CHAPTER 7

ADDITIONAL STUDIES –RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1 INTRODUCTION

Risk involves the occurrence or potential occurrence of some accident consisting of an event or sequence of events.

MCA stands for Maximum Credible Accident or in other words, an accident with maximum damage distance, which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. In practice the selection of accident scenarios for MCA analysis is carried out on the basis of engineering judgement and expertise in the field of risk analysis especially in accident analysis.

Detailed study helps in plotting the damage contours on the detailed plot plan in order to assess the magnitude of a particular event. A disastrous situation is the outcome of fire, explosion or toxic hazards in addition to other natural causes that eventually lead to loss of life, property and ecological imbalances.

MCA analysis encompasses defined techniques to identify the hazards and compute the consequent effects in terms of damage distances due to heat radiation, toxic releases, vapour cloud explosion etc. A list of probable or potential accidents of the major units in the complex arising due to use, storage and handling of the hazardous materials are examined to establish their credibility. Depending upon the effective hazardous attributes and their impact on the event, the maximum effect on the surrounding environment and the respective damage caused can be assessed.

7.2 METHODOLOGY OF MCA ANALYSIS

The MCA analysis involves ordering and ranking of various sections in terms of potential vulnerability. The data requirements for MCA analysis are:

- Flow diagram and P&I diagrams
- Detailed design parameters
- Physical & chemical properties of all the chemicals
- Detailed plant layout
- Detailed area layout
- Past accident data

The following steps are involved in MCA analysis:

- Identification of potential hazardous process units, storage sections and representative failure cases from the vessels and pipe lines
- Visualization of chemical release scenarios

- Consequence Analysis for computation of damage distances from the release cases through mathematical modeling

7.3 CONSEQUENCE ANALYSIS

Hazardous substance on release can cause damage on a large scale in the environment. The extent of the damage is dependent upon the nature of the release and the physical state of the material. It is necessary to visualise the consequences and the damages caused by such releases.

The quantification of the physical effects can be done by means of various models, which can then be translated in terms of injuries and damage to exposed population and buildings.

Hazardous substances may be released as a result of a catastrophe causing possible damage to the surrounding areas. The extent of damage depends upon the nature of the release. The release of flammable materials and subsequent ignition results in heat radiation, pressure wave or vapour cloud depending upon the flammability. It is important to visualise the consequences of the release of such substances and the damage caused to the surrounding areas.

An insight into physical effects resulting from the release of hazardous substances can be had by means of various models. Vulnerability models are used to translate the physical effects occurring in terms of injuries and damage to exposed population and buildings.

7.3.1 Factors Influencing the Use of Physical Effect Models

In order to calculate the physical effects of the accidental releases of hazardous substances the following steps must be carried out in succession:

- Determine the form in which the hazardous substances occur- gas, gas condensed to liquid or as a liquid in equilibrium with vapour
- Determine the way in which the release takes place, above or below the liquid level in a process unit or storage facility, instantaneous or continuous
- Determine the outflow volume (as a function of time) of the gas, vapour or liquid in the event of liquid outflow, possible two phase outflow,
- Determine the evaporation from the pool of liquid formed
- Dispersion of the released gas or vapour which has formed into the atmosphere

A distinction has to be made between toxic and flammable substances. In the event of the incidental release of toxic substances it is necessary to compute the concentrations of gas cloud (as a function of time and place) spreading in the surrounding areas. In the case of flammable substances, the heat radiation is computed for the following situations:

- Torch, if vapours are ignited
- Pool fire, if pool of liquid is ignited
- Boiling Liquid Expanding Vapour Explosion (BLEVE) which is a physical explosion

In the event of an explosive gas cloud the peak overpressure resulting from the explosion is calculated and the damage contours are plotted. In the distribution model account is taken of the atmospheric stability, the so-called Pasquill classes (A to F) and a wind velocity. The model is based on a point source. In practice, however, a point source will never exist; for example, a surface sources in the case of pools. To enable the source dimensions to be included in the calculation in the dispersion models in spite of this, an imaginary (virtual) point source is assumed, which is put back in such a way that the cloud area calculated according to the model has the source dimensions at the site of the actual source. In calculations based on a continuous source, the duration of the source is also included in the calculation. Some conditions for this calculation model are as follows:

- There must be some wind at the site

The model applies only to open terrain; allowance is made, however, for the roughness of the terrain. The influence of trees, houses, etc. on the dispersion can be determined by means of the roughness length.

7.3.2 Models for the Calculation of Heat Load and Shock Waves

If a flammable gas or liquid is released, damage resulting from heat radiation or explosion may occur on ignition. Models for the effects in the event of immediate ignition (torch, pool fire and BLEVE) and the ignition of a gas cloud will be discussed in succession. These models calculate the heat radiation or peak overpressure as a function of the distance to the torch, BLEVE, the ignited pool or gas cloud.

7.3.3 Model for a BLEVE

BLEVE stands for Boiling Liquid Expanding Vapour Explosion. BLEVE is a follow-up effect that occurs if the vapour side of a tank is heated by a torch or a pool fire. Due to the heating, the vapour pressure will rise and the material of the tank wall will weaken. At a given moment the weakened tank wall will no longer be able to withstand the increased vapour pressure and it will burst open. As a result of the expansion and flash-off a pressure wave occurs. In the case of flammable gases a fireball will form. The effects of a BLEVE for a tank with a flammable liquid are:

- A fireball : model gives the radius of the fire ball and the thermal load
- Pressure wave effects resulting from the expansion of the vapour and the flash-off. This is however, not predominating in this case
- Rupture of the tank, resulting in the formation of numerous fragments of the tank. These fragments can be hurled over at fairly great distances by the energy released

7.3.4 Ignition of a Gas Cloud

If a flammable gas is not ignited directly, this cloud will spread in the surrounding area. The drifting gas cloud will mix with air. As long as the gas concentration is between the lower and upper explosion limit, the gas cloud may explode or give flash fire on availability of an ignition source. The flammable content of a gas cloud is calculated by a three-dimensional integration of the concentration profiles, which fall within the explosion limits. If the gas cloud ignites, two situations can occur, namely non-explosive combustion (flash fire) and explosive combustion (flash fire + explosion).

The heat radiation from a flash fire is not calculated since the burning time is very short. Models exist for the calculation of the peak overpressure in explosive combustion as a function of the distance from the center of the gas cloud.

7.3.5 Burning Torch

The out flowing gas on immediate ignition gives a burning torch. In this model, an ellipse is assumed for the shape of a torch. The volume of the torch (flare) in this model is proportional to the outflow. In order to calculate the thermal load the centre of the flare is regarded as a point source.

7.3.6 Injuries Resulting from Flammable Liquids and Gases

In the case of flammable liquids and gases on immediate ignition, a pool fire or BLEVE or a flare will occur. The injuries in this case are mainly caused by heat radiation. It is only in the case of a BLEVE that injury may occur as a result of flying fragments also. Serious injuries as the result of the shock wave generally do not occur outside the fire ball zone. Fragmentation of the storage system can cause damage up to distances of over 1 km.

If the gas is not ignited immediately, it will disperse into the atmosphere. If the gas cloud ignites, it is assumed that everyone present within the gas cloud will die as a result of burns or asphyxiation. The duration of the thermal load will be too brief in case of explosion to cause any injuries. In the event of very rapid combustion of the gas cloud the shock wave may cause damage outside the limits of the cloud. Explosive combustion will only occur if the cloud is enclosed to some extent between buildings and structures.

7.3.7 Damage Models for Heat Radiation

It is assumed that everyone inside the area covered by the fire ball, a BLEVE, a torch, a burning pool or gas cloud will be burnt to death or will asphyxiate. The following probit functions are examples of methods which can be used to calculate the percentage of lethality and first degree burns that will accurate a particular thermal load and period of exposure of an unprotected body.

Lethality

Pr = - 36.38 + 2.56 ln (t.q4/3)

First degree burn symptoms

Pr = -39.83 + 3.0186 ln (t.q4/3)

Where, t =exposure time in seconds,
q = thermal load in W/m2,
Pr = Probit value, which relates to the percentage of affected people

For the exposure time, two values are chosen:

10 seconds: In a residential area, it is reasonable to assume that affected people can find protection from the thermal load within 10 seconds.

30 seconds: This pessimistic assumption applies if people cannot directly flee or no protection is provided to them.

7.3.8 Damage Model for Pressure Waves

A pressure wave can be caused by a BLEVE or gas cloud explosion.

The peak overpressure of 0.3 bar will lead to heavy damage to buildings and structures. Secondary fire and explosion are likely to take place due to cascading effects. A peak overpressure of 0.1 bar is taken as the limit for fatal injury and 0.03 bar as limit for the occurrence of wounds as the result of flying fragments of the glass. Similarly a peak overpressure of 0.01 bar is taken as the limit for the smashing of windows pans.

7.3.9 Specific Emergencies Anticipated and Their Possible Mitigation Measures

- **Consequence analysis for leakage from RS/ENA storage tank.**

The following inputs were used to run ALOHA model for computation of damage distances from 2" & 4" leak from one RS/ENA tank:

Tank diameter: 10.34 m
Tank height: 14.3 m
Type of tank: above ground cone roof vertical tank (flat bottomed)
Storage temperature: Ambient temperature i.e., 30^0C
Storage pressure: Atmospheric pressure (1 bar)
No of tanks: 1nos

ALOHA model developed by USEPA was used to quantify the damage distances for release scenario of 2 inch leak in one RS/ENA storage tank for heat loads of 37.5

kW/$m^{2,}$, 12..5 kW/$m^{2,}$, and 4 Kw/m^2 for pool fire scenario under weather condition of 3F. The damage distances for 37.5 kW/$m^{2,}$, 12.5 kW/$m^{2,}$, and 4 Kw/m^2 were computed as 6 m , 9 m and 17.3 m respectively.

Similarly the release scenario for 4 inch leak in one RS/ENA tank was visualized for heat loads of 37.5 kW/$m^{2,}$ 12..5 kW/$m^{2,}$, and 4 Kw/m^2 for pool fire scenario under weather condition of 3F. The damage distances for 37.5 kW/$m^{2,}$, 16.5 kW/$m^{2,}$, and 4 kW/m^2 were computed as 9.9 m , 19.2 m and 32.9 m respectively.

For avoiding any kind of fire incident leakages inside the factory premises, the following safety measures have to be undertaken:

Safety Equipment

- Fire extinguisher
- Fire detectors
- Fire Alarm

Fire fighting provision for existing distillery :-- Fire hydrant , fire extinguisher

13 nos DCP type extinguisher for alcohol tank + plant area + 3 nos sand buckets.
For CO_2 recovery : 2 nos DCP type extinguisher + 4 nos sand bucket
For existing Biogas plant : 2 nos DCP type extinguisher
Fire brigade vehicle : Fire tender with foam arrangement *viz.* foam type as follows :--
Foam compound, aqueous film forming compound 3% to 6% alcohol resistance foam concentrated bearing ISI mark 4889. Standard packing :-- 20 litre in each can.
Motos are flame proof and each equipment is having earthing

Fire fighting for proposed distillery :--

13 nos DCP type extinguisher for alcohol tank
For proposed Biogas plant: 2 nos DCP type fire extinguisher.
Motos are flame proof and each equipment is having earthing

Risk Reduction Measures

The following opportunities will be considered as a potential means of reducing identified risks during the detailed design phase:

- Buildings and plant structures designed for cyclone and seismic events (where appropriate), to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods;
- Provision for adequate water capacity to supply fire protection systems and critical process water;
- Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations;
- Installation of fit-for-purpose access ways and fall protection systems to facilitate safe access to fixed and mobile plant;

- Provision and integrity of process tanks, waste holding tanks and bunded areas as per relevant standards;
- Containment of hazardous materials;
- Security of facility to prevent unauthorized access to plant, introduction of prohibited items, and control of onsite traffic; and
- Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).
- Surrounding population (includes all strata of society) should be made aware of the safety precautions to be taken in the event of any mishap within the plant. This can effectively be done by conducting the training programs.
- Critical switches and alarm should be always kept in line
- Fire extinguishers should be tested periodically and should be always kept in operational mode
- A wind direction pointer should also be installed at storage site so that in an emergency the wind direction can be directly seen and downwind population cautioned
- Shut off and isolation valves should be easily approachable in emergencies
- A detailed HAZOP and Fault Tree Analysis should be carried out before commissioning of any new installation.

7.3.10 Disaster Management Plan

Disaster Management Plan is an elaborate scheme of planning events and organizing the chain of command which will enact swiftly to counter contingencies arising out of the accident whose cause can be catastrophic rupture of tank leading to pool fire – among many others. The general description of the emergency management plan is discussed below which is further bifurcated into the onsite emergency plan and off-site emergency plan

7.3.10.1 Declaration of Emergency

a) Communication With Declarer Of Emergency

When an emergency situation arises in the plant, it will be first noticed by some workers on the shop floor. He will immediately get in touch with shift –in-charge of that particular section. The shift –in-charge will initiate action to overcome the emergency, and will use his discretion to shut – down the factory if he feels that emergency situation is very serious. He will simultaneously get in touch with the Declarer of Emergency. The possible Declarers of Emergency in the order of priority are given below

i) Chairman & Managing Director
ii) General Manager
iii) DIstillery Managers

b) Communication With Declarer

The shift incharge has to try to get in touch with number one of the declarer of emergency on phone. The phone number of the Declarers of Emergency should be known to every worker. In case the phones are out of order due to some reason or the other, a messenger has to be immediately sent by the shift by the shift –in-charge to contact the Declarer of Emergency As the vehicles are coming under the jurisdiction of the Transport Department, which is open all the 24 hours, the shift –in –charge will get in touch with the in charge of the Transport Department, who will in turn make arrangements to send a messenger to the Declarer of Emergency. In case the the first Declarer is not available or is out of station, as the case may be, due to some reason or the other, the Shift –in –charge or the messenger, will get in touch with the second or the subsequent Declarer of Emergency in order of priority given in the above section.

c) Announcing of Emergency

The Declarer of Emergency has to immediately come to the place of work, assess the situation and act in an appropriate way. He may decide that emergency may be declared in one or two sections. On the other hand, he may feel that the emergency is more serious and the whole plant is to be whole plant. To indicate to the workers and other living in the vicinity that an emergency will continue as "Regular Declarer of the Emergency". The Deputy Superintendent of Police will have to get in touch with the Superintendent of Police and when he comes , he will have to look after the Emergency in the capacity as Declarer.

7.3.10.2 Control of Emergency

The emergency has to be controlled from one particular spot. This spot should be away from the likely points of accident, should be easily accessible to workers / officers / police / Ambulance and also there should be easy asphalted access from the factory to the Control Room.

- **Facilities at the Control Room**

- Factory Layout Plan
- Emergency telephone numbers;
- General telephone numbers;
- Emergency lighting;
- Hooters
- Daily number of people working in hazardous area;
- Population around the factory;
- Hot lines to the District Magistrate, Police Control Room, Fire brigade, antidotes and telephone numbers of hospitals etc,
- Information regarding dispersion and
- Safety equipment.

Apart from the above information, the control rooms shall have a list of possible accidents and the number of people to be affected in each of possible accident displayed on daily basis depending on the predominant wind direction and weather conditions.

The Control room shall not be on the main road as it is likely that there will be traffic congestion a these points. This should make the task of controlling the Emergency as well as controlling the traffic easier.

After the assembly of plant workers at the control room suitable evacuation and plant shut down methodology is to be adopted.

7.3.10.3 Emergency Fire Fighting Equipment

The industry will provide fire fighting facilities in the industry in order to tackle the emergency fire fighting:

- Adequate number of fire extinguishers as per the factory rules shall be provided.
- A storage sump exclusively for storing water for meeting emergency fire conditions will be provided with necessary piping and pumping facilities;
- Adequate number of safety showers and eye wash fountains in the plant as per the factory rules shall be provided.
- Regular fire fighting and safety training shall be imparted to the employees.

7.3.10.4 Evacuation Of Workers And Plant Shut Down

When the emergency is declared, all workers should leave their places of work and reach the safe place has been recognized as the Main Gate of the Plant. However in confusion and excitement, the workers may not exactly know which path may not be visible.

Further when the emergency is in the same section in which a particular worker is working; there will be so much smoke or toxic fumes that it may be difficult for him to find the path or exit and he will require some special guidance. Thus it is very necessary that there are guide paths for the workers to follow in case of emergency so that they can reach the main gate in safe condition. The especial guide paths with an emergency lighting shall be drawn and workers will be made familiar with them. It may so happen that these paths fall in the way of toxic fumes. Thus alternate paths have also been decided upon .

There may be some workers who could be hurt and/ or unable to come out. To help them, a special team has to be selected on voluntary basis. This team is quite a large one because not all its voluntary members will be available in one shift. The appropriate members who should send this team with hooters to the factory area along with necessary safety equipment which will always be kept ready for use in the

main control room. This team shall pick up those workers who have been hurt and make arrangements to bring them to safe place near the main gate.

At the gate itself there shall be arrangement for counting of the workmen reporting there. In some cases, it may so happen that in the excitement of the emergency some workmen may go away without reporting at the main gate, inspite of the fact the training being given to them to report at the main gate. All the workers who have arrived at the main gate. All the workers who have arrived at the main gate should be counted against the number which had entered. The total number consists of not only the workers but also the visitors and contract laborers(not only associated with the factory but also associated with the contractors).

When the injured workers are brought to the main gate, they have to be shifted to the hospitals with or without the help of police. For this, arrangements will be made for a number of vehicles, ambulances etc.

If outside public in the nearby villages are affected, their evacuation shall be done by police. The local controller of emergency shall also arrange for guarding the property and law and order control. The police shall also arrange for temporary shelter and food and will also make arrangements to take the public back to their residences, after the emergency situation has been controlled.

It is absolutely necessary that the plant is shut down immediately. For the shutting down of the plant, the procedure to be followed is described below.

7.4 ON-SITE EMERGENCY MANAGEMENT

The following section describes methodology to deal with On-site emergency. The responsibilities of the various plant personnel are also indicated.

7.4.1 Duties of personnel if fire occurs

A) Chief Co-ordinator

Functions

He will declare the state of emergency to every one concerned, specially to people above him and to the senior officials of the organizations whose help will be required

He will be in constant contact with the Deputy Chief Co-ordinator

1) He will receive all information regarding the emergency from the disaster site
2) He will receive information regarding additional resources requirement from site
3) He will convey necessary instructions to the site - Dy. Chief Co-ordinator
4) He will authorize evacuation of personnel through Dy. Chief Co-ordinator
5) He will authorize additional resources mobilization through his advisors

6) He will approve release of information regarding disasters to outside agencies through Administration Advisor

B) Special Advisor (Location: Main Control Center)

Functions

If the chief Co-ordinator is not in the spot then he is incharge of the crisis control room

1) He is communicator between the chief Co-ordinator higher up like Director, C. & M. D., Ministry, etc.
2) He is Co-ordinating with Airforce, Navy and air freighting special equipment / material will be done by the special advisor on behalf of the chief advisor

C) Technical Advisor

Functions:

1) Collection of data and analysis all the available data regarding the disaster
2) He is the communicator between Dy. Chief Co-ordinator through Chief Co-ordinator
3) He is responsible for maintenance of logbook record charts etc will be in his custody
4) Any queries that regarding chemical, ot any oils will be answered through him

D) Material Co-Ordinator

Functions

1) He is responsible and the requlatise for procurements being made on an emergency basis.
2) He will inform about all purchases to finance advisor

E) Finance Advisor

Functions:

1) He is responsible for all finance-related work such as excise and customs, insurance formalities and FR cashier and relating emergency cash if required

F) Administration Advisor

Functions:

1) He takes approval from the chief co-ordinator and will inform the press and outside agencies regarding disaster.

2) He will arrange catering and inform through welfare officer regarding communication to relative of the injured employees
3) When approved by the chief co-ordinator he will supervise to as of the emergency location with the press/Govt. agencies along with the Technical advisor.
4) He arranges CISF for transport and additional manpower.

G) Fire And Safety Co-Ordinator

Function:

1) On arrival at the scene, he will evaluate the strategy chalked out by Manager-Fire & Safety / Manager-Shift and co-ordinate with Civil Fire Brigade for effective control
2) Co-ordinate with Dy. Chief Co-Ordinator) for actions as deemed necessary, which will assist the operations department to carry out their activities safety
3) Assess the need of rescue operation and make arrangements for the same
4) Co-ordinate with Medical Adviser for ambulance and other medical assistance as may be necessary
5) Ensure that all the assigned personnel as mentioned above are carrying out their duties and whenever any extra assistance is required makes arrangements for the same
6) Co-ordinate with Manager-PR, for meeting the Press and members of public, if called for.
7) Ensure adequacy of men and equipment at the scene and proposed plant premises. If required, make arrangements for getting necessary assistance
8) Make arrangements for replacements of unwanted equipment/damaged equipment from the scene
9) Ensure that all approaches are clear and safe and deploy men and equipment in a co-ordinated fashion
10) Provide necessary expert guidance for fire fighting operation and carry out further operations safety
11) If any maintenance assistance is required, liaises with Maintenance Co-ordinator for the same

7.5 FUNCTION OF MEDICAL CENTER

1. Co-Ordinate Ambulance Activities
2. Get Blood Donors
3. Give First Aid
4. Get More Ambulance
5. Hospital Co-Ordination
6. Keep Statistics Of Injured Employees
7. Take Out History Cards Of Injured Employees
8. Procure Additional Medicines/Bandages Etc.

7.6 FUNCTION OF MEDICAL ADVISOR

1. He will be stationed at the dispensary
2. He will be coordinating with first aid & ambulance teams
3. He will direct ambulances to the designated hospitals
4. He will be talking to different Hospitals in the city regarding admission to injured
5. He will call more Doctors to the factory if found necessary
6. He will consult with other specialists whenever necessary
7. He will arrange for outside ambulances and first aider if the situation calls for

7.7 ACTION TO BE TAKEN BY SHIFT SECURITY CHIEF

A: Function of Security Center

1. Receive and co-ordinate with police
2. To give direction to incoming external help
3. Cordon off area and provide road blocks as per instruction
4. Review evacuation procedure with police
5. Control incoming traffic, traffic near main gate & out going movements
6. Mobilise available vehicles
7. Get additional help from barricks

7.8 ACTION TO BE TAKEN BY EXTERNAL CONTACT CENTER

A: Function of Mechanical center

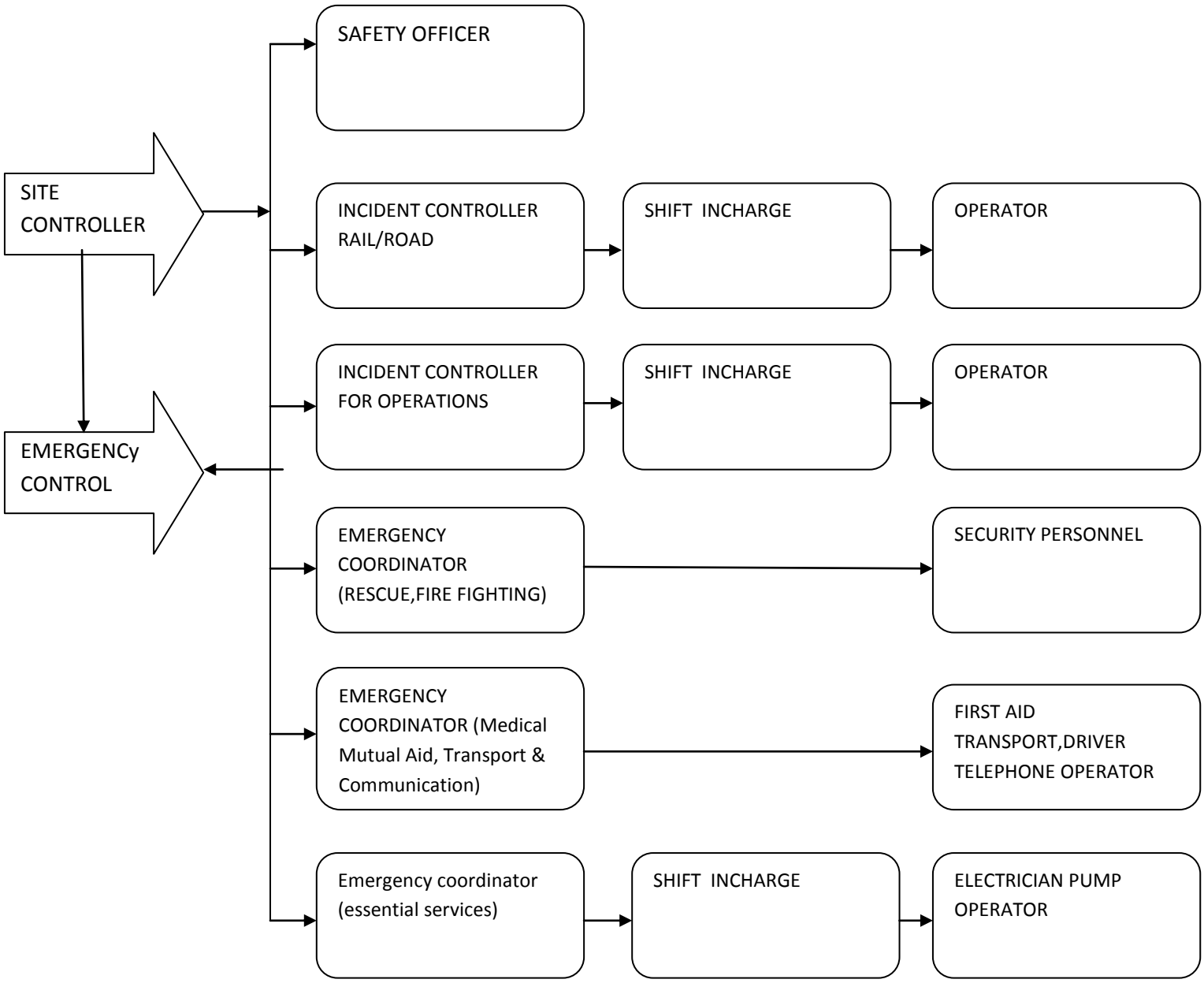
1. Arrange available transport at different locations.
2. Arrange the additional vehicles.
3. Mobile Canteen.
4. Emergency Maintenance Jobs.

B: Function of Transport Officer

1. Will mobile all the available vehicles and drivers
2. He will rent vehicles as needed
3. Will arrange for vehicles requirement of plant co-ordinator, chief co-ordinator

A typical organogram for the on –site emergency plan is shown in **Figure -7.1**

Figure 7.1: Typical organogram for onsite emergency management plan



7.8 OFFSITE EMERGENCY PLAN

The off-site emergency plan begins beyond the premises of the plant. The possible impact on the immediate vicinity of the plant when emergency condition arises from the proposed plant. The responsibilities of various personnel and departments are as given below:--

7.8.1 Responsibilities of the Police

- Communicate the information about the mishap to the other agencies.
- Provide support to the other agencies as required.
- Traffic management by cordoning of the area.
- Arrange the evacuation of people.

7.8.2 Responsibilities of the fire brigade

- Fighting fire and preventing the spread.
- Plugging the leaks of the chemicals, reducing the effects of gases and fumes.
- Rescue and salvage operation.

7.8.3 Medical /Ambulance

- First aid to persons affected.
- Medical treatment.

7.8.4 Technical (Factory Inspectorate, Pollution Board, Technical experts from industry, research and training institution)

- Furnish all the technical information to emergency services as required.
- Investigate the causes of disaster.
- Suggest the preventive measures for future action.

7.8.5 Rehabilitation (Local authorities and district administration)

- Provide emergency control center in the area with facilities for directing , co-ordinating emergency control activities.
- Arrange for rehabilitation of persons evacuated and arrange for food, medical, hygienic requirements.
- Arrange for transportation for evacuation from residential location when required.
- Maintain communication facilities and conditions with the help of the telephone department.

7.9 MEASURES TO BE TAKEN DURING THE EMERGENCY

- ✓ The plant authorities shall immediately send messages to the administration in case the hazard is likely to spread beyond the plant.
- ✓ The concerned Police officers along with civic officials shall make arrangements for evacuation of the people from the villages to the safer areas.
- ✓ The plant authorities shall extend the technical support in containing the damage.
- ✓ Most importantly ,it is the responsibility of the officials of the plant that the people don't get panicky.
- ✓ After , all the hazard is totally curbed, people may be brought back to their respective villages.

A typical organogram for the off –site emergency plan is shown in **Figure -7.2** on the next page :--

Figure 7.2: Typical Organogram for off-site emergency management plan