briefly described as below;

A. Minor Crude Oil Spill:

A minor oil spill is confined within the well site area. The conditions which can result in minor oil spill are as follows:

➤ Spillage in Crude Oil Storage System

Crude Oil valves, spillage from leaking lines and storage tank.

➤ **Spillage while Crude Oil production**

During the well production operation, there exists a possibility of hydrocarbon gases being released and spillage of crude oil may result from a failure of pipe, lines valves, separator at production facility. Spilled oil should be immediately cleaned once the leakage is controlled.

B. Major Crude Oil Spill:

- ✓ Spillage can only happen in case of major leaks from storage tanks, separators or uncontrolled flow from wells (possibilities are rare as these wells are low pressure wells).
- ✓ Since the reservoir does not have the pressure which will allow the wells to self flow, an artificial lift method (sucker rod pump) is proposed to bring the oil to the surface for commercial production. Therefore possibility of uncontrolled flow from well during production is remote. Such situation may occur only if, there is a mechanical damage or failure of Emergency Shutdown system or combination of both. Oil is produced with associated gas, therefore, an oil spill arising from a failure system will result in the release of hydrocarbon vapors together Oil. Since, the produced crude oil is proposed to be transported by Road Tankers to ONGC-CTF, the possibilities of major oil spills due failure / overturning / accident of road tanker cannot be ruled out.

C. Blowout:

As the formation pressure is very low and with installed Christmas tree, possibilities of well blow out is negligible.

D. Hydrogen Sulphide (H₂S):

Since the available data does not show any content of the H₂S, hence the release of H₂S during production is not envisaged.

7.4 ACCIDENT OR CAUSE CONSEQUENCE ANALYSIS

Oil and gas may be released as a result of jet fire, pool fire & less likely unconfined vapor cloud explosion causing possible damage to the surrounding areas. The extent of the damage depends upon the nature of the release. The release of flammable material and subsequent ignition results in heat radiation, pressure wave or vapor cloud depending upon the flammability and its physical state.

It is important to visualize the consequence of the release of such substances and the damage caused to the surrounding areas. Consequence analysis quantifies vulnerable zone for a conceived incident and once the vulnerable zone is identified for an incident, measures can be proposed to eliminate damage to plant and potential injury to personnel. The following likely maximum credible scenarios (Primary) considered for hazard analysis.

- ✓ Catastrophic failure of crude oil storage tank
- ✓ Catastrophic failure / leakage of separator lead to free spread pool fire.
- ✓ Full bore failure of pipe from well to separator lead to pool / jet fire.
- ✓ Entire inventory leaked out from road tanker / leakage in road tanker lead to free spread pool fire.

Table No. 7.1: Damage Caused Due to Various Heat Load

Heat Load, Kw/m ²	Type of Damage
37.5	Sufficient to cause damage to process equipment. 100% fatal in 1 min. 1% fatal in 10 sec.
12.5	Minimum energy required for piloted ignition of wood, melting plastic tubing. 1% fatal in 1 minute. First degree burn in 10 seconds.
4.0	Pain after 20 seconds. Blistering unlikely

Data considered for Release

Crude oil Storage Tank is of capacity 45 KL and at time of release 80% full inventory was released from the tank and Tanker is considered of 20 KL and scenario near crude oil storage tank.

Table No. 7.2: Damage Distance with Heat Loss

Scenario	Distance in m from source		
	4 Kw/m ²	12.5 Kw/m ²	37.5 Kw/m ²
Crude oil storage tank pool dyke fire	20.70	13.90	9.68
Full bore failure of pipe from well to separator lead to pool fire	17.8	11.7	9.30
Full bore failure of pipe from well to separator lead to jet fire	25.8	20.7	18.40
Road tanker all inventory leakage free spread pool fire	125.0	75.30	50.81

7.5 DETAILS OF SAFETY MEASURES

- ✓ Adequate Personal Protective Equipment shall be provided to all the employees.
- ✓ Proper and sufficient fire fighting arrangement shall be provided in and around the storage as per OISD.
- ✓ Training for use and maintenance of fire fighting equipments are most essential.
- ✓ First aid box shall be kept at site and training shall be given to employees for First Aid.

Control measures for major spills of crude oil from storage tanks, separators and pipe lines:

- ✓ Inspection of tanks / separator during fabrication shall be carried out as per the requirements of the applicable codes, specifications, drawings etc. This inspection requires regular checks on the work at various stages as it progresses. During fabrication, a thorough visual check should be undertaken and the tank should be checked for foundation pad and slope, slope of the bottom plates, proper welding sequence and external & internal surfaces etc.
- ✓ Roof plates shall be inspected for defects like pin holes, weld cracks, pitting etc., at water accumulation locations.
- ✓ Tanks pad shall be visually checked for settlement, sinking, tilting, cracking and general deterioration.
- ✓ Anchor bolts wherever provided shall be checked for tightness, and integrity by hammer testing.
- ✓ All open vents, flame arrestors and breather valves shall be examined to ensure that the wire mesh and screens are neither torn nor clogged by foreign matter or insects.
- ✓ If a tank is insulated, the insulation and weather proof sealing shall be visually inspected for damages.
- ✓ Grounding connections shall be visually checked for corrosion at the points where they enter earth and at the connection to the tank.
- ✓ The tanks shall be inspected for any obvious leakage of the product. Valves and fittings shall be checked for tightness and free operations.
- ✓ The tanks shell shall be visually examined for external corrosion, seepage, cracks, bulging and deviation from the vertical.
- ✓ NDT test for pipeline.
- ✓ Hydrostatic testing of tanks shall be carried out.

- ✓ Facility certification from relevant competent authority under petroleum rules to be obtained before starting the operation.
- ✓ OISD standard 244 once implemented should be followed.

Control Measure for Crude Oil Spill from Road Tanker:

- ✓ Proper route of road tankers should be decided in the premises for entry and exit of road tankers. Security persons should guide the tanker drivers to follow the route accordingly.
- ✓ Speed of road tankers in the premises should be strictly restricted.
- ✓ All road tankers / vehicle entering in the production / storage area should be provided with spark arrester at their silencers to avoid spark into open atmosphere in case of leakage / spillage of oil.
- ✓ During loading / unloading – double earthing should be practiced.
- ✓ Proper SOP should be prepared and implemented for connection of road tanker, filling and disconnection.
- ✓ All road tankers utilized should be tested and certified by competent person under petroleum rules.
- ✓ Drivers should be well trained and experience in driving of vehicles carrying Hazardous substances.

7.6 DETAILS OF FIRE FIGHTING SYSTEM

The fire fighting facilities will be installed as per OISD – STD-189 for hydrocarbon production facilities and drill site.

- ✓ Fire water pit of 200 KL capacity
- ✓ Fire water pump
- ✓ Fire water Distribution system
- ✓ Hydrant
- ✓ Monitor
- ✓ Above ground piping
- ✓ Appropriate fire extinguisher shall be located as per OISD 189

7.7 OCCUPATIONAL HEALTH SURVEILLANCE PLAN

Occupational health and safety is about preventing people from being harmed by work or becoming ill from work by taking adequate precautions and providing a safe and healthy work environment. Working with chemicals and/or in a chemical industry poses many risks, including causing diseases/injuries like chemical burn, Asthma, Allergies, Cancer, Asphyxiation etc. The necessary personal protective equipments should be given to all the workers.

All employees/ contractors should go through the medical examination once in two years to ascertain the health status of all workers in respect of Occupational Health hazard to which they are exposed.

The industry will provide training program for the employees to inform them of the following aspects; hazards of operations, proper usage of nose mask and earplugs, the importance of engineering controls and work practices associated with job assignment(s).

7.7.1 Periodic Medical Examination

Periodic Medical examination is being conducted as per the following schedule. Workers employed are examined by a qualified medical practitioner, in the following manner:

- ✓ Before employment, to ascertain physical fitness of the person.
- ✓ During employment, every year to ascertain physical fitness of the person to do the particular job. Medical records will be maintained by unit.
- ✓ Once in a year, to ascertain the health status of all the workers in respect of occupational health hazards to which they are exposed and in cases where in the opinion of the Medical Officer it is necessary to do so at a shorter interval in respect of any workers;
- ✓ In periodic and pre-medical examinations, various parameters will be checked. Viz., LFT, Chest X-rays, Audiometry, Spirometry, Vision testing, ECG and other parameters will be found necessary.

7.8 DISASTER MANAGEMENT PLAN

A disaster is a natural or manmade event which results in widespread human loss, loss of livelihood, property and life.

Disaster management plan is an important to overcome or minimize the risk when the accidents take place. The objective of plan is to aware and train people to be safe prior to accidents happened.

7.8.1 Objectives of the Plan

Following are the objectives of the disaster management plan:

- To define and assess emergencies, including risk and environment impact assessment.
- To reduce possibilities of an accident
- To safeguard employees, visitors and other people in the vicinity.
- To minimize damage to property and/or the environment.
- To inform employees, general public and the authorities on the hazards/risk assessed, safeguards provided, residual risks, if any, and the role to be played by them in the event of an emergency.
- To inform authorities and mutual aid centres to come for help.
- To identify and list any dead.
- To inform and help relatives.
- To secure the safe rehabilitation of affected area and to restore normality.
- To provide authoritative information to the news media.
- To preserve records, equipment, etc., and to organize investigation into the cause of the emergency and preventive measures to stop its reoccurrence.
- To ensure safety of the work force before they re-enter and resume work.
- To work out a plan with all provisions to handle emergencies and to provide for emergency preparedness and the periodical rehearsal of the plan.

7.8.2 Emergency

A major emergency can be defined as an accident/incident that has potential to cause serious injuries or loss of life. It may cause extensive damage to property, serious disruption both in production and working of unit and may adversely affect the environment. The following factors may cause major emergency:-

- Fire
- Human error
- Natural Calamities

The main objectives of an emergency plan are:-

- To control and contain the incident/accident and if possible, eliminate it; and
- To minimize the effects of the incident on persons, property and environment.

7.8.3 ON-SITE EMERGENCY PLAN

Preparation of On-site Emergency Plan is mandatory for each industrial unit. On-site Emergency plan containing details how major accidents will be dealt with on the site on which the industrial activity will be carried on and that plan shall include the name of the persons who is responsible for safety on the site and names of those who are authorized to take action in accordance with the plan in case of emergency. Mock drill of the onsite emergency plan is conducted at least one in every six months.

Main Elements of On-site Emergency Plan

The main elements of on-site emergency plans are:-

- Leadership and Administration.
- Role and Responsibilities of Key Personnel.
- Emergency action.
- Light and Power.
- Source of energy control.
- Protective and rescue equipment.
- Communication.
- Medical care.
- Mutual Aid.
- Public relation.
- Protection of vital records.
- Training.
- Periodical revision of plan.

Emergency Action Plan for On-Site Emergency Plan

The Action Plan should consist of the following:-

- Designated Emergency Control Centre/Room.
- Key Personnel.

Emergency Control Centre:

This is the main center from where the operations to handle the emergency are directed and co-ordinated. Facilities to be made available in the emergency control are:-

- Internal and external communication
- Computer and other essential records
- Daily attendance of workmen employed
- Storage of hazardous material records and manufacturing records
- Pollution records
- Walky-talky
- Telephone directory
- Company Directory
- List of Important phone numbers
- Mobile phone
- Plan of the plant showing Storage area of hazardous materials, Storage of safety equipments, Fire fighting system and additional source of water, Site entrance, roadway and emergency exist, Assembly points, surrounding location
- List of Key Personnel with addresses, telephone number etc.

Assembly Point:

A safe place far away from the plant should be pre determined as assembly point where in case of emergency personnel evacuated from the affected areas are to be assembled. The plant workers, contract workers and visitors should assemble in assembly point in case of emergency and the time office clerk should take their attendance so as to assess the missing persons during emergency.

The Key Personnel for Onsite Emergency:

1. Site Main Controller
2. Incident Controller
3. Other Key Officers
 - a. Communication Officer
 - b. Security and Fire Officer
 - c. Telephone Operators
 - d. Medical Officer
 - e. Personnel/Administrative Officer
 - f. Essential work team leaders

Site Main Controller (SMC)

His task will be to co-ordinate all internal and external activities from the Emergency Control Centre at Main Security Gate from where all operations will be directed. He shall:

- Assess the magnitude of the situation and decide whether the evacuation of staff from the plant is needed.
- Exercise and direct operational control over areas other than those affected.
- Maintain a continuous review of possible development and assess in consultation with work incident controller and other Key Personnel.
- Liaison with Police, Fire Service, Medical Services, and other Govt. Agencies.
- Direct and control rehabilitation of affected area after emergency.
- Intimate Off-site Emergency controller if the emergency spreads beyond the unit premises and likely to affect the surrounding area.
- Ensure that evidence is preserved for enquiries to be conducted by statutory authorities.

The Site Main Controller will declare the emergency and he will instruct gate office to operate the emergency siren after assessing the gravity of the situation.

Incident Controller (IC)

He is the next responsible officer after the Site Main Controller. In case of emergency he will rush to the place of occurrence and take overall charge and report to the Site Main Controller by personnel communication system like cell phones or walky-talky and inform about the magnitude of emergency.

He will assess the situation and considering the magnitude of emergency he will take decision and inform Communication Officer to communicate the news of emergency to different agencies. He will give direction to stop all operations within the affected area. He will take the charge of Main Controller till the Main Controller arrives. He will order for shutdown and evacuation of workers and staffs from affected area. He will inform all Key Personnel and all outside agency for help. He will inform security and fire officers and State Fire Services. He will ensure that all non-essential workers/staff are evacuated to assembly point and areas searched for casualties. He will report all significant development to Communication Officer. Moreover he will advise to preserve evidence of emergency into the cause of emergency.

Other Key Personnel and Their Duties

Communication Officer - On hearing the emergency siren/alarm he will proceed to the control center and communicate to Incident Controller. He will collect information from the emergency affected area and send correct message to Site main controller for declaration of emergency. He will maintain a log book of incident. He will contact all essential departments. He will take stock of the meteorological condition from local meteorological Department. He will communicate all information as directed by Works Main Controller.

Security and Fire Officer - The Security or Fire officer will be responsible for the fire fighting. On hearing the emergency alarm/siren, he will reach the incident area with fire and security staff. Immediately after arrival to the emergency area, he will inform through telephone or walky-talky to the communication officer. He will inform to the Incident Controller about the situation and requirement of outside help like State Fire Service and other mutual aid members. At the site, the entire fire squad member will respond to the advice and information given by the incident controller. The security will control the visitors and the vehicle entry.

Telephone Operator - In case of fire is discovered but no emergency siren is operated, he shall ensure the information about the location of the fire/emergency incident from the persons discovered/notices the above and communicate to different Key Personnel immediately with clear message.

Medical Officer - Medical Officer with his team will report to the Incident Controller on hearing the fire/emergency siren immediately. The ambulance will be parked nearest to the site of incident. Name of injured and other casualties carried to the Hospital will be recorded and handed over to Incident Controller. The ambulance will carry the injured to the nearest hospital for treatment.

Personnel/Administrative Officer - He should work as a liaison officer liaising with site main controller and other essential departments such as Police, Press and Statutory authorities. His responsibilities shall include:-

- To ensure that casualties receive adequate attention to arrange additional help if required and inform relatives.
- To control traffic movement into the site and ensure that alternative transport is available when needed.

- When emergency is prolonged, arrange for the relief of personnel and organize refreshment and catering facilities.
- Arrange for finance for the expenditure to handle the emergency.

Essential Works and Team Leaders -In the area immediately affected, it may be possible to isolate equipment from which flammable or toxic material is leaking. This work must be immediately carried out by plant supervisors and essential operators. Workers/staff need to be nominated to carry out the following essential works at the time of emergency:-

- Extra first aid personnel to deal with casualties.
- Emergency engineering works, provision of extra or replacement of light, isolation of equipment, temporary bypass electrical lines etc.
- Moving tankers or other vehicles from area of risk.
- To carry out tests on ambient air quality.
- To act as runner in case of communication system fails.
- The Site Main Controller will require a task force of suitable trained people for the following works:-
 - Manning of assembly points to record the arrival of evacuated people.
 - Assistance of casualty arrival areas to record details of casualties.
 - Manning the site entrance in liaison with security to direct emergency vehicle containing the gate e.g. ambulance, fire tenders etc.

For these essential jobs designated teams should be made available. The responsibilities of the team and the leader should be given.

The essential work teams are-

1. Task Force and repair team.
2. Fire fighting team.
3. Communication team.
4. Security Team.
5. Transport Team.
6. First aid and medical team.
7. Safety team.

Communication System:

Communication is a key component to control an emergency. The following communication system may be provided in the plant-

- Walky-Talky
- Telephone (internal & external)
- Cell phone
- Intercom/paging

Alarm System:

Suitable alarms require to be made for each of emergencies. The alarm should be audible in every part of the site. In areas of high noise levels, an alternative to an audible alarm, such as flashing lights may be installed.

There are three levels of emergencies;

- First level: Confined to a particular unit of the entire site,
- Second level: A spreading emergency, that requires outside help, and
- Third level: A major emergency requiring neighboring population to be alerted.

Raising the First Level Emergency Alarm:

Any person noticing an emergency should be able to raise or cause to be raised, the First Level Emergency Alarm. All employees must be trained to operate such emergency alarms. There should be adequate places within the site, where provision to raise an alarm is available. This could be an audible warning, individual signal or message to a manned location.

Raising the Second and Third Level Emergency Alarms:

In case there is a risk of the event spreading beyond the original unit and / or outside the site premises, then a second level emergency alarm can be raised. This could be across the entire site, as opposed to the first which could be at a part of the site.

In case a third level or (major) emergency is to be declared, telephonic information to members of the local crisis group, or in case of failure of power and formal communication systems, and non-availability of mobile phone signals, a big bell or a messenger can be deployed.

Declaring a Major Emergency:

Declaration of a major emergency should never be done on whims, immature judgement or without proper thought. Further, because of the scale of activity that will commence due to declaration of a major emergency, it is advisable to restrict the authority to declare it, and a limited number of persons may be invested the authority to declare such an emergency, although care should be taken to ensure that at least one such person is always at site.

Identifying the Type of Emergency through an Alarm:

Alarm systems vary and will depend upon the size of individual sites. The person noticing the incident should warn all those in the site vicinity to either evacuate or take other immediate action according to a predetermined plan. Automatic alarms may be considered. Audible alarms include sirens or other alarms over public address systems.

Alarms for a particular type of emergency (toxic leak or fire) can be raised separately enabling different emergency plans to be put in motion. However, this must be done after giving due thought about avoiding confusion in the minds of the site personnel.

Use of alarms can be carried out to communicate different information such as:

- Declaration of a first level emergency by an alarm in a particular area
- Declaration of an advanced emergency situation by sounding of an alarm in the entire site
- Declaration of a major emergency by sounding of a hooter, alarm or by communication through phone, bell or messenger.

Escape Route:

The escape route from each and every plant should be clearly marked. The escape route is the shortest route to reach out of the plant area to open area, which leads to assembly point. This route should be indicated on the layout plan attached to the On-site Emergency Plan.

Evacuation:

All non-essential staff should be evacuated from the emergency site. As soon as the emergency siren rings the workers have to shut down the plant and move to the assembly point. The plant shut down procedure in case of emergency should be prepared and kept ready and responsible persons should be nominated for the purpose.

Counting of Personnel:

All personnel working in the plant should be counted. Time office persons should collect the details of personnel arriving at the assembly point. These should be checked with the attendances of regular workers, contract workers present in the site on the day of emergency. The accident control should be informed and arrangement should be made for searching missing persons in the emergency affected area. The employees' address, contact number of next to kin should be maintained in the time office so that during emergency relatives of those affected due to emergency may be informed accordingly. Information in respect of emergency should be given to the media and other agency.

All Clear Signal:

After control of emergency the Work Incident Controller will communicate to the works main controller about the cessation of emergency. The main controller can declare all clear by instructing the time office to sound "All Clear Sirens".

Mutual Aid System:

Mutual aid scheme should be introduced among industries so that in case of emergency necessary help from mutual aid partner may be extended.

Mock drills on emergency planning should be conducted once in 6 months and sequence of events should be recorded for improvement of the exercise. Exercises on On-site Emergency Planning should be monitored by the high officials of the organization and the plan is reviewed every year.

Emergency facilities:

The following facilities should be provided in any unit to tackle any emergency at any time.

- Fire protection and fire fighting facilities.
- Emergency lighting and standby power.
- Emergency equipment and rescue equipment.
- Safety Equipment like Respirators, Gum boots, Safety helmets, Asbestos Rubber hand gloves, Goggles and face shield, Toxic gas measuring instruments, Explosive meter, Oxygen measuring instruments,, Wind direction indicator.

On-site Emergency Plan should contain-

1. Site plan and topographic plan.
2. Plan showing the fire fighting facilities.
3. Plan showing hazardous material storage area.
4. Material safety data sheets for hazardous chemicals.
5. Facilities available in main control center.
6. List of emergency equipment.
7. List of Safety Equipment.
8. List of important telephone numbers and addresses.
 - Nearest hospitals and ambulance service center.
 - Nearest fire station.
 - Govt. Officials.
 - Transport provider.
9. Names and address & contact telephone number of Key Personnel.

The onsite emergency plan so prepared shall be documented in a printed form in sufficient copies to give all concerned for knowledge, study and easy follow up. The emergency plan shall be rehearsed and practiced at regular intervals to test efficiency of personnel, equipment coordinated efforts and to increase confidence and experience to operate such plan. The plan so prepared should be updated annually.

7.8.4 OFF-SITE EMERGENCY PLAN

An off-site emergency plan is prepared to deal with those incidents which have the potential to harm persons or the environment outside the boundary of the site premises. A major accident, major emergency and disaster may affect areas outside the plant. An explosion can scatter debris over wide areas and its effects of blasts can cover considerable distances. Wind can spread burning fumes of flammable/toxic gas. Thus, the events like these described above can affect outside areas and combating them needs an Off-site Emergency plan. Envisaging such a rare incident, an off-site emergency plan should be drawn up for the following purpose.

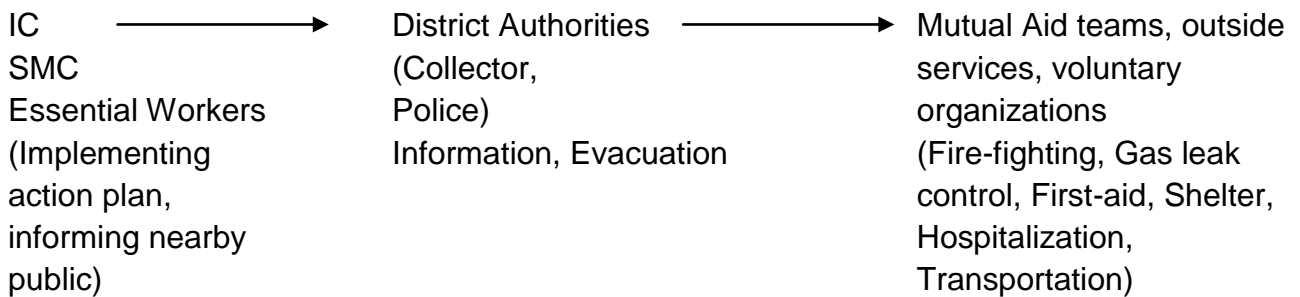
1. To provide basic information about the risk and environmental impact assessment related to the unit to local / district authorities, police, fire-brigade, surrounding units, and the general public. To appraise them of consequences and the protection / prevention measures and control actions and to seek their help to communicate with

public in case of a major emergency. The information from all industries shall enable district authorities to educate public about what could go wrong, and to train them of measures to be taken as an individual.

- 2. To enable district authorities to prepare the off-site emergency plan (contingency) for the district or particular area and to organize rehearsals and initiate actions learnt from these incidents.

Emergency Plan shall be made after considering the all possible effects of incidents on the neighboring population and the remedial measures will be devised in consultation with the local authorities and emergency services.

Structure of the Off-Site Emergency Plan



Role of GSPC Management

The Off-Site emergency Plans are dovetail so that the emergency services shall be summoned at the appropriate time and shall be provided with accurate information and a correct assessment of the situation. The responsibility for this is with the Site Main Controller. The Site Main Controller shall provide a copy of On-Site and Off-Site Emergency Plan to the District authorities, the Factories Inspectorate and the Emergency Services, so that on the basis of information and such authorities can make their emergency preparedness plan to formulate and execute the District / Area off Site Emergency Plan. Further on the advice of the authorities unit can also modify their plan to make plan more effective and perfect.

Role of Emergency Co-Ordination Officer (ECO)

The various emergency services will be co-ordinate by the Emergency Co-ordination officer (ECO), who will likely to be a Collector. The ECO will liaise closely with the Site

Main Controller. The Emergency Control Centre of the site can be utilized by the ECO to keep liaison with the Site Main Controller.

Role of the Fire Authorities

The control of fire is normally the responsibility of the senior fire officer who would take over the handling of fire from the IC on arrival at the site.

- The senior fire brigade officer may also have similar responsibility for other events such as explosion and toxic releases. Fire authority having major hazard units in the area shall- familiarize themselves with the location and site of all stages of flammable materials, water and foam supply points, firefighting equipment.
- Act as observer of an on-site exercise involving only site personnel.

Role of the Health Authorities:

Health authorities, including Doctors, Surgeons, Hospitals, and Ambulances so on, have a vital part to play following a Major Accident and they should form an integral part of any emergency plan. In case of major fires, injuries will be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle this type of injuries cases may be generally available in most of the hospitals. But in case of major toxic releases, the effects vary according to the chemical, which has leaked, and it is important for health authorities that might be involved in dealing with the aftermath of a toxic release to be familiar with the treatment appropriate to such casualties. Major Off-Site incidents are likely to require medical equipment and facilities additional to those available locally and a Medical 'Mutual Aid' scheme should exist to enable the assistance of neighboring authorities to be obtained in the event of an emergency.

Role of Telephone Department:

The communication system between the unit and the various above role-playing authorities must be effective. The ineffective public telephone system will not be useful in emergency. Therefore, telephone department should maintain the phones and if required temporary telephone connection may be provided to various above authorities to deal the emergency.

Role of Police and Evacuation Authorities:

- To protect life and property
- To control traffic movement
- To inform people to remain indoors or evacuate
- To carry-out evacuation
- To identify dead, deal with casualties and inform relatives of dead or injured.

For evacuation, the following criteria are useful:

- a) In case of major fire, only houses close to fire and in the direction of smoke need evacuation.
- b) If fire is escalating and in turn threatening a store of hazardous material, it is necessary to evacuate people nearby if time is available; otherwise they should be informed to keep themselves indoor and shield from the fire.
- c) For release of flammable/toxic gases, limited evacuation may be appropriate in downwind direction with windows closed and provides good protection. Flammable/toxic gases which are hazardous down to much lower concentration cover a long distance. This factor must be considered while deciding upon the need and extent of evacuation.

Role of the Mutual-Aid Agencies:

Mutual-aid arrangements shall be made in areas of fire & toxicity control, medical and transport & evacuation. All partners of mutual-aid shall extend all possible help in these areas.

Mock exercises on Off-site plan should be carried out at least once in a year to train the employees, up to date the plan, observe and rectify deficiencies.