

Risk Assessment

1 Introduction

Risk assessment is a step in a risk management procedure. Risk assessment is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat (also called hazard). Quantitative risk assessment requires calculations of two components of risk; the magnitude of the potential loss, and the probability that the loss will occur.

The study comprises to carry out Risk Assessment for existing as well as proposed modernization units using most prevalent and relevant methodologies that involve the steps of identifying hazards associated with the operations and selecting worst case scenario for consequences estimation. Adopting reputed software models for consequences estimation. We suggest risk reduction measures for effective implementation which is based on effective frequency of occurrence.

2 Hazard Identification and Risk Analysis (HIRA) study

HIRA is a collective term that encompasses all activities involved in identifying hazards and evaluating risk at facilities, throughout their life cycle, to make certain that risks to employees, the public, or the environment are consistently controlled within the organization's risk tolerance. These studies typically address three main risk questions to a level of detail commensurate with analysis objectives, life cycle stage, available information, and resources. The three main risk questions are:

- Hazard – What can go wrong?
- Consequences – How bad could it be?
- Likelihood – How often might it happen?

The hazard analysis shall address the following:

- The hazards of the process.
- The identification of any previous incident that had a likely potential for catastrophic consequences.
- Engineering and administrative controls applicable to the hazards and their interrelationships.
- Consequences of failure of engineering and administrative controls.
- Stationary source siting.

- Human factors.
- A qualitative evaluation of a range of the possible safety and health effects of failure of controls.

A HIRA study is typically performed by team of qualified experts on the process, the materials, and the work activities. Personnel who have formal training on risk analysis methods usually lead these teams, applying the selected analysis technique(s) with subject matter experts from engineering, operations, maintenance, and other disciplines as needed.

3 Hazard identification

Identification of causes and types of hazards is the primary task for planning for risk assessment. Hazard can happen because of the nature of the chemicals handled and also the nature of process involved. The methods employed for hazard identification in this study are:

- Identification of major hazards based on Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 of GOI (as amended in 2000) and
- Identification of hazardous units and segments of plants and units based on relative ranking technique. Example: Fire Explosion and Toxicity Index (FE&TI)

4 Storage facilities of hazardous chemicals

The storage capacities / details of the major hazardous chemicals proposed to be used for manufacturing various products are given in **Table 1**

Table 1 Details of Solvents storage capacity, sizes, type of tanks

S. No	Solvent	CAS No	Storage type	Storage Capacity		No. of tanks with capacity
				Kgs	KL	
1	2-Butanol	78-92-2	Vertical		50	50 KL-1
2	Acetic acid	64-19-7	Vertical		120	50 KL-2, 20 KL-1
3	Acetone	67-64-1	Vertical		120	50 KL-2, 20 KL-1
4	Acetonitrile	75-05-8	Vertical		150	50 KL-3
5	Acetonitrile	75-05-8	Vertical drum	21760		136, 160 Kg's capacity
6	Chloroform	67-66-3	Vertical		50	50 KL-1
7	Chloroform	67-66-3	Vertical drum	1309		In HDPE drum
8	Cyclohexane	110-82-7	Vertical		70	50 KL-1, 20 KL-1
9	DI Isopropyl ether	108-20-3	Vertical Drums	3000		145-20 DRIMS
10	Dimethyl acetamide	127-19-5	Vertical		50	50 KL-1
11	Dimethyl Sulfoxide	67-68-5	Vertical drum	61726.5		In HDPE drum
12	Dimethyl formamide	68-12-2	Vertical		50	50 KL-1
13	Dimethyl formamide	68-12-2	Vertical drum	1207		7, 190 kg's drum
14	Ethanol	64-17-5	Vertical		140	50 KL-2, 20 KL-2
15	Ethylacetate	141-78-6	Vertical		120	50 KL-2, 20 KL-1
16	Farmic Acid 99%	64-18-6	Vertical drum	15823		65, 250 Kg's capacity
17	Heptanes	142-82-5	Vertical		50	50 KL-1
18	Hexanes	110-54-3	Vertical drum	5772		45 drums, 135 cap
19	Isopropyl acetate	108-21-4	Vertical		100	50 KL-2
20	ISO PROPYL ACEATE	108-21-4	Vertical drum	3090		In MS drums(180KGS)
21	Isopropyl alcohol		Vertical		120	50 KL-2, 20 KL-1
22	Methanol	67-56-1	Vertical		300	50 KL-6
23	Methyl ethyl ketone	78-93-3	Vertical drum	9000		In MS drums
24	Methylene chloride	75-09-2	Vertical		170	50 KL-3, 20 KL-1
25	Methyl-tert-butyl ether	1634-04-4	Vertical		80	50 KL-1, 30 KL-1
26	N,N Dimethyl Acetamide	127-19-5	Vertical drum	28620		151, 190Kg's capacity
27	N-Heptane	142-82-5	Vertical drum	6000		In MS drums
28	n-Hexane	142-82-5	Vertical drum	30195		230 In MS drums-1320Ltr
29	n-propanol	71-23-8	Vertical		50	50 KL-1
30	N-propanol	71-23-8	Vertical drum	2310		In MS drums
31	O-Xylene	95-47-6			20	20 KL-1

32	Petroleum ether		Vertical drum	19800		Cap 200-99 drums
33	Petroleum ether	8032-32-4			20	20 KL-1
34	Pet Ether 60-80	64742-49-0	Vertical drum		10	60, 200Ltr capacity
35	Pet Ether 60-80		Vertical drum	8850		45 no's-200Ltr
36	Tetrahydrofuran	109-99-9	Vertical		120	30 KL-4
37	Tetra Hydro Furan(Drums)	109-99-9	Vertical drum	50745		282 No's-180 Ltrs
38	Toluene	108-88-3	Vertical		250	50 KL-5
39	Methyl iso butyl ketone	108-10-1	Vertical Drums	41745		165-253
40	MONO ETHYLENE GLYCOL	107-21-1	Vertical Drums	5000		230-22
41	N-Butyl Alcohol	71-36-3	Vertical Drums	8250		165-50
42	N-methyl-2-pyrrolidone	120-94-5	Vertical Drums	3000		220-15
43	Tri Ethyl amine	121-44-8	Vertical Drums	2382.24		150-16
Dia of tanks 50KL – 4m, 30KL-3.25m, 20KL - 2m, 15KL-2m, 10KL- 2m, 5KL- 1.5m						
Length of tanks 50KL – 6m, 30KL-5m, 20KL - 7m, 15KL- 5m, 10KL- 4m, 5KL- 3.5m						
Dia of drums 0.5m						

5 Fire Explosion and Toxicity Index (FETI) Approach

The most widely used relative ranking hazard index is Dow's Fire Explosion Index (F&EI) and Mond's Toxicity Index (TI) together is called as Fire Explosion and Toxicity Index (FETI). It involves objective evaluation of the realistic fire, explosion, toxicity and reactivity potential of process or storage units. The quantitative methodology relies on the analysis based on historic loss data, the energy potential of the chemical under study and the extent to which loss prevention measures are already applied.

The basic objectives that characterize FETI are,

- Identification of equipment within the plant that would contribute to the initiation or escalation of an incident.
- Quantification and classification of the expected damage potential due to fire, explosion and toxicity incidents in realistic terms.
- Determination of "area of exposure" surrounding the process or storage unit.

F&EI is a product of Material Factor (MF) and Hazard Factor. While MF represents the flammability and reactivity of the substances, hazard factor is itself a product of General Process Hazard (GPH) and Special Process Hazard (SPH).

➤ **Determination of Material Factor**

The Material Factor (MF) is the basic starting value in the computation of the F&EI and other risk analysis values. The MF is a measure of the intrinsic rate of potential energy release from fire or explosion produced by combustion or chemical reaction.

The MF is obtained from the flammability and instability rankings according to NFPA 704. Generally, the flammability and instability rankings are for ambient temperatures. It is recognized that the fire and reaction hazards of a material increase markedly with temperature. The fire hazard from a combustible liquid at a temperature above its flash point is equivalent to that from a flammable liquid at ambient temperature. Reaction rates also increase very markedly with temperature. If the temperature of the material on which the MF is based is over 140 °F (60 °C), a certain adjustment may be required, as discussed below under C. "Temperature Adjustment of Material Factor."

The F&EI is calculated from,

$$F\&EI = MF \times (1 + GPH) \times (1 + SPH)$$

The TI is calculated as follows,

$$TI = \left(\frac{Th + Ts}{100} \right) (1 + GPH + SPH)$$

The toxicity number (Th) is derived from the NFPA health factor Nh (NFPA 704, 325M or 49). Nh is an integer number ranging from 0 to 4.

Table 2 Toxicity Number

Health Factor – Nh	Toxicity Number - Th
0	0
1	50
2	125
3	250
4	325

The Penalty Factor (Ts) is the second toxicity parameter used to determine the TI. The Ts value is derived from the 'Threshold Limit Values (TLV)'.

The TLV-values are drawn up by the American Conference of Governmental Industrial Hygienists. TLV represents a time weighted average (TWA) air concentration to which workers can be exposed during a normal working week without ill effects. TLV is often indicated as a TWA-value, both are the same.

Table 3 Threshold Limit Values

Threshold Limit Values (TLVs)	Penalty Factor (Ts)
< 5	125
5-50	75
> 50	50

By comparing the indices of F&EI and TI given in above table, the unit under analysis is classified into one of the following categories established for this purpose.

Table 4 Categories of substances based on F&EI and TI

Category	Fire and Explosion Index (F&EI)	Toxicity Index (TI)
I	< 65	< 6
II	$65 \leq \text{F\&EI} < 95$	$6 \leq \text{TI} < 10$
III	≥ 95	≥ 10

Certain basic minimum preventive and protective measures are required for the three hazard categories.

Figure 1 Risk Model Flow Diagram

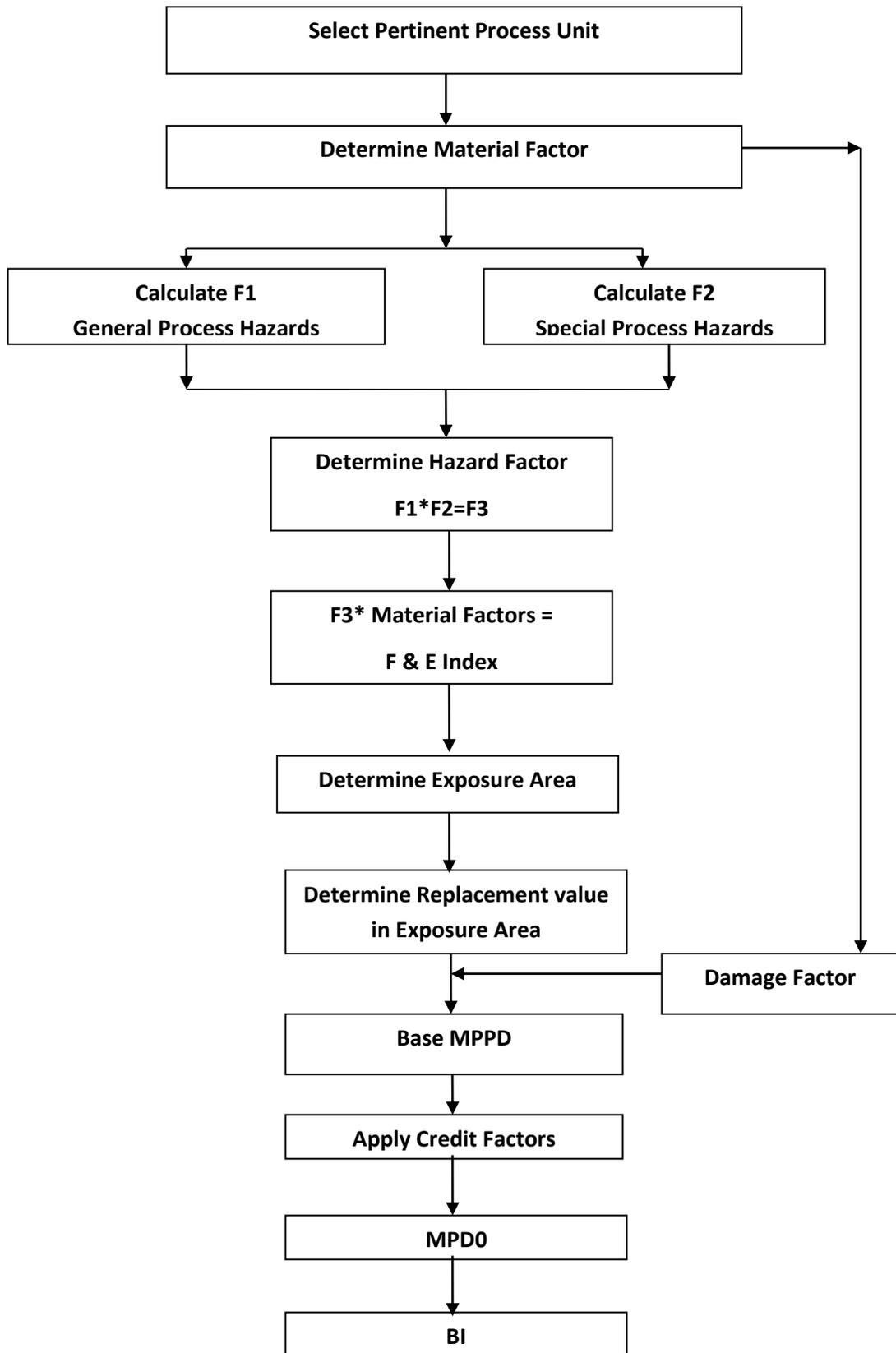


Table 5 Risk Scenario: 1

Risk Model Scenario : 1, If $N_f > 2$									
Heat Radiation Effects - Pool Fire									
S. No	Solvent Name	Maximum Storage in KL	Threshold Quantities (T) For Application of Rules		37.5 (kW /m ²)	25 (kW /m ²)	12.5 (kW /m ²)	4.5 (kW /m ²)	1.6 (kW /m ²)
			4,5,7 -9 and 13-15	10 -12					
1	Acetone	120	1500	10000	<10	<10	<10	16	25
2	Acetonitrile	150	1500	10000	<10	<10	10	17	25
3	Butanol	8250	1500	10000	<10	<10	11	18	27
4	Cyclohexane	70	1500	10000	<10	<10	11	19	31
5	Di isopropyl ether	3000 kg	1500	10000	<10	<10	<10	17	28
6	Ethanol	140	1500	10000	<10	<10	10	16	24
7	Ethyl acetate	120	1500	10000	<10	<10	<10	15	24
8	Heptane	50	1500	10000	<10	<10	11	19	30
9	Hexane	5772 kg	1500	10000	11	16	26	47	79
10	Isopropyl acetate	100	1500	10000	<10	<10	<10	16	25
11	Isopropyl alcohol	120	1500	10000	<10	<10	11	17	26
12	Methanol	300	1500	10000	<10	<10	<10	14	21
13	Methyl ethyl Ketone	9000 kg	1500	10000	<10	<10	<10	<10	<10
14	Methylene chloride	170	1500	10000	<10	<10	<10	<10	15
15	Methyl-tert-butyl ether	80	1500	10000	<10	<10	<10	17	28
16	n-Heptane	6000 kg	1500	10000	<10	<10	11	19	30
17	n- Hexane	30195 kg	1500	10000	11	16	26	47	79
18	n-propanol	50	1500	10000	<10	<10	11	17	26
19	o-Xylene	20	1500	10000	<10	<10	11	20	31
20	Petroleum ether	20	1500	10000	<10	<10	<10	<10	<10
21	Tetrahydrofuran	120	1500	10000	<10	<10	<10	17	28
22	Toluene	250	1500	10000	<10	<10	11	19	31
23	Triethylamine	2382.2 kg	1500	10000	<10	<10	10	18	29
Dia of tanks 50KL – 4m, 30KL-3.25m, 20KL - 2m, 15KL-2m, 10KL- 2m, 5KL- 1.5m									
Length of tanks 50KL – 6m, 30KL-5m, 20KL - 7m, 15KL- 5m, 10KL- 4m, 5KL- 3.5m									
Dia of drums 0.5m									

Table 6 Risk Scenario: 2

Risk Model Scenario : 2, If $N_h > 2$							
Toxic Area of Vapor Cloud Distance in Meter							
S. No.	Solvent Name	Maximum Storage in KL	Threshold Quantities (T)		TWA/TLV	STEL	IDLH
			For Application of Rules				
			4,5,7 -9 and 13-15	10 -12			
1	Acetic Acid	120	1500	10000	326	260	132
2	N,N-Dimethylaniline	28620 Kg	1500	10000	89	52	10
3	Triethylamine	2382.3 Kg	1500	10000	288	223	105

IDLH : Immediately Dangerous to Life or Health, STEL: Short-Term Exposure Limit, TWA: Time Weighted Average , TLV : Threshold Limit Value

5.1 Damage Criteria of Thermal Radiation

Details of damage criteria for thermal radiation are given in in **Table 7**.

Table 7 Damage Criteria of Thermal Radiation

S. No.	Incident Radiation (kW/m^2)	Type of Damage Intensity	
		Damage to Equipment	Damage to People
1	37.5	Damage to process equipment	100% lethality in 1 min. 1% lethality in 10 sec.
2	25.0	Minimum energy required to ignite wood at indefinitely long exposure without flame	50% lethality in 1 min. Significant injury in 10 sec.
3	19.0	Maximum thermal radiation allowed on thermally unprotected equipment	-----
4	12.5	Minimum energy to ignite with a flame	1% lethality in 1 min
5	4.5	-----	Causes pain if duration is longer than 20 Sec, however blistering is unlikely (1st degree burns)
6	1.6	-----	Causes no discomfort on long exposure

5.2 Damage Criteria for Over Pressures

Details of damage criteria for over pressures are given in **Table 8**.

Table 8 Damage criteria for Over Pressures

Human Injury		Structural Damage	
Peak Over Pressure (bar)	Type of damage	Peak Over Pressure (bar)	Type of damage
5 - 8	100% Lethality	0.3	Heavy (90% damage)
3.5 - 5	50 % Lethality	0.1	Repairable (10% Damage)
2 - 3	Threshold Lethality	0.03	Damage of Glass
1.33 – 2	Severe Lung Damage	0.01	Crack of windows
1 - 1.33	50 % Eardrum rupture	-	-

5.3 Risk Output Model

Treat Zone for all bulk storage of solvents at various locations within the plant site is within the project boundary. The risk contours for some solvents are given in **Figure 2**

Figure 2 Output of the Risk model



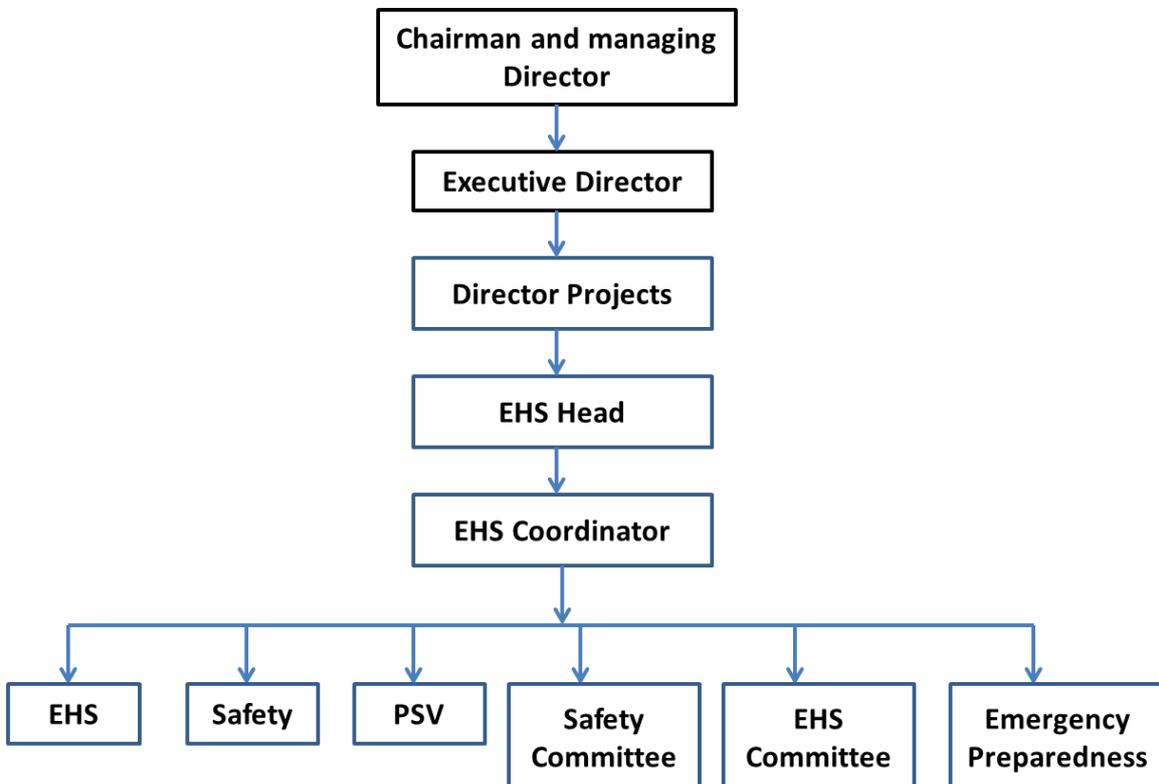
6 Onsite Emergency Plan

Handling hazardous materials, bursting of pipelines or pressure vessels or Fire in chemical industry is a very complex job. From the individual on the front line to the first line supervisor and to the senior executives, each person requires a different degree of information, training, awareness. Hence this on-site emergency plan is for the group of people who are being called as key personnel or Emergency Response Team. Organogram of Environment Health and Safety is given in **Figure 3**.

To improve the efficiency of handling emergency situation and to avoid getting panic by different operators or workers working in the premises during an Emergency situation following actions are taken. During emergency situations the authority takes charge, if the incident is vested in different agencies, personnel and executives. All those involved must be ready to meet their responsibilities; this plan is called as “Emergency Preparedness Plan”.

With reference to the statutory provisions, this plan is related to this unit and prepared to save the lives of the personnel and the public and to reduce / minimise the loss incurred due to major accidents.

Figure 3 Organogram of EHS Management



6.1 Statutory Requirements

MSIHC Rules-1989.under EPCACT 1986 Amended in 2002, Rule No 13: Preparation of the on-site emergency plan by the Occupier / Manager.

Factories Act-1948, chapter-IVA in that section 41B- compulsory disclosure of Information by the Occupier / Manager. Sub section (4): on-site emergency plan has to be prepared & detailed measures for his factory and make know to the workers

6.2 Scope

The scope of the plan is to ensure safety of Life, Protection of Environment and Protection of installation and restoration of production salvage operations in this order of priority. To improve the efficiency of the plan implementation, all personnel will be trained by conducting Mock Drills / Training.

6.3 Objectives of the Emergency Plan

This plan is developed to meet the best possible use of resources at its command and / or outside agencies for the following purposes.

- Controlling the emergency, localising the emergency and eliminating the hazard.
- The emergency shall be controlled with in the premises of the block or in worse scenarios control the emergency within the plant premises.
- Rescue of victims and treating them suitably to support speedy recovery at the OHC.
- Safeguard others by evacuating them to safer place.
- Identification of personnel effected, notification to relatives and extending necessary assistance.
- Providing relevant record for data needed as evidence for subsequent enquiries.
- Ensuring safety of employees and their works before resuming the work.
- To supply equipment & material at right time in emergency.

6.4 Measures and Things expected during Emergency

Onsite emergency is an event that may affect several departments within the factory or may cause serious injuries, Loss of life, extensive damage to property, serious disruption of work, damage to environment which requires the involvement of several resources to handle it effectively.

During emergency situations what measures are needed to be taken and what things expected from employees is given in below **Table 9** and locations to be identified with expected hazard in that area is given in **Table 10**.

Table 9 Measures & Things expected during Emergency

Measures to be taken	Things expected from the employees
<ul style="list-style-type: none"> ➤ Minimizing the consequences of emergency. ➤ Passing of information to relevant persons/relevant departments/in charges. ➤ Passing the information to govt. bodies & local Panchayaths (if situation warrants) ➤ Warning and advising the persons who are likely to be affected. ➤ Mobilizing and gearing up of inside resources. ➤ Calling up of outside agencies (if situation warrants) ➤ Intimating and organizing evacuation of the personnel from the affected area. ➤ Collecting latest status, other information and any requirements. ➤ Co-ordination with various agencies. 	<ul style="list-style-type: none"> ➤ Do not get panic. ➤ Do not spread unauthenticated information. ➤ Do not approach the scene to be a spectator. ➤ Do not engage communication channels (telephones and PAS) unnecessarily. ➤ Do not move around unnecessarily. ➤ Be attentive and follow to the instructions. ➤ If you have no role to play, move out of the area after informing the time office. ➤ All contract labour should report to their supervisor/concern in charge. ➤ Use only evacuation routes / pathways while reaching gathering areas.

Table 10 Areas to be identified

Area	Hazard
Production Blocks	Fire/ Explosion/ Toxic Gas Release / Leak/ Spillage
Bulk Storage Yard	Fire/ Explosion / Leak
Ware House	Fire / Explosion/Leak/Toxic Gas Release / Leakage /Spillage
Air Compressor/N ₂ and its System/ Hot Oil	Bursting of pipelines and vessels
Electrical Panel rooms/HT yard/Transformer yards	Fire / Explosion
Coal Yard	Fire
Boiler	Explosion / Bursting of pipe lines
Road Tankers	Fire / Explosion

ETP & Incinerator	Fire / Explosion / Hazardous waste leakage /spillage
Others	Riot, Mob Attack, Thieves & Terrorists attacks and Natural calamities
All areas	Persons effected during emergencies or while performing other regular activities.

The On Site Emergency usually takes birth with one or more combination of the following occurs in the plant

- Fire - Jet Fire / Pool Fires.
- Explosion
- Spillage / leakage of hazardous material.
- Release of toxic gases or liquids.
- Bursting of pipelines and vessels.
- Riot, Mob Attack, Thieves & Terrorists attacks and Natural Calamities.
- Persons meet in accident while performing other regular activities.

6.5 Protection of Plant

Protection of the plant and human life is one of the main points to be taken care during onsite emergencies by the following protection systems.

Initially Fire Extinguishers are used to prevent the fire. In case if fire is higher Fire Hydrant System is to be used to prevent the fire. If the fire is turned to major (assuming it may be uncontrollable / it may leads to major), where the temperature is high, so we may not able to go and operate the fire extinguishers, keeping this in-view, we use the system called fire hydrant and foam sprinkler system.

6.5.1. Fire Extinguishers:

There are different types and capacities of fire extinguishers are available and to be provided based on the requirement. The details of Fire Extinguishers are given in **Table 11**

Table 11 Details of the Fire Extinguishers

S.No	Type of Fire Extinguishers	Quantity (Nos)
1	DCP Fire Extinguishers of various capacities	100
2	FOAM Fire Extinguishers of 50 lts capacity	50
3	CO ₂ Fire Extinguishers of various capacities	50
4	ABC Fire Extinguishers of 02 kgs capacity	50
5	Modular type/ Roof mounted Fire extinguishers of various capacities	100

Higher capacity Fire Extinguishers (DCP – 150 KG & 75 KG) are provided at the various strategic locations.

6.5.2. Fire Hydrant System

In addition to Fire extinguishers, plant is facilitated with a high-pressure water line laid for Fire Fighting. This system is called as Fire Hydrant System. The line pressure will be maintained between 7.0 to 10.0 kg/cm² pressure. Pressurized Fire Hydrant system is laid through out the plant, covering all Production blocks, BST yard, Raw Material Ware Houses, Drum sheds, Main canteen, Laboratory buildings, Coal yard and Boiler areas.

Fire Hydrant can be operated from any side of the incident / emergency spot by considering Wind Direction. The length of the fire hose reels are 15 M & 30 M and jet range is minimum 12 to 15 M. The line is well designed, such that Fire fighting can be done from minimum 03 to 04 points at a time. The fire hydrant valve opening / closing directions are clearly marked. Sufficient quantity of Fire hose reels is arranged in 'Fire Emergency Cabinets'.

The 'Fire Emergency Cabinets' are constructed near to Fire hydrant points in such a way that they can be identified easily during emergency situations.

The cabinet is divided into three racks. The First rack is filled with Jet nozzle, Fog / Multi Purpose nozzle, Foam Making branch pipe, Flags, etc. In Second rack Hose Reels are placed, in Third rack Foam Carbuoys are placed. The items description is painted on the Fire Emergency Cabinet. The Usage of Flags is painted in all 'Fire Emergency Cabinets'. Pressure Gauges are arranged for Fire hydrant lines at various strategic locations, Where it can be visible all people.

6.5.3 Fire Water Pump House & Water Capacity

Two water reservoirs are provided with the approximate capacities of 10 ML and 280 ML within the project site for emergency needs. Water pump details are given below.

- FM Approved diesel driven pump with 681 m³/ hr pumping capacity and one Jockey pump with 68 m³/ hr pumping capacity were provided.
- Two no's of electrical driven pumps with 180 m³/ hr pumping capacity and One Jockey pump with 20 m³/ hr pumping capacity were provided as stand by.

The instrumentation control is arranged for the system to start the motors automatically and maintain the line pressure. The main function of the jockey pump is to boost up the pressure in line when the line pressure falls to 7.0 Kg/ cm², the jockey pump

will starts automatically and feed the water into the fire hydrant line when the line pressure increased to 10 Kg/cm² the jockey pump will stop.

The scheme of operation for fire water pumps viz. Main pump and Standby pump are given below.

Main Pump House Operating procedure of FM approved diesel engine & pump.

- Pressure transmitter gets sensing to activate through pressure sensing line when fire hydrant line pressure is decreased to 6kg/cm².
- Activated transmitter sends the signal to PLC.
- Activated PLC will send the signals to battery for activation.
- “ON” the self-motor of the engine by activated battery.
- Automatically on the fire diesel engine through the self-motor.
- Red LED will glow in PLC display after started the engine.
- Water will be pumped into fire hydrant line from the water sump through the fire diesel engine pump suction and delivery lines.
- Water will be circulated to the engine heat exchanger through the 1½” water line connected on delivery line of the pump and discharge into the water sump.
- Even though it is in auto mode engine should be stopped in manual mode only.

Both the systems are synchronized.

- Main pump (Diesel engine fire pump) “ON” when line pressure decreases to 6kg/cm², and pump shall be “OFF” manually.
- Main jockey pump starts when line pressure decreased to 7kg/cm² and stop when line pressure reaches 10kg/cm² automatically.

Stand by pump house operating procedure

- Pump no: 03 (JOCKEY PUMP) starts when line pressure decreased to 6.8 Kg/cm²
- Pump No: 01 Starts when the line pressure drops from 10 Kg cm² to 5.8 Kg/cm².
- Pump No: 02 Starts with in 30 Seconds if the line pressure is not increased to 7.0 Kg/cm² even though the Pump No: 01 is running

6.5.4 Foam Sprinkler System

The Foam Sprinkler system covers all the production blocks except the Water reactive chemicals storage / reactions area. The Foam Sprinkler system is also laid in BST yard. Safety department will discuss with production in-charges regularly, regarding the sprinkler lines and its modifications (about the water reactive chemicals and its storage, usage/ any new requirements/reshuffle of equipment). In case, if they require any modification safety department will take action.

It works with the fire hydrant system, foam tank connected to header which is located at outside of the block. Operating procedure for Foam Sprinkler system is displayed at the header, such that the valve operating person can read it while operating the valves. The Sprinkler line is marked with the reactor/eq. no's, where the sprinkler is arranged. A Mobile Foam Trolleys are placed in the strategic areas, for filling Foam in the Sprinkler system's tank during Emergencies. The Mobile Trolleys are located various strategic locations n the site, such that they are visible to all people, even in emergency.

Procedure for operation of foam sprinkler system

- Before operating the foam sprinkler system, check the area whether foam liquid usage is required or not.
- Isolate the power supply to the block by operating the emergency power shut "OFF" push button located at outside of the block.
- Ensure the main line pressure for 07 Kg/Cm²
- If any water reactive chemicals they should be removed from the block.
- Check the foam liquid level in the foam tank.
- Open the valve of the foam sprinkler line (check the area where it is required and See the valve No. which is to be operated)
- After opening the valve water will flow through the inline inductor and suck the foam from the foam tank.
- Foam with water will flow through the pipe line in to the block and foam water will make the foam at foam sprinkler.
- After usage drench the line with water by removing the sucking pipe of inline inductor from the foam liquid tank.
- High expansion ARFFF 1-3% foam liquid is used for the operation of foam sprinkler system. This foam liquid expansion ratio is 1:500 after mixing with water.

6.5.5 Fire Water Containment and Run Off

In the plant, whenever fire-fighting is carried with water or foam, sand is used to make a bund to avoid fire water runoff into soil or other storm water drains.

- Production block drains are connected to the block surrounding drainage. From the drainage the fire water is flow through the gravity to ETP effluent collection sumps for further treatment.
- Bulk storage tanks and day storage tanks have bund wall arrangement. Fire water shall be collected in bund walls later it shall be transferred and sent to ETP for further treatment through the mobile tankers.

For contain the fire, water and sand carboys are kept ready at blocks. They can be used in emergency situation.

7 Emergency Control Centre

Three Emergency Control Centers are identified in the site to handle the emergency. They are located at,

- i). Emergency Control Center – 01 (Safety Office).
- ii). Emergency Control Center – 02 (EOU GM's Office)
- iii). Emergency Control Center – 03 (DSN SEZ GM's Office)

An emergency control centre has been established and equipped with adequate means of communication to areas inside and outside of the works together with the relevant equipment to assist to those managing the emergencies and enable them to act accordingly. The control centers also contain the following.

1. Site plan /lay out
2. Public Addressing system Facility.
3. A list of hazardous materials available in site/MSDS.
4. Intercom Telephone Numbers list
5. Names, Addresses and Phone Numbers of emergency response personnel/team.
6. External Telephone numbers – like Hospitals, Blood Banks, Fire station, Police Station, Government Officials.
7. Telephone facility (Inter come & P&T)
8. Fire Hydrant layout
9. Emergency equipment / items layouts.
10. Evacuation plan
11. Mega Phones
12. Fire fighting nozzles (Jet nozzle, Fog nozzle, Spray Nozzles, Multipurpose nozzle)
13. Nomex fire suit
14. Cartridge & Canister Masks
15. SCBA sets
16. Wall clock
17. Drinking water
18. Barricading cone and tape
19. Safety net
20. Non Sparking tools
21. Hand held analyzers
22. Communication panel
23. Wooden plugs
24. Rain coats

- 25. Torch lights
- 26. Absorbents.

7.1 Occupational Health Centre

The industry is having an Occupational Health Centre managed by in-house Medical Officer. A good stock of Medicines, Oxygen Administration sets, Anti dotes, Automated External Defibrillator etc. are maintained, and Ambulances is available. The OHC will function as emergency First Aid Centre in case of emergency.

7.2 Evacuation Route & Gathering Areas

Assembling / Gathering areas are located in different areas which are away from the production Blocks. The same are given below

- Lawn in front of Dining Hall.
- Lawn beside the OHC.
- Lawn, in front of Q.C. Building.
- Lawn, in front of J & K-Pharma.
- Beside Nutra Building
- Lawn in front of T – Block
- Lawn beside the V- Block.
- Lawn in way of BST-2 from P-Block

Workers / employees are instructed to use only evacuation routes / pathways while reaching assembling / gathering areas.

7.3 Emergency Safety Cupboard

To tackle an emergency the plants are equipped with Self-Contained Breathing Apparatus. The location of Self Contained Breathing Apparatus and Emergency safety appliances are Located at,

- | | |
|------------------------|-----------------------|
| 1. SB - A | 2. RM Ware House - IV |
| 3. RM Ware house-II | 4 W-Block |
| 5. Near P – Block | 6. F – Block |
| 7. Near T- Block | 8. Near SB – E |
| 9. In front of J-Block | 10. SRS |
| 11. RM WH – V | |

The Emergency Safety Cupboard contains the following items

- a. Self-Contained Breathing Apparatus -02 sets
- b. Spare cylinders – 02 No's

- c. Tyvak/ Shirt & pant -01 set
- d. Splash goggles -02 nos.
- e. Chemical gloves -02 nos
- f. Electrical gloves -01 pair
- g. Safety belt -01 no
- h. Torch light -01 no.
- i. Face Shield -01 no
- j. Air mask -01 no
- k. Gas cylinder key -01 no
- l. Nylon rope -30 meters
- m. Resuscitator bag - 01 no
- n. Wooden sticks - - 04 no's
- o. Fire retardant suit - 01 no.
- p. Novamex Suit – 01 No's

7.4 Toxic Gas Leak Control Kits, Wind Socks & Stretchers

The toxic gas leak control kits are used to contain the leakage of gases. The windsocks help in identifying the direction of wind to safeguard in an emergency. These are located on following areas. Stretchers are used to carry the injured person in an emergency. The details of the locations of Toxic gas control kits, Wind Socks placement area and Stretchers placement areas are given in **Table 12**.

Table 12 Toxic gas leak kit, Wind Socks and Stretchers Locations areas

Toxic gas leak control kit location areas	Wind Socks location areas	Stretchers location areas
G-Block Area Infront of J-Block Water cooler area M- Block SB-A. Chlorine Shed H-Ext T-Block SB-E	New R&D Nutraceuticals A-Block Near P-Block on pipe rack B-Block SRS Water Purification block T-Block Between B & D Block V-Block J-Block W-Block Near J-Block on pipe rack SB -E	S.B – A RM Ware House-IV Water Purification Block Near E-Block Nutraceuticals building G- Block panel room P – Block In between J & K-Blocks R&D/DRC building SRS – II Boiler House – II RM Ware house-II H- Block STP Finished Building



	H-Ext Hostel area G-Block Service center	S-Block T-Block U-Block Water cooler area W-Block SB-E
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8 Emergency Communication Systems

8.1 Emergency Siren

There are Four no's Electrical Emergency Sirens in the plant. One is located at Safety office top floor, second no is located at J-Block top floor, third one is at T-Block top and fourth one is located at Nutraceuticals building. The siren at Safety office can be operated at A,B, C, D, E, F, G, P, M, & N, R-Blocks, S.B-A, RM Ware House-I & IV, Boiler House-II, Finished Building, R&D and Q.C, buildings. The electrical siren at J-Block top floor can be operated from H, H-Ext, J, K-Blocks, RM WH-II&III. The siren at T-Block can be operated at S,T,U,V,W - Blocks, SB-E, RMWH – V. The siren at Nutra building can be operated at Nutra building & SB-B only.

As soon as the siren blows one person will give the signal with red flag for easy identification of area where the incident/emergency is occurred and after situation is controlled the incident controller will give clearance to the same person to show the green flag as an indication that the emergency is controlled.

Red Color lights are arranged at each area push buttons of emergency siren. When the siren is hooted, the Red lamp glows for indication of Incident/emergency area/spot. The light glows whenever the push button is pressed.

A Green light is arranged in front of GM's office, in front of J- block and in between T&S - Blocks for monitoring the circuit healthy condition of Emergency siren's. The light will continuously blinks indicating that supply is running for Siren circuit. Whenever it stops glowing, it is the indication that somewhere siren push button is locked or supply for siren is blocked. Employee, whomever notices that Green light is not glowing, will inform in safety office or through intercom (2333/2444/2345). Six no's of Hand operated sirens are installed in the site, to operate in case of Power failures. These are located in front of EOU GM's office, In-between P&G-Blocks, Nutraceuticals area, in front of SB-C, SB-E and In between T&S -Blocks.

8.2 Public Addressing System

Public addressing system is established in Emergency Control Centers. During emergency, Site controller will operate it. Loud speakers are installed in front of each and every block/area and at some of the necessary places. Whatever instruction announces by the site controller, will pass through every loud speaker. Therefore, it will be made easy for communication during emergencies. Two 12V batteries are provided for power supply. Therefore, system will work irrespective of power supply.

8.3 Telescopic & Tilttable Movable Lighting Tower

It is emergency equipment for arranging light at where illumination is very low. As per the instructions from Site Controller the Movable lighting tower shall be brought to emergency spot. The Telescopic & Tilttable Movable Lighting Tower is having 9 Mts height and up to 7.5 acres of area shall be covered, the details of the same are given in **Table 13**.

Table 13 Details of Telescopic & Tilttable Movable Lighting Tower

S. No	FEATURES	NLT-9 Model
01	Engine make	Mitsubishi Heavy Industries (Mysore India) Model L2E
02	Generator Capacity	4.8kw
03	Fuel Consumption	1.5Ltr/hr
04	Fuel Tank Capacity (Diesel)	100 lts
05	Area Covered	07 1/2 acres
06	Most Rotating Facility	360°
07	Highest diameter of light fittings	√
08	Extendable Height	9mts
09	Lamps	Soduim Vapour / Halide lamp
10	Individual light shutoff	No
11	Indicators (oil level, voltage, fuel, overload, service due)	Yes
12	Lights available	4
13	Runtime (With full tank)	64hrs
14	Input power socket for running light	yes
15	Sound level in DB	73DB
16	Electrical classification	NFLP

9 Declaring Emergency (Normal Hours)

9.1 Fire Emergency

Any person noticing the fire, if he is confident to put off the fire, he shall attempt to put off the fire by using the nearby firefighting appliances. Simultaneously he will start shouting fire, fire / mantalu, mantalu, till assistance arrives and he may attempt to cut-off the source of fire (if he is confident). His colleagues or anyone who hears him shall intimate the safety department/other departments either by operating the siren or calling them by telephone.

The firefighting crew (Pre-identified and trained employees in firefighting) soon after the reaching the fire shall start firefighting work as much as possible and try to put off the fire. If the fire is not controlled within three minutes they will hoot the fire siren. As soon as siren blows concerned area incharge shall declare emergency and instructions to shut off the power supply by operating the nearby emergency power shut off switch and the shutdown officer shall cutoff the steam supply to effected area immediately. On hearing the fire siren the incident controller will rush to the scene and take the charge of the firefighting operations and on assessing the incident.

9.2 Liquid Leak Emergency

Any person noticing 'Leak' shall try to stop the leakage by operating valves / cut off the power supply to the related equipment etc.. If not possible, should intimate the Shift Incharge and Safety Department through intercom (2444/2345). The area in charge shall assess the situation and if required declare the leak emergency by operating the emergency siren. On hearing the siren, the Incident Controller will rush to the scene and take the charge and act according to his roles.

9.3 Toxic Gas Release Emergency

In case of toxic release, the man who notices shall shout 'Leakage' 'Leakage' till the assistance arrives. The person who hears the caption leakage shall intimate safety department/ other departments either by operating the siren or calling them by telephone (2444/2333/2345 etc.). On hearing the emergency siren the incident controller will rush to the scene and take the charge and act according to his roles.

9.4 Riot, Mob Attack, Thieves, & Terrorists And Natural Calamities:

In case of attacks by Riot, Mob Attack, Thieves, & Terrorists from outside and natural calamities, the man /guard who notice /discover shall shout as till the assistance arrives. The person / guard who hears about the attack shall intimate (through intercom) Emergency Control Centre, safety department, P&A,/ other departments. Up on receiving the intimation / information, the site controller declaring the emergency through the

public addressing system. By receiving the information the incident controller will rush to the scene. Assume charge and act according to his role. In the same way if any natural calamities noticed from External agencies, Internet, alerting news and Govt. Authorities, etc., On-Site Emergency Team and top management shall review the Situation and action plan shall be initiated.

Alarm codes during fire / toxic gas release are given in **Table 14**.

Table 14 Fire / Toxicgas Release Alarm Code

Fire/Explosion: Single Siren	1 minute
Liquid Leak / Toxic Gas Release: Double Siren	1 minute – 10 sec gap – 1 minute
All Clear: Long Continuous Siren	02 minutes long continuous
Note:	
<ol style="list-style-type: none"> The emergency shall be communicated by site controller/ safety concern, from the nearest Emergency Control Center through Public Addressing System. Based on the emergency situation Site controller shall instruct to Liaison officer regarding communication shall maintain with government bodies & local panchayath concern with coordination of P&A department. 	

9.5 Outside the Normal Hours (17.00 Hrs To 8.00 Hrs)

During afternoon shifts and night shifts the following management staff will take the charge and deliver the duties accordingly as given in **Table 15**.

15 Details of the Officers for Emergency Handling in outside normal hours

Incident Controller	Night residing GM /DGM/AGM / Sr. Manger
Communication officer	Night residing QC/QA officers/ Security officer
Evacuation officer	Night residing production Asst. Manger / Area Shift incharge / Supervisor
Shut Down / Services Officer	Night Residing Engg. Incharge (Elect./Services)/ Night Shift area Engg. Supervisor /Services supervisor
Fire officer	Night residing production Asst. Manger / Area Shift incharge / Supervisor
Leak Control Officer	Night Residing Engg. Incharge (Mech.)/ Night Shift area Engg. Supervisor.
Liaison / Resources/ supply Officer	Night residing P&A / WH officers
First Aider	Concern Block / area First Aider / Night shift OHC concern
Water Supply Officer	Night shift Water block supervisor / area services supervisor
Condition officer	Night residing R&D, QC, QA officers

Any person noticing fire/leak shall attempt (if he confident/able) to put off the Fire/ Liquid leak / Toxic Gas Release using necessary appliances available.

Simultaneously he will start shouting fire, fire, mantalu; mantalu or leak, leak (based on the situation of incident / emergency concern area persons assess the situatin and start the shouting relevantly) till the assistance arrives. His colleagues, himself, or any one who hears them shall arrange for hooting emergency siren.

The shift Mechanical Maintenance Incharge and Shift leak control crew and other management staff act according to “Specific Emergency Plan” till the On site emergency team arrives. If emergency is put off, long continuous siren shall give for all clear.

“The rescue and suppression crew soon after reaching the scene of fire shall start fire fighting”. As soon as Shift Electrical Incharge and Shift Mechanical Incharge hears the longest hooting of emergency siren should runs to the location assessing the situation the shift Mechanical Maintenance Incharge should arrange to call the fire brigade from Tagarapuvalasa (08933-226458) and Vizianagaram(08922-226101).

Other Non-essential workers should stop their work after taking necessary precautions and proceed to the gathering area (which is nearer to the spot against the wind direction) without becoming panic (as soon as they hear the emergency siren).

As soon as arrival of onsite emergency team arrives (Outside normal hour command structure) they (night shift officers) assume their respective duties as per the On-Site Emergency plan and report to site controller.

In the meantime the Shift incharge call the following emergency response personnel such as communication officer, Liaison Officer, Safety Officer, Concerned Block Sr. Officer and other key persons.

When the incident is controlled the Sr. Officer/Asst. Manger / Manager / Asst. General Manager / General Manager will arrange to blow siren for all clear signals. Hearing the all clear signal all the workers/staff assembled in the gathering areas shall resume for duties at their respective blocks.

9.6 Restarting Procedure

After the situation is brought under control the detailed inspection must be carried out by the committee consisting the following officers for giving clearance to normal operation.

➤ Site Controller

- Incident Controller
- Safety & EHS representatives
- Concerned area Sr. Manager / AGM / Night residing in charge.

On their satisfaction of the situation the Site Controller / Incident Controller give recommendations to resume normal work in the plant.

10 Key Persons and Their Functions

10.1 Essential Staff

In plant immediately affected areas or likely to be affected area as decided by the Incident Controller, efforts will be needed to shut down and make the process unit's safe. With the guidance or direction of the shutdown officer, this work will be carried out by the plant supervisor, provided they can do it without exposing themselves to undue risk. Some supervisors/ workers will also require to do above works. For e.g., as attendants, messengers, first aiders, leak control technicians, supply team, who will be essential staff and it is the responsibility of the Incident controller to identify the essential staff. The line managers who are not designated as key persons in the onsite emergency team, should assist the key persons as they will be directed by Incident Controller. The essential staff will assist the key persons for controlling of the emergency. It is the responsibility of the evacuation officer to remove the non-essential staff to other gathering areas.

10.2 Non-Essential Staff:

As soon as they hear the emergency siren all workers shall hand-over their work to essential staff and proceed to the gathering areas as per direction of evacuation officer. No worker other than required should be allowed near the incident site. Whenever their assistance will be required they will be informed. After hearing all clear siren they should resume for duties at their works.

The details of the Officer and their designation during emergency are given in **Table 16**.

Table 16 Details of the Officer and their designation during emergency

Name & Designation	Designation During the emergency
General Managers	Site Controller
AGMs – Production	Incident Controller
Asst. Managers – Production	Communication Officer
Asst. Managers – Production	Information Officer
AGM–Engg. /Sr. Manager–Engg. / Engg. Dept.	Shut Down Officer

Sr. Manager – Engg. / Manager - Engg. / Manager - Engg.	Leak Control Officer
Manager–Ware House/ Asst. Manager– P&A./ P&A. Dept.	Liaison Officer
Jr. Officer-Ware House/ Supervisor–Ware House	Supply Officer
Sr. Manager – Prod. /Manager– Engg. / Asst.Manager	Evacuation Officer
Asst.Manager-Safety / Sr. Officer – Safety / Jr. Officer - Safety	Safety Officer
Asst.Manager–production/P&A Dept. /Supervisor–P&A	Resources Officer
AGM–Ware House / AGM – Production / AGM –R&D	Conditions Officer
Sr. Officer– Engg.. / Sr.Supervisor– Engg.	Water Supply Officer
Manager – Projects / Sr. Manager – Prod. Sr. Manager – Prod.	Fire Officer
Medical Officer / Pharmacist / Supervisor	Medical Officer
<p>One Sr. Manager / Asst. General Manager / General Manager are available in the factory guesthouse after general shift hours on all days.</p> <p>One Engg. dept. Engineer / Officer / Manager / Asst. Manager, One Production Manager / Asst. Manager/ Sr. Officer and QC/ R&D Manager/ Asst. manager are available in all days after general shift hours.</p>	

11 Functions of Key Personnel

11.1 Site Controller

General Managers, he is responsible for overall On-Site Emergency control.

- As soon as he is informed of the emergency, he shall proceed to the Emergency Control Centre.
- He takes Care (slips, falls, Hit injuries, etc...) of himself during his way to Emergency Control Centre. Upon as soon as he reaches ECC, he shall send Hand Mike to Incident Controller through his office bearers.
- Assess the magnitude of the situation and up on knowing severity of incident from Incident Controller decides if evacuation is required from the affected areas and plant areas.
- He shall assess the situation in co-ordination with incident controller and take following actions.
- He first assess the situation on the basis of no human loss or threat to human life. When the situation warrants for evacuating all the personnel including fire fighters.
- He shall guide the additional emergency teams to take all the actions such as bunding, re routing of drains, creation of foam beds to the floors, closure of extended vents and common facilities avoiding flammable atmospheres, solvent spreading, compressed gas piping that will not allow the emergency situations to spread into neighboring areas to avoid loss extension to other areas.

- g. He ensures that BST & effected area / block power shut off and also all the tank valves closed at BST & as well as effected area /block for no transfers of the material during emergency. Supply of additional resources either form inventory stocks or from neighboring areas/ blocks.
- h. He shall guide neighboring areas to shut off the operations or to bring the operations to safer situation.
- i. He shall asses the situation and obtains additional resources from neighboring industries, government bodies, like district crisis group / state crisis group, technological solutions from the experts, government bodies.
- j. Maintain a continuous review of possible action plans and assess in consultation with Incident Controller and other key personnel as to whether shutting down of the plant and evacuation is required.
- k. He will use Public Addressing system to give instructions to the employees.
- l. Based on the emergency situation Site controller shall instruct to liaison officer, regarding communication shall maintain with government bodies & local panchayath concern with coordination of P&A department and hostel warden for dealing the emergency like evacuation / transportation, immediate shelters arrangement, etc.. if necessary.
- m. During off site emergency, liaise with the district emergency authority.
- n. Provide advice on possible effect on areas outside the factory premises.
- o. Inform the statutory authorities.
- p. He will make a contact with Management for giving the progress of the situation. He will assist management for post actions.
- q. Site Controller shall inform as necessary to Top management for taking a necessary action for speedy assistance from Local Administrative authorities, Enforcing departments, Ministries, Government , Government sector companies, Non-Government organizations etc.

11.2 Incident Controller

Incident controller is responsible to managing all emergency operations at the incident/emergency spot. As soon as incident controller receives the message of emergency, he will rush to the scene of occurrence, take over all charges, and report to site controller. He takes Care of himself from slips, falls, Hit injuries, etc...during his way to Incident spot.

- a. Before taking any action, he will assess the hazard that likely to happen for himself and his team. Take necessary precautions as necessary. E.g., wearing of appropriate PPE, necessary masks like Air mask/ SCBA, etc...
- b. In case the situation is aggravating / uncontrollable situation, he shall not go near to the incident/emergency spot and operate from appropriate safe distance and

- see that the Emergency team takes care all the precautions associated with that are to be taken during emergency.
- c. He will also directs / assess the pumping requirements the pollutants that occur during emergency and acts accordingly.
 - d. On arrival he will assess the magnitude of emergency exists or is likely to exists, inform Communication Officer and directs the Prod. Sr. Officer/ Shift in-charge
 - e. He delegates responsibilities to respective emergency response personnel.
 - f. Direct all operations with in the affected areas with priorities for safety of personnel; minimize damage to the plant, property, and environment.
 - g. Give instructions for the shutting down and evacuation of plant and areas likely to be adversely affected by the emergency.
 - h. Give instructions for the shutting done and evacuation of plant and areas likely to be adversely affected by emergency.
 - i. Ensure that all the emergency response personnel and outside help are called on.
 - j. Ensure that all Non-essential staff, public workers of the areas affected or evacuated to the gathering areas, and the area is searched for casualties.
 - k. He directly consults with the technical resources.
 - l. Direct the Sr. Officer/ Shift In-charge of affected areas by safeguarding personnel, minimizing the damage to plant and environment.

11.3 Communication Officer

Up on hearing the emergency siren Communication Officer shall proceed to the emergency/incident spot and reports to incident controller and be away from Incident Controller.

- a. He takes Care of himself from slips, falls, Hit injuries, etc...) during his way to Incident spot.
- b. After getting information from Incident Controller through Hand Mike, he will inform to the site controller regarding the situation by using telephone/ by messengers as necessary depending on the situation.
- c. In case of failure of communication system he will reserve specified messengers to act as runners between the site controller and himself.
- d. Based on situation and getting the information from site controller & incident controller, communication shall be maintained with the hostel wardens and P&A dept.

11.4 Supply Officer

Up on hearing the emergency siren Supply Officer shall proceed to the emergency/incident spot and reports to incident controller.

- a. His main duty is to provide equipment and material that might be needed during the Emergency.

- b. He and his team takes Care of them selves from slips, falls, Hit injuries, etc...during his way to Incident spot.
- c. Then knowing the incident he shall select the staging area which may not be in the proximity of Emergency Control Centre and shall be close to the incident controller.
- d. He shall co-ordinate the activities through Incident Controller.
- e. He shall work closely with rescue and suppression Officers and move tools, Fire equipment, full fill the containment items/ requirements (if any leak/spill), personnel and apparatus to the rescue and suppression officers.
- f. He is to ensure that apparatus and equipment are available for immediate requirement.
- g. He must keep an inventory of equipment and make sure that supplies are maintained.
- h. He shall also provide personnel protective equipment for operating personnel and medical Facilities.

11.5 Leak Control Officer

Up on hearing the emergency siren Leak Control Officer shall proceed to the emergency/incident spot and reports to incident controller. As per the directions of the Incident Controller, his crew wear Self Contained Breathing Apparatus or appropriate PPE and enters into the area of leakage along with leak control kit.

- a. He and his team takes Care of themselves from slips, falls, Hit injuries, etc...during his way to Incident spot.
- b. Before taking any action, he will assess the hazard that likely to happen for himself and his team. Take necessary precautions as necessary. E.g., wearing of PPE, PVC suit, PVC apron, Face shields, gumshoe, necessary masks like Air mask/ SCBA, nose mask, required neutralizing agents etc...
- c. In case the situation is aggravating / uncontrollable situation, he shall not go near to the emergency and operate from appropriate distance and see that the Emergency team takes care all the precautions associated with that are to be taken during emergency.
- d. Direct all operations with in the affected areas with priorities for safety of his team and personnel; minimize damage to the environment.
- e. On assessing the situation, leak control crew contain the leakage
- f. He shall maintain the leak control procedures of toxic gases/liquid leak and also he should know the neutralizing agents.

11.6 Information Officer

Up on hearing the emergency siren Information Officer shall proceed to the control centre and report to site controller.

- a. He takes Care of himself from slips, falls, Hit injuries, etc...during his way to Emergency Control Centre.
- b. He is responsible for dealing with news media and see that proper and correct information is given.
- c. He shall maintain the communication (continual / frequent communication maintain) with hostel warden & security concern regarding the emergency situation.
- d. The Information Officer frees the incident controller from the problems of interviews and descriptions during an emergency decision making.

11.7 Medical Officer

Up on receipt of information keep himself in readiness and alert his staff to attend serious and urgent cases.

- a. The Medical Officer is responsible for providing first aid to those injured/ rescued and making that they are promptly shifted for treatment.
- b. Co-ordinate with the supply officer for medical supplies, respirators, oxygen and Ambulance.
- c. He should be familiar with antidotes for specified chemicals.
- d. If victim is panic and behaving abnormal, he would seek assistance from the neighbour departments.
- e. He will assess the situation in case of more numbers of victims sent to OHC, he will assess the severity of the victim/s, start treatment as necessary, and seek assistance from First Aiders if required to suppress the panic situation of the victims.
- f. If the situation is uncontrollable, he will seek the senior staff from neighbour department's assistance in improving the confidence of the victim.
- g. Depending upon the situation, he will direct P&A department to send him to Outside hospitals as necessary.

11.8 Shut Down Officer

Up on hearing the emergency siren he shall proceed to the control centre and report to site controller.

- a. He takes Care of himself from slips, falls, Hit injuries, etc...during his way to Emergency Control Centre.
- b. Before taking any action he will assess for the hazards like Electric shock, thermal burns, etc...
- c. Understanding the situation and arrange to shutdown the power and steam of equipment, plants etc. as required instructions of incident controller.
- d. On hearing the all clear signal he will resume to start up the shut downed equipment and plants up on clearance from Site Controller / Incident Controller.

11.9 Resources Officer

Up on hearing the emergency siren he shall proceed to the Emergency Control Centre and report to site controller.

- a. He takes Care of himself from slips, falls, Hit injuries, etc...during his way to Emergency Control Centre.
- b. If necessary he shall contact the neighboring companies/local vendors to supply for arrangement of control centre equipment and record the details.
- c. He shall communicate the arriving equipment / material details to information officer to allow inside and direct them to emergency area.
- d. He shall make a clear report and submit to site controller to communicate the resource availability message to incident controller.

11.10 Liaison Officer

Up on hearing the emergency siren he shall proceed to the control centre and report to site controller.

- a. He takes care of him self from slips, falls, Hit injuries, etc...during his way to Emergency Control Centre.
- b. He co-ordinates with all outside agencies who offer assistance to an emergency response supporting team.
- c. He shall maintain the communication with the local panchayath/ surrounding villagers and govt. bodies, based upon the emergency situation. And he shall proceed further course of actions like evacuation / transportation, immediate shelters arrangement, etc.. with the guidance of Site controller.
- d. He shall know who represents the various agencies and where and how to contact them.
- e. Some of the agencies liaised with law enforcement, public fire services, red cross, rescue or emergency services, local Government Officials, (Inspector of factories, Police) Utility Personnel (Water sewer, telephone and electrical) health officials, hospitals and ambulance services, lawyer for legal advice (if necessary).
- f. He is to ensure that the victims are paid adequate attention and the alternate transport is available, when need arises.
- g. When emergency is prolonged he shall co-ordinate with supply officer in arranging for the relief or rescue or fire fighting personnel and organizes refreshments or catering facilities.

11.11 Safety Officer

Up on hearing the emergency siren he shall proceed to the control centre and report to site controller.

- a. He takes care of himself from slips, falls, Hit injuries, etc...during his way to Incident spot.

- b. Assists Site Controller in maintaining prescribed equipment ECC.
- c. He works as coordination between Site Controller and Incident controller.
- d. He coordinates between all officers.
- e. He ensures that assistance is given to Incident Controller.
- f. He coordinates with Site Controller for outside assistance from the other blocks.
- g. Ensures that other areas shall not affect.
- h. He maintains all telephone numbers like Intercom, outside Telephone, Fire Stations, Police Stations and hospitals etc.
- i. He will observe for any lapses in attending emergency and informs to Site Controller and Incident Controller.
- j. He prepares progress report on all actions that are carried out at affected area.
- k. He checks/ ensures that the impact will be less on the environment during any emergency occur.

11.12 Conditions Officer

Up on hearing the emergency siren he shall proceed to the emergency/incident spot and take charge.

- a. He takes care of himself from slips, falls, Hit injuries, etc...during his way to Incident spot.
- b. He keeps records of what is happening during the emergency.
- c. Progress report will come to the conditions officer from which a current status report of the situation is maintained for incident controller. He will record all functions of the involved persons, possibility and direction of spread, progress of the suppression, rescue forces, and special factors such as rerouting of traffic, arrival of special extinguishing agents, and evacuating procedures etc.
- d. Conditions officer has the responsibility of the photographic coverage of the incident if required.
- e. Condition officer should maintain overall control chart for incident controller, which would give details of the key persons at the scene and their assignments, what has been done, what is being done and what need to be done. The chart should also contain rescue and suppression personnel and positioning of apparatus and attack positions.
- f. Condition officer gives importance to the environment and informs the lapse made by the key persons.

11.13 Evacuation Officer

Up on hearing the emergency siren he shall proceed to the emergency/incident area and reports to incident controller.

- a. He and his team takes care of themselves from slips, falls, hit injuries, etc during their way to incident area.

- b. He shall act according to the instructions of incident controller. Also will have clear instructions for the area covered for evacuation.
- c. He and his team shall actively contribute while evacuating the employees during emergency with out getting panic.
- d. He gives instruction to his team members to evacuate the non essential persons including contract workers from the emergency / incident area while giving due consideration to the wind direction.
- e. He and his team shall evacuate the persons including contract workers with the guidance as below.
 - Do not get panic.
 - Use only evacuation routes / pathways while reaching gathering areas
 - Consider wind direction. and move up wind
 - Do not run, walk brisk.
 - Do not tress pass / overtake / push others while getting out.
 - Do not waste time in collecting your belongings / tools / tackles / documents etc...
 - Assemble at the designated gathering areas only.
- f. Advise all the employees and contract workers (other than key persons, like fire fighters & first aiders, leak control team etc.) to assemble at gathering area (areas – 1, 2, 3, 4, 5, 6 &7) via evacuation routes. Gathering area shall be chosen depending upon wind directions. All the employees during evacuation shall be directed to the upwind direction in case of toxic gas release.
- g. If the chemical release / spill is large and / or in a poorly ventilated area, Based on the instructions form incident controller, the near by area / block persons shall also be evacuated.
- h. He enquired the situation in hostel with the hostel warden during emergency, and he shall act as per the situation with the guidance of Incident & Site controllers.
- i. Evacuation Officer shall evacuate the persons whoever working at heights, working in confined spaces, loading and offloading the tankers / trucks etc.
- j. He should nominate one of his team members to monitor the condition of the employees and the wind direction at the gathering areas very frequently. If any abnormal conditions arise at gathering area he calls for emergency medical assistance by calling 2109, by giving the information like location of the gathering area, extent and nature of the injury, if known Evacuation team member shall also give the details about the chemicals, toxic fumes involved / exposed etc.
- k. Based on the incident and situation, up on data collected from concern block/ department in charge, head count shall be done by evacuation officer at gathering area. And also he will enquire the Security & P&A concern for Biometric for

ensuring everybody in safe. If anybody found missing, he shall inform to site controller.

- l. Up on instructions from Site controller, He shall maintain regular communication with hostel warden on emergency, evacuation shall be done at hostel if required.
- m. He shall give information to Local Panchayath with help of P&A department on emergency up on instructions from Site controller.
- n. He shall also control traffic movement inside the factory like stopping vehicle movement , etc.. He can use security persons as evacuation team members.
- o. When site controller gives all clear signal, he shall call back the employees to their respective area / blocks up on clearance from inspection team for restart.

11.14 Water Supply Officer

Up on hearing the emergency siren he shall reports to Site Controller and takes charge.

- a. He takes care of himself slips, falls, Hit injuries, etc... during his way to Water sumps and pumps.
- b. He performs such as determining the locations, accessibility, and water quantities available from all usable sources. Evaluating the incident, water requirements or quantities needed for planned operations and how this compares to the supply / stock available. He initiates water supply operations to over come deficiencies.
- c. The officer should be familiar with water system or have proper drawings available that indicate the storage capacities, pipe sizes and pump capacities.
- d. Water supply officer must maintain constant communication with Site Controller to perform efficiently. He should arrange for change over of pumps and system with stand by in case of Mechanical difficulties. He will co-ordinates with fire officer.

11.15 Rescue & Suppression Officers

All Shift In charges will become as rescue and suppression officers along with emergency volunteers.

- a. Rescue and suppression wing contains rescue and suppression officers and emergency volunteers. In case of emergency, each and every Shift In-charge will become as Rescue & Suppression officers for their blocks.
- b. They takes care of themselves from slips, falls, Hit injuries, etc...during their movement in the blocks.
- c. Incase the situation is aggravating/ uncontrollable situation, he shall not go near to the emergency and operate from appropriate distance.
- d. He and his team supports/provide to the key persons requirements (like foam/fire water bunding, contain kits / neutralising agents supplying etcc..) in spot of the emergency.

11.16 Fire Officer

Up on hearing the emergency siren he shall proceed to the emergency/incident area and reports to incident controller.

- a. He and his team takes care of themselves from slips, falls, hit injuries, etc during their way to incident area.
- b. Before taking any action, he will assess the hazard that is likely to happen for himself and his team. Take necessary precautions as necessary e.g., wearing of PPE, like NOMEX Fire suits, Fire retardant suits, Fire Blankets, necessary masks like Air mask/ SCBA, etc...
- c. He gives instruction to his fire fighters on how to tackle fire emergency. He also takes care of his fire fighters safety during the scenario.
- d. In case the situation is uncontrollable, he shall not go near to the spot (Incident / Accident) and shall operate from appropriate distance and sees that his Emergency team members (fire fighters) takes care of all the precautions associated.
- e. He consults Shift In charge / Supervisor of area regarding special precautions such as:
 - Type of chemical
 - Type of extinguishing media required (DCP,FOAM etc.)
 - Toxic products & combustible materials.
 - Water reactive chemicals storage & reaction.
 - This is to use correct extinguishing media for fire fighting.
- f. Decide line of action in consultation with the incident controller.
- g. Consult with water supply officer for additional water sources.
- h. Consult supply officer for immediate requirement of Personnel protective equipment, apparatus and equipment.
- i. Guide fire fighters during Fire Emergency if necessary.
- j. If any fire hydrant system/ sprinkler system is used for fighting purpose, rescue and suppression team supports to the fire team to see that the foam/fire water should not spread on the soil, any area and send to ETP through drain.
- k. He instructs to his team members to clean the affected area (the area where fire extinguishers are used), in order to protect the environment, the cleaned material will be send to ETP

12 Emergency Control Procedures

All employees will be trained in practicing Fire Prevention measures, firefighting. The practical demonstration of firefighting will be conducted once in every month and it is ensured that each employee is covered in demonstration. In the practical demonstration,

the operation of the fire extinguishers will be taught at the same time if any powder sprays to other areas, the total area where the fire extinguisher are used should be cleaned and must be send to ETP.

12.1 Fire Emergency Procedure

Fire or any external source of heat results rapid increase of pressure in the containers and lead to rupture. If the toners/ cylinders are involved in fire accident, they should be shifted away to an isolated area. When this is not possible, water should be sprayed continuously to cool the cylinder.

- a. As soon as the fire is noticed the person who noticed fire should operate suitable fire extinguisher and try to extinguish or confine the fire.
- b. Simultaneously he should start shouting “FIRE, FIRE...”.
- c. Take the help of other employees in getting some more suitable fire extinguishers.
- d. Shift in charge should inform about the incident to the SAFETY DEPARTMENT and also to the concerned department head.
- e. Once emergency siren is blown the situation should be handled as per the On Site Emergency team
- f. By hearing the siren fire volunteers will bring the fire extinguishers from various locations will assist to the Emergency team.
- g. If any fire hydrant system/ sprinkler system is used for fighting purpose, rescue and suppression team supports to the fire team to see that the foam/effluent should not spread and send to ETP through drain.
- h. After controlling fire, Rescue and suppression team reaches the spot and clean that area and collect the cleaned material and send to ETP.

12.2 Toxic Gas Leak Emergency Procedure

- a. Person(s) after observing the TOXIC GAS LEAK shall evacuate the area upwind.
- b. Simultaneously he will report to “ Area controller/ shift Controller”
- c. Call the “ Ambulance” and transport the victim (s) (if any) and send the “Antidote kit” along with the victims.
- d. Inform/ alert the “Surrounding Blocks” about the situation and evacuate to up wind if necessary.
- e. If it is “Major” Leakage, evacuate OFF- SITE PEOPLE also.
- f. If it comes from leakage of reaction mass, “stop the drainage flow”. Do not let the reaction mass to mix with other effluents.
- g. Neutralize the spilled material with suitable “Neutralizing Agent” by wearing Air Mask/ TYVAK hood / SCBA Set.
- h. Stop the agitation by switching off at panel room.

- i. Wash the “spilled area” with flowing water and let into the drainage after “Neutralization”
- j. If it is “MINOR”, Block personnel may control it.
- k. If it is “MAJOR” Leakage, then the situation should be taken as EMERGENCY & Declare “ The Emergency” and assume the responsibility to Key personnel as Per “ ON-SITE EMERGENCY PLAN”.
- l. Tightening gland nuts may connect leaks on cylinder valves.
- m. If a leak persists, the cylinder should be discharged into water.
- n. In cases, where leaks cannot be valued off, use large volumes of water sprayed directly on the leak and maintain contact until the contents have been discharged and the tank is empty.
- o. The person handling the leak should handle from an up wind side.
- p. The person tackling a leakage of ammonia should be equipped with self-contained breathing apparatus (SCBA)/PVC hood and other appropriate PPE (i.e., TYVAK suit, hand gloves, and gumshoes).
- q. In case of a large spill, evacuate in a down wind direction an area of 0.4 miles wide and 0.6 miles long.
- r. If possible, turn leaking cylinder so that gas escapes rather than liquid.
- s. Isolate area until gas has dispersed.
- t. Use water to reduce gas cloud from severe leak or spill.
- u. Arrest the leak using toxic gas emergency kit.
- v. Prevent liquid entering sewage drain.
- w. Contain leaking liquid with sand or soil.
- x. Collect the spilled material into a separate container and send to ETP for disposal.

12.3 Gas Leak Control Tool Kit:

Tool kit for arresting Toxic gas (chlorine) leak from toners and cylinders is available at various strategic locations in the premises. This kit contains specially designed tools to suit various parts of the toners and cylinders. The essential tools include in the kit are grouped in three given in **Table 17**.

Table 17 Details of the tools in gas leak control kit

Group A	Group B	Group C
<ul style="list-style-type: none"> - Tie rods - Relevant solution in a glass bottle. - Big hood with vent valve and valve cap 	<ul style="list-style-type: none"> - Gas mask with corrugated hose - Filter canister. - Fiberglass hood respirator with PVC 	<ul style="list-style-type: none"> - Spanners- 30mm X 32mm & 3/4” X 5/8” - Stud with welded handle. - Hammer. - Rubber gasket (OD 155mm – ID



<p>on.</p> <ul style="list-style-type: none"> - Angle irons - Small hood. - Round yoke plate with cap screw. - Chains-96" long. - Base plates. - Leak detection torch. 	<p>bolero.</p> <ul style="list-style-type: none"> - PVC Apron. - One pair of PVC hand gloves. - Gas tight rubber goggles. 	<p>90 mm).</p> <ul style="list-style-type: none"> - Flexible copper tubing. - Yoke clamp. - Yoke with stud. - Opening/ closing lever for vent valve. - Tie rod pipe pieces. - Cap nut. - Drift pins. - Rubber gasket. - Rubber gasket (OD 115mm – ID 60mm). - Tie rod washers. - Fiber gasket (1.25" OD – 0.75" ID). - Blind fiber gasket (1" dia.,). - Teflon tape. - Steel patch plate. - Dummy clamps for the valves. - Valve hood with tie rod assembly for toners. - Hood and clamp assembly for dummy plugs on toners. - Dummy block with chain assembly for toners. - Valve hoods and chain assembly for cylinders. - Ring type clamp assembly for cylinder shell, steel drift pins, wooden pegs, rubber gaskets, gland packing etc. and wrenches, keys, ammonia torch etc.
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The person, who attends to control leaks, must gain higher skills in the use of emergency tools and have to work speedily without any confusion.

12.4 Leak Control Measures

Leak from valve gland

Gland leaks develop due to a) Worn-out packing or spindle stem and Gland nut threads slip. These leaks can be controlled by any of the following corrective measures:

- a) Gently tight gland nut.
- b) Shut the valve fully
- c) Fix the dummy hood on valve with tie rods or chain assembly.

Leaks From Valve Seating

These leaks are common and the reasons will be :-

- a) Human errors .e.g.: Valve not closed or partially closed.
- b) Valve struck up in open position.
- c) Foreign matter or scale on seats.
- d) Worn – out or scratches on seat surfaces.
- e) Spindle threads slipped.

The leak control method can be chosen depending on the type of trouble exist.

- a) Shut the valve completely
- b) Hit the wrench with the heel of hand to operate struck spindle. Hammer or other implements should be used.
- c) Slightly open the valve and close immediately to blow out foreign matter in valve.
- d) Fix valve outlet dummy cap.
- e) Fix dummy clamp on valve outlet. This is ideal method for arresting seating leaks.
- f) Fix dummy hood on valve with tie rods or chain assembly.

Note: Vent valve on dummy hood should be opened to release pressure and it is closed after tightening the hood assembly.

Leak From Valve External Threads

This type of leak may happened due to

- a. Worn-out threads and
- b. Valve struck by hard object

This leak can be controlled by fixing a dummy hood on the valve with tie rods or chain assembly.

Valve Broken Or Detached

This can be happened due to

- a) Careless handling.
- b) Dropping containers from height.
- c) Valve struck by hard object and
- d) Defective threads.

These leaks can be controlled by

- a) fixing dummy hood on valve end
- b) Inserting steel drift pin or wooden peg in the hole.

Leaks from Container Shell

The chlorine toner or cylinder shell may develop leak due to

- a) Cracks due to large dents.
- b) Hole formation due to top fitting and
- c) Corrosion.

The leak on the toner shell is controlled by fixing a chain and yoke assembly, but leak on dished ends can't be controlled by this method. Wooden plug can be inserted in the holes only as a last effort. This involves risk of enlargement of hole.

The persons who attend to control leaks, must gain higher skills in the use of emergency tools and have to work speedily without any confusion.

12.5 Emergency Handling Procedure for LPG

The degree of fire and explosion hazards of LPG is High, mainly for the following reasons

- a. Extremely low boiling point
- b. Large liquid to gas expansion ratio (1:245 to 270) at room temperature and subsequently the air/LPG flammable mixture is 10 to 100 times the gaseous volume of LPG.
- c. Poor visibility of the Ignitable mixture and High burning velocity (0.38 m/sec) that can injure instantly anyone coming into contact with it.
- d. Ability to Ignite and burn as a Deflagration, giving rise to a fire ball with intensive heat radiation.

The emergency handling procedure for LPG leakage are given below

- a. Evacuate the area.
- b. Shut off all ignition sources.
- c. The person handling spill or leakage of LPG should be equipped with self contained breathing apparatus and other appropriate PPE (i.e. Tyvek shirt and pant, Tyvek hood, hand gloves and gum shoes).
- d. In case of major leakage (depending upon situation) warn all persons including neighbors.
- e. In case of large leaks the first step to do is try to stop the flow by closing the valves.
- f. If practicable, without unduly endangering the personnel safety, stop the leakage at source.
- g. Prevent material from entering the confined spaces, sewers and other water sources.

- h. Stay upwind.
- i. Do not touch the spilled liquid and avoid inhalation.
- j. Contain spilled liquid with sand, earth or absorbent material which does not react with LPG.
- k. Do not put water on spilled LPG.

12.6 Electric Shock Emergency

If shock observed, start alerting others by shouting that SHOCK, SHOCK still assistance is arrived.

- a. Colleagues or any one who hears him shall intimate the safety department/other departments either by operating the SIREN or calling them by telephone.
- b. Do not allow the unknown/out side persons into the scene as they may also effect to the shock.
- c. In case of block, immediately push the Emergency Shut Off Switch. They were available in First floor and ground floor.
- d. Supervisor/ incharge attending the scene shall immediately STOP/ISOLATE the connected source form the victim.
- e. Incase Fire/Flash occurred in MCCs/PCCs/HT Sub-Stations, the responsible persons and On-Site Emergency Team will handled the matter as serious.
- f. Department Fire volunteers shall being the fire Extinguishers (DCP & CO2) from the various places.
- g. If still the hazard is not controlled, then INCIDENT CONTROLLER, who reached the spot, will inform the SITE CONTROLLER regarding the incident and he declares the Emergency and assume the responsibilities to KEY PERSONNEL as per On-Site Emergency Plan.

12.7 Emergency Procedure For Leakage From Tank

On noticing the leakages from tank first evacuate the area if required.

- a. Shut of all sources if any.
- b. Incase of major leakage warn all the employees.
- c. Barricade the area with danger boards & flags.
- d. Stay up-wind direction.
- e. While arresting leak, wear PVC hood/PVC suit/ Air mask/Hand gloves / Gum shoes.
- f. Make a bund wall with sand to avoid spreading.
- g. Unload the material into drums/ tank.
- h. Shut off leak without risk if required.
- i. Prevent liquid entering drains, sewages lines / drains, basements and work pits. Vapour may become create highly vapour cloud and flammable and irritating atmosphere.

- j. Spray water to control the vapour cloud.
- k. Spray the soil, sand, and absorbent and neutralizing material on spilled area.
- l. Collect the spillage into a separate container and send to ETP for disposal.
- m. In case of minor spillage/ leakage the solvent will be prevented by not spreading through sand or soil. It will be transferred in to carboys by wearing complete PPE; the affected part of floor will be cleaned and that collected material will be send to ETP.
- n. In case of major spillage/ leakage the solvent will be prevented by not spreading through bund wall. It will be transferred through pumping to mobile Shuttle transfer tanks for transferring in to other storage tanks.

Note: For neutralizing materials refer MSDS.

12.8 In Case Of Hazardous Material Spillage / Leakage

If leak / spill is observed, first it shall be attempted to control by stopping the pump / closing the valve, if possible.

- a. Simultaneously it shall be reported to Shift Incharge/ Sr. Officer.
- b. Assess the leakage / spillage magnitude whether it is major / minor.
- c. Based on assessed situation, arrange the neutralizing material, sand, and water hoses make ready to contain the spilled liquid.
- d. If possible, arrange vacuum line to suck and to control the leakage. If vacuum to be used, it should be collected into empty trap.

Depending upon the size and nature of the spill, and the hazardous chemical involved, the following steps must be taken:

01. Evacuate any non-essential personnel to an area safe from any possible harm and provide emergency first aid if called for.
02. If the chemical is flammable or combustible, reduce the risk of fire or explosion by extinguishing any open flames and any other sources of heat or ignition.
03. Evaluate the extent of the situation and the ability of plant personnel to deal with it. If necessary call outside assistance.
04. Assume that it is an abnormal situation, although personal protective equipment may not be necessary in the day to day handling or use of the chemical. Spill or leak may go beyond the operational control that normally applies. PPE can be determined in advance to deal safely with the situation from MSDS.
05. Eliminate the further spread of the chemical involved by control it at its sources if possible. This may be done by closing a valve, sealing a tank or re-routing a process or containing with sand etc.,
06. Attempt to contain the spill or leak by dyking and / or absorption. If appropriate, the chemical should be either sealed in containers or neutralized.

07. Once the chemical is safely stored or neutralized the area of the spill or leak must be decontaminated, inspected, and shift to a safe place.
08. Don't cover the acid spillage with any dust. It creates fire risk.
09. Don't pour alkali material on concentrated acids.
10. Skilled / trained person should handle the leaks / spillage.
11. If any person is found injured in this situation, call for First Aider.
12. If the area is found safe, normal activities can resume upon taking confirmation by Shift-Incharge / Sr. Officer

a.If the leak is from Pipe Line

- Assess the situation whether it can be handled within the block or area or outside (From other areas) assistance is required.
- The pumping / transferring should be stopped immediately.
- Leak should be stopped by closing valves if possible.
- The area should be barricaded and persons in and around area shall be cautioned.
- Shift all reactive materials, if any to a safe area.
- Skilled / trained persons should handle the leaks by wearing suitable PPE and appropriate tools.
- Shut off all ignition sources.
- Observe the wind direction and proceed.
- Contain the spillage by using sand / soil.
- Sweep up / vacuum the spillage, neutralise and collect into suitable container for disposal to ETP.
- Neutralise the spilled area and Flush with plenty of water.

b.If the leak is from Drum/ Carbuoy

- The leak should be contained by using sand to prevent spread.
- The content in the leaky container is to be transferred in to another suitable empty drum by applying vacuum, if possible.
- The leak spot can be blinded, if practicable.
- Shift all reactive materials, if any to a safe area.
- The above operations to be carried only after wearing suitable PPE.
- Contain the spillage by using sand / soil.
- Sweep up / vacuum the spillage, neutralise and collect into suitable container for disposal to ETP.
- Neutralise the spilled area and Flush with plenty of water.

c. If the Storage Tank develop leaks

- Assess the situation whether it can be handled within the block or area or outside (From other areas) assistance is required.

- The leak should be contained to prevent spread.
- The leak spot can be blinded, if practicable.
- Shift all reactive materials, if any to a safe area.
- Observe the wind direction and proceed.
- The content in the leaky tank is to be transferred in to another suitable empty tanks / drums by pumping / applying vacuum.
- Stop leak if you can do so without risk.
- Skilled / trained person should handle the leak by wearing suitable PPE and appropriate tools.
- Shut-off ignition sources, if any.
- Sweep up / vacuum the spillage, neutralize and collect into suitable container for disposal to ETP.
- Neutralize the spilled area and Flush with plenty of water.
- If the situation is not controllable, hoot the siren and call for emergency team.

It is essential that the plant personnel dealing with the spill or leak should immediately be able to judge whether or not the situation can be handled from within the plant or whether outside assistance is needed. Only trained and knowledgeable persons should involve in the controlling operations.

If leak / spill is minor, it will be controlled by block personnel itself.

If major leakage / spillage, then situation will be declared as the emergency and assume the responsibility of key personnel as per On – Site Emergency Plan.

d. If Nitrogen supply fails

- By receiving information from Service Block...
- Immediately stop charging / agitation of the critical batches,
- Stop steam supply to reactor,
- Apply Nitrogen only to specific equipment, which requires nitrogen-blanketing compulsory from the Nitrogen bank.
- Stop using nitrogen for transferring / filtration.
- Bring down all the operations to a safer level and maintain the Nitrogen bleed
- Simultaneously follow the RM WH to organise additional Nitrogen Cylinders

e. If Power supply fails

- Stop the steam supply immediately.
- Immediately stop material charging / addition into reactor.
- If there is any critical reaction, that reacts vigorously if not agitated, a person must be kept ready at the bottom valve for unloading the material ump tank.

- Apply Nitrogen to specific equipment, which requires nitrogen blanketing compulsory.
- Assess the situation whether it can be handled with in the block or out side (from other areas) assistance is required.
- If the situation exceeds the normal condition, evacuate the place, and hoot the Hand operated Siren, which is located, in front of GM's Office.

f.If Brine supply fails

- The chemical additions, which generate heat / exothermic, are to be stopped.
- Apply Nitrogen to specific equipment, which may create other risks due to increased temperature.
- RT cooling to be given, wherever required.
- Assess the situation whether it can be handled with in the block or out side (from other areas) assistance is required.
- For critical reactions, which produces high exotherms shall be immediately stopped. A person, wearing PPE, should be kept at the bottom valve of reactor for unloading the material into dump tank.
- If the situation exceeds the abnormally, drain the reaction mass in to the drain or quench tub.
- If the situation exceeds the normal condition, evacuate the place and hoot emergency siren.

g.If Reactor pressure builds up or run-away reaction takes place

- Assess the situation and inform shift incharge.
- Stop steam / hot water supply immediately.
- Immediately stop the feeding / charging any material / reactant.
- Alert the surrounding people.
- Supply RT water / Brine to the reactor jacket
- Apply Nitrogen blanketing to reactor in order to avoid the Fire risk.
- Open all vents of the reactor.
- Evacuate the surrounding people
- If the situation is still uncontrollable, drain the material into the drain / dump tank.
- If any person is injured in the situation, call for First Aider and inform OHC.
- If the situation exceeds the normal condition, evacuate the place and hoot emergency siren.

h.If Reactor temperature raise or run-away reaction takes place

- Assess the situation and inform to shift in-charge
- Stop the steam / hot water supply immediately.
- Immediately stop the feeding / charging any material / reactant.
- Alert the surrounding people
- Supply RT water / Brine to the reactor jacket
- Give Nitrogen blanketing to reactor in order to avoid the Fire risk.

- Open all vents of the reactor.
- Evacuate the surrounding people
- If the temperature can not be controlled immediately drain the material into drain / dump tank.
- If the situation exceeds the normal condition, evacuate the people.
- If any person is injured in the situation, call for First Aider and inform OHC.
- If the situation exceeds the normal condition, evacuate the place and hoot emergency siren.

13 Emergency Action Plan for Riot, Mob Attack, Thieves, Terrorists and Natural Calamities:

After receiving the information through Telephone/public addressing system about the attack of Riot, Mob Attack, Thieves, & Terrorists, the site controller, shall alert key personnel as per on-site emergency plan through public addressing system.

- a. Employees from Nearest blocks/ departments, fire fighting teams, along with leak control team shall reach the area/spot immediately after hearing/receiving the information. Remaining teams also may participate if required.
- b. All key personnel shall take their positions as per their responsibilities.
- c. Fire officer / Leak control officer shall alert their teams to take action against threat as per instructions of incident controller.
- d. Cover the area by the emergency teams.
- e. Action shall be taken as per nature of the threat.
- f. Intimation to the police station and fire station will be given to get external help if needed as per the instructions of site controller.
- g. Emergency equipments such as torch lights, sticks, ropes etc.. shall be collected from security /time office where they are kept ready to use in emergency situations only.
- h. Process area shall be alerted about threat to take necessary actions.
- i. Emergency facilities such as OHC and ambulance shall be alerted.
- j. Neighboring industries help shall be taken if needed
- k. If possible hold the Riot, Mob Attack, Thieves, & Terrorists and handed them over to the local police with the help of P&A officials.
- l. Site controller / incident controller shall instruct P&A AGM for detailed report on attack.

During any natural calamity the On-Site Emergency Team and top management shall review the Situation (i.e probable impact & its consequences, immediate actions / preventive measures to minimize the impact) up on alertness information by External agencies, Internet, news and Govt. Authorities. Based on out come of review the actions shall be initiated by the emergency team and concern area in charges.

14. Procedure For Rescue Of Casualty From The Emergency

14.1 Rescue of the casualties, if they involved with fire

- If fire is still in contact with the clothing, stop the fire with fire blanket and cool the body with water and shift the victim to a fresh air by using stretcher/ help of two persons.
- Before rescue the casualty, Rescue person should protect himself with suitable P.P.E
- Organize for first aid to the casualty.

If Conscious

- Cool the body with water.
- Check for proper breathing
- Call the ambulance.
- Shift the casualty to the OHC.
- Get medical help.

If Unconscious

- Shift the medical oxygen cylinder
- Give Medical Oxygen to casualty.
- If not breathing, administer CPR by trained person.
- Cool the burns with water.
- Call the Ambulance.
- Shift the casualty to the OHC.
- Get Medical aid
- Before rescue the casualty, Rescue person should protect himself with suitable P.P.E
- Arrange for first aid to the casualty.

14.2 Rescue of the casualty, if they effected with toxic gas

- ↪ Before rescue the casualty, rescue person should protect him self from the toxic gas by wearing the suitable PPE like air mask or S.C.B.A etc.
- ↪ First shift the casualty to the fresh air from the place of incident by using stretcher or with the help of two persons.
- ↪ Check the casualty is in conscious or not.

If Conscious

- ↪ First remove his clothing.
- ↪ Give the medical oxygen.
- ↪ Call the ambulance and send him to OHC.
- ↪ Get the medical aid immediately.

If Unconscious

- ↪ First remove the contaminated clothing.

- ↪ If casualty feels difficult to breath, supply medical oxygen.
- ↪ If casualty not breathing, administrate CPR with qualified persons.
- ↪ Call the ambulance and send him to OHC.
- ↪ Get the medical aid immediately.

14.3 Rescue of the casualty subjected to Hazardous spillage/leakage:

Before going to rescue the casualty, Rescue person should wear suitable PPE like P.V.C. Hood or Pant & Shirt, Chemical resistant hand gloves, gum shoe etc. As a first step, shift the casualty from the place of incident to the fresh air by using stretcher or with the help of two persons.

- If the hazardous material falls on his body, clean the body with water at Eye Wash and Body Wash fountain for about 15 to 20 minutes.
- Call the Ambulance and send him to OHC.
- Get medical aid.
- If the material falls in eyes, wash his eyes with plenty of water at Eye Wash and Body Wash fountains or with eye wash bottle for about 15 to 20 minutes by opening the both eye lids.
- Call the Ambulance and send him to OHC.
- Get medical aid.

As in the case of Low Boiling liquid leakage or spillage rescue person should also wear the breathing apparatus.

- Check the person is in conscious stage or not.
- Shift the casualty from the contaminated area to fresh air.
- If person conscious and he feel difficult for breathing, give Medical Oxygen to him.
- Call the Ambulance and send him to OHC.
- Get medical aid.

If Conscious

- First remove his contaminated clothing.
- Check casualty is breathing or not.
- If not breathing administrate CPR with qualified persons.
- If feels difficult to breath give him medical oxygen.
- Call the ambulance and send him to OHC.
- Get the medical aid immediately.

14.4 Rescue the casualty when the slips and falls occurs:

- Ask the victim where he got pain /injury.

- Shift the first aid box.
- Do the first aid, for the casualty by using First aid box.

If Back injury occurs:-

- Do not lift on hands.
- Make him to lean.
- Tie the both legs together with bandage cloth at two or three areas.
- Shift the stretcher.
- Call the ambulance.
- Move the casualty from the floor to stretcher with help of another two or three persons carefully

If thigh bone injury:-

- Do not lift on hands
- Tie up the both legs with the bandage cloth at 2 or 3 areas
- Shift the stretcher.
- Move the causality from floor to stretcher carefully.
- Call the ambulance.
- Send him to OHC and get medical aid

Head injury-

- As a first step try to stop the bleeding with the help of cotton and bandage
- Get the first aid items from nearest first aid box
- If the casualty is unconscious, check the breathing
- If not breathing give medical oxygen
- Call the ambulance and shift the casualty to OHC
- Get medical aid

Shoulder bone injury: -

- Tie up the hand to the neck with the help of bandage or tourniquet
- Call the ambulance and send him to OHC
- Get medical aid.

14.5 Rescue the casualty when he subjected to Electric Shock:

- First switch off the power supply
- If it is not possible, separate the victim from the source of power with dry wooden piece or with any other non-conducting material.
- Check the victim is in conscious or not.

If Conscious.....

- If victim is conscious and has some burns on his body, cool the body with water.

- Call the ambulance and send him to OHC

If Unconscious.....

- Clean the mouth and check the victim is breathing or not.
- If victim is not breathing, give artificial respiration.
- If breathing is difficult give oxygen.
- Check for any burns on the body.
- Loose the cloth and cool the body with water.
- Call the ambulance and send him to OHC.

14.6 Rescue of the casualty subjected to chemical splash

IN EYE:

- If the chemical fall in the eye, immediately take the victim to the Eye Wash Fountain or bring the Eye Wash Bottle.
- Wash the effected eye with plenty of water for at least 20 minutes occasionally lifting lower and upper eye lids.
- Do not rub the effected eye and do not close the eye lids.
- If irritation persists repeat flushing.
- Call the ambulance and send him to OHC.

ON SKIN:

- If chemical splashes on body, immediately take the victim to the Body Wash Fountain.
- Remove all contaminated clothing and shoe.
- Wash the effected area with plenty of water for at least 20 minutes.
- Do not rub the effected area.
- Call the ambulance and send him to OHC.

14.7 Rescue of the casualty subjected to Poisoning:

- Immediately clean the air passage way and clean the mouth if any foreign material is present.
- Preserve packets or bottles, which you suspect contain the poison and any vomits and symptom, etc.
- Check the victim is in conscious or not.

If Conscious.....

- Do not induce vomiting
- Clean the mouth. If vomiting occur naturally.

- Check the casualty is breathing or not.
- If not breathing, start artificial respiration.
- If breathing is difficult, give medical oxygen.
- Do not use Mouth to Mouth respiration.
- Call the ambulance and send him to OHC.

If Unconscious.....

- Induce vomiting unless the ingestion material is a corrosive material.
- Give him large amount of milk or water.
- If vomiting occur naturally, repeat administration of water or milk.
- Call the ambulance
- Send him to OHC

14.8 Rescue the person hanging on safety belt:

- Immediately arrange the scaffold
- Arrange the rope along with pulley.
- One person has to move along with another safety belt to top
- Fix Pulley at the top and arrange the rope in pulley one end of the rope should be tied to safety belt & other end of the rope should be hold tightly by two or three persons at the ground.
- Then slowly remove safety belt hook.
- Slowly leave the rope from the holding person through pulley when he got fixed.
- Firm base when he stand or when he caught.
- Slowly bring down from the top to ground
- The rescue may be followed depend upon the location.

14.9 Emergency handling procedure for confined space hazards.

The Confined space hazards are very serious, if proper precautions are not taken. To handle the confined space emergencies required specific procedure. The following hazards may encounter during the confined spaces when Proper precautions are not taken.

- Oxygen deficiency.
- Bodily injury during maintenance works
- Leakage of Hazardous chemicals in to confined space
- Leakage of toxic gases
- Accidental start of the agitation
- Fall of objects in to confined space.
- Slips and falls
- Out side emergency which can endanger to the person working in confined space.

➤ Heat Stress

The above identified hazards are eliminated when the permit to work system is sound.

When rescuing the casualty from the confined space, rescue man & rescue team shall be followed the rescue procedure. Responsibilities of the rescue man:

- Constant communication with the all workers in confined space
- Rescue man must be notified if an entrant recognizes unusual action/behavior, unexpected hazard, unsafe act, detects a condition prohibits by the permit.
- Rescue man should aware of the rescue plan.
- Rescue man should not enter into a confined space & he has to guide the trained attendants
- Rescue man should capable to assess the situation when person effected in the confined space is in consciousness & unconsciousness or bodily injury or involved with other hazards mentioned above.
- Before rescuing the person from the confined space, consider his personnel safety to avoid endanger to him.

Rescue plan:

- Rescue man should communicate the message to alert the neighboring attendants to get the assistance in rescue operation through a co-employees/volunteers.
- Start the rescue operation based on the requirement it may externally or internally, by anchoring the lanyard or hauling by pulling the lanyard slowly with help of attendant from outside or sending the person to inside by providing all safety gadget.
- Shifting the Rescue equipments like harness, lanyard with shock absorbers, fall arresters, rope ladders, pipe line supports, stretchers, fire extinguishers etc.from the nearby locations.
- Shift the first aid kit, medical oxygen cylinders and additional PPE like shoes, helmets, face shields, respiratory protective equipments, hearing protection to use incase of rescue operations.
- If the entrant has effected, Call the Ambulance and send him to occupational health center for further treatment or medical attention.

15 Off-Site Emergency Plan

If an accident takes place in a plant and its effects are felt outside its premises, the situation thus created is called an “off-site” emergency. It no longer remains the concern of the factory management alone but also becomes a concern for the general public living outside or passing by the premises of the factory or storage site involved. To meet such situations, off-site emergency plans are to be prepared as stipulated and put into operation. It is mandatory under Rule 16 of the Hazardous Chemical Rules for District authorities to prepare an off-site emergency plan in respect of clusters of hazardous

chemical industries or at locations where accidents are likely to have an off-site adverse effect.

The off-site emergency plan should detail how emergency related to major accidents on the site will be dealt with. For preparing the plan, the concerned district authorities should consult the industries and other persons who would be concerned with its execution should such an emergency arise. The following points should be noted by all concerned in respect of an off-site emergency plan:

- The Industrial or storage units to be covered under the plan should provide all the necessary information related to industrial activities under their respective control to the concerned authorities.
- In case of any new industrial activity proposed or being set up in the area, an on-site emergency plan should be prepared before the activity is commenced
- All districts having major hazard installation should have an off-site emergency plan.
- The off-site emergency plan should be updated from time to time, especially when a new process is started or new units are established.
- The off-site emergency plan should be tested for its efficacy through mock exercises / drills.
- The persons outside the site, who may be affected by a major accident, should be informed about:
 - The nature of the major accident hazard.
 - Safety measures to be adopted.

15.1 Responsibility for Planning an Off-Site Emergency

The planning for emergency response requires cooperation among the responders to know the persons responsible for various activities. This understanding is facilitated through personal interaction and close working in devising and updating a plan. Therefore, the pre-requisite for preparing a plan is the formation of a planning team. The possible composition of the planning team is given below:

- Collector/Deputy Collector.
- District authorities Incharge of Fire Services, Police.
- Medical Services.
- Factory Inspectorate.
- Pollution Control Board.
- Industries and
- Transport