7 RISK ASSEMENT AND SAFETY MEASURES

7.1 Objective, Philosophy & Methodology of Risk Assessment

7.1.1 Objective:

The main objective of the Risk Assessment study is to determine possible damage due to major hazards having damage potential to life and property and provide a scientific basis to assess safety level of the facility. The secondary objective is to identify major risk in manufacture of chemicals, storage of chemicals and provide control though assessment. To prepare onsite, offsite, disaster management plan for control of hazards.

7.1.2 Philosophy:

The main philosophy of risk assessment is to find out the real cause of accident and then based on it to suggest appropriate remedial measures to prevent its recurrence.

To find out unsafe action negligence, omission or personal fault.

7.1.3 Methodology:

Identify Vulnerable Zone for toxic dispersion, pool fire, Tank on fire (Thermal Radiation), Flash Fire, and Explosion over pressure (Vapor Cloud Explosion) by using software.

7.2 Details of Chemicals to be Handled

In the proposed unit, risk will be involved in storage, handling and transportation of various chemicals those will be handled in the form of raw materials and products. Details of the raw materials and products with storage are given in ***Table 7-1.***

Table 7-1: Raw Materials and Products Details

Sr. No	Name of Raw Material	Requirement (MT/Month)	Requirement (MT/Day)	Used in Manufacturing of	Physical Form	Mode of Storage	Capacity of storage unit (MT)	No. of Units	Total Storage Capacity (MT)	Storage Inventory (Day)
1	Phenol	424.4	17.0	Phenol Formaldehyde Resin (P. F. Resin)	Liquid	MS Tank	25	1	25	1.5
2	Formaldehyde	167.4	6.7	Phenol Formaldehyde Resin (P. F. Resin)	Liquid	MS Tank	25	1	50	2.9
		135.0	5.4	Melamine Formaldehyde Resin (M. F. Resin)						
		133.7	5.3	Urea Formaldehyde Resin (U. F. Resin)		Fiber coated MS Tank	25	1		
3	Caustic	2.3	0.1	Phenol Formaldehyde Resin (P. F. Resin)	Solid	Bag	0.05	50	2.5	28
		1.1	0.05	Urea Formaldehyde Resin (U. F. Resin)						
4	Melamine	90.0	3.6	Melamine Formaldehyde Resin (M. F. Resin)	Solid	Bag	0.025	1000	25	7
5	Urea	89.1	3.6	Urea Formaldehyde Resin (U. F. Resin)	Solid	Bag	0.025	1000	25	7.0
6	Acetic Acid	1.1	0.05	Urea Formaldehyde Resin (U. F. Resin)	Liquid	Barrel	0.231	5	1.155	26

Sr. No	Name of Raw Material	Requirement (MT/Month)	Requirement (MT/Day)	Used in Manufacturing of	Physical Form	Mode of Storage	Capacity of storage unit (MT)	No. of Units	Total Storage Capacity (MT)	Storage Inventory (Day)
7	Kraft Paper	236.3	9.5	Laminated Sheets	Solid	Dedicated Area	20	1	20	20
8	Design Paper	33.8	1.4	Laminated Sheets	Solid	Dedicated Area	20	1	20	20
9	Resin	405.0	16.2	Laminated Sheets	Liquid	MS Tank	18	1	18	18
10	Methanol	74.3	3.0	Laminated Sheets	Liquid	Fiber coated MS Tank	25	1	25	8

Sr. No.	Description	Physical Form	Type of Packing / Storage/ Mode of storage	Transportation	Capacity of storage (Tonne)
1	Phenol Formaldehyde Resin	Semi solid	Stored in 1 nos. of MS tank	Captive consumption & rest will be transported by road, rail & ship	10
2	Melamine Formaldehyde Resin	Semi solid	-	Captive consumption & rest will be transported by road, rail & ship	-
3	Urea Formaldehyde Resin	Semi solid	Stored in 1 no. of MS tank	Captive consumption & rest will be transported by road, rail & ship	8

7.3 Details of Hazardous Chemicals to be Handled

Amongst the above described raw materials and products, some are the hazardous chemicals as per the MSIHC rules, 1989 amended in 2000. Details with chemical and physical properties of the same are given in ***Table 7-2.***

Table 7-2: Hazardous Chemicals Details

Sr. No.	Chemicals	TLV	Toxicity Level			Flammable Limit					Chemical Class (As per MSIHC Rules)
			LD_{50} Oral mg/ Kg	LD_{50} Dermal mg/Kg	LC_{50} mg/l	LEL%	UEL%	FP ^{0}C	BP ^{0}C	Class (As per petroleum classification)	
1	Phenol	5 ppm	317	669	125	1.7	8.5	79(CC) 85(OC)	182	C	Flammable, Toxic, Hazardous
2	Formaldehyde (37%)	0.3/l ppm	100	270	203	6	36.5	50^{0}C CC 60^{0}C CC	96	B	Flammable, Toxic, Hazardous
3	Methanol	200 ppm	5628	15800	64000 ppm/ 4 hr	6	36.5	12 ^{0}C	64.5	A	Very high flammable
5	Caustic Soda	2 mg/m^3	N.A	N.A	N.A	N.A	N.A	N.A	1388	--	Hazardous
6	Melamine	N.A	3161	1000	N.A	N.A	N.A	93.3 ^{0}C	N.A	C	Slightly flammable
7	Urea	--	8741	--	--	N.A	N.A	N.A	N.A	--	N.A

Note: CC: Close Cup; OC: Open Cup; N.A.: Not Available.

The Toxicity level of hazardous chemicals as per Manufacture, storage and import of Hazardous Chemical (Amendment) Rules, 2000 (MSIHC) is shown as below

Sr. No	Toxicity	Oral Toxicity LD_{50} (mg/Kg)	Dermal Toxicity LD_{50} (mg/Kg)	Inhalation Toxicity LD_{50} (mg/Kg)
1	Extremely Toxic	<5	<40	<0.5
2	Highly Toxic	>5- 50	>40-200	>0.5-2
3	Toxic	>50-200	>200-1000	>2-10

7.4 Hazard Identification and Preventive Measures

7.4.1 Raw Material Storage Hazards and Controls

Sr. No.	Name of material stored	Quantity (Max)	Operating press/ temp	Hazard Rating Systems	Type of hazard / Risk involved	Persons Affected
(1)	Phenol	25 KL x 1	NTP	TLV – 5 PPM STEL-10 PPM **NFPA Ratings:** Health: 4; Flammability: 2; Instability: 0 **Flash Point:** 79.44^{0}C	• Toxic when contact with Skin • Causes burns • Toxic if swallowed • Irritating to Skin, Eyes and Respiratory System	• Operators • Maintenance • Technicians
	Control Measures: • Dyke provision to storage tank • Safety boards displayed on the tank • Good ventilation must be provided. • For accidental contact with skin, nearby provision of soap-suds • Use water spray to keep fire-exposed containers cool. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal					

Sr. No.	Name of material stored	Quantity (Max)	Operating press/ temp	Hazard Rating Systems	Type of hazard / Risk involved	Persons Affected
	decomposition products. • Handling of Phenol with Safety glasses, hand gloves, gumboot					
(2)	Formaldehyde (37%)	25 KL x 2	NTP	TLV – 0.3 PPM (1 ppm) **NFPA Ratings:** Health - 3 Flammability - 2 Reactivity - 0 **Flash Point:** 50^0C	• Flammable • Very toxic by inhalation. • Very toxic in contact with skin. • Very toxic if swallowed. • Causes burns. • Limited evidence of a carcinogenic effect. • Risk of serious damage to the eyes. • May cause sensitization by skin contact.	• Operators • Maintenance • Technicians
	Control Measures: • Dyke provision to storage tank • Safety boards displayed on the tank • Good ventilation must be provided • Trap & collect spills with Sand or other inert solids • Use an approved gas mask in un-ventilated areas if necessary because of fumes. • Handling of Formaldehyde with Safety glasses, Nitrile or butyl rubber gloves					

Sr. No.	Name of material stored	Quantity (Max)	Operating press/ temp	Hazard Rating Systems	Type of hazard / Risk involved	Persons Affected
(3)	Methanol	25 KL x 1	NTP	TLV – 200 PPM (8-hr TWA) STEL-250 PPM **NFPA Ratings:** Health: 1 Flammability: 3	• Highly Flammable • Toxic by inhalation • Toxic when contact with Skin • Toxic if swallowed • Danger of very serious irreversible effects.	• Operators • Maintenance • Technicians •
	Control Measures: • Keep away from sources of ignition, tight closed container and dyke provision to storage tank • Safety board's displayed on the tank • Effective ventilation must be provided. • For accidental contact if you feel unwell, seek medical advice immediately • Handling of Methanol with Safety gloves and protective clothing					

7.4.2 Process hazards and controls

Name of hazardous process and operation	Material in the process / operation	Type of hazard possible toxic gas release / fire / explosion / run away reaction / rupture, etc.	Control measured provided
Boiler	Steam	• Handling of anti scalent • Heat burns	• Annual inspections • Safety interlocks to be provided • Safety and pressure gauge valves fitted • Properly supported and protected against corrosion • Testing of Jackets and joints of tubes regularly
Reactor Vessel	Formaldehyde (37%), Melamine, Urea, Phenol	• Exothermic Run-away reaction • Release of Heat and Flammable gases • Fire, Toxic gas release and Explosion	• Raw Materials quantity must be controlled either volumetrically or gravimetrically. • Process control devices must be installed includes the use of sensors, alarms, trips and other control systems that either take automatic action or allow for manual intervention to prevent the conditions for uncontrolled reaction occurring. • High Temperature indicator valve and alarm system must be provided • Auto cutoff system must be provided after reaching of predetermined maximum safe temperature. • Pressure gauge is must provided. • Safety Control valve is must be provided. • The Vessel Emergency Relief vent should discharge to a suitably designed catch pot or should be so positioned that people working in the area and members of the public will not be in danger if the contents of the vessel are discharged. • Use skilled worker • Proper selection of MOC • Mechanical seal in all pumps and reactors

Name of hazardous process and operation	Material in the process / operation	Type of hazard possible toxic gas release / fire / explosion / run away reaction / rupture, etc.	Control measured provided
			• Transportation of finished product from vessel to storage tank through

7.4.3 General Hazards and Controls

Type of Emergency	Identification of Area	Possible Causes	Possible Results	Preventive/control Measures
Fire	Tank farm area	• Fire due to Bottom nozzle failure • Damage of storage tank Pump discharge nozzle failure • Unloading road tanker hose rupture	• Major fire in the tank farm, it may spread all over the company and surrounding area • May cause fatalities	• Licensed and isolated storage tank farm. • Flame proof fittings. • Earthling while unloading. • Spark arrestor at main gate. • Dip pipes on the tank for unloading. • Provision of dyke. • Earthling of tanks and pumps.\ • Get approval from an explosive department for plan approval, equipment layout & emergency control measures. • No electrical junction box close to storage materials. • Hot work permit system followed for hot working in the ware house.
Toxic Gas Release	Tank Farm Area and Reaction Vessel area	• Cylinder blast • Rupture of discharge valve • Rupture of gas cylinder body	• Major gas exposure in the company and /or surrounding area of the company which resulting in irritation to respiratory track eyes	• Storage Tank stored under shed and good ventilated area. • Procured by license holder party. • Fitted with valve protection cap. • Valve opened with special key.

Type of Emergency	Identification of Area	Possible Causes	Possible Results	Preventive/control Measures
		• Bursting of pipelines	and suffocation. More inhalation results in fatalities.	• Loading/unloading done safely. • Trained persons for Material Handling in Tank Farm and Storage Tank area. • Periodic hydraulic testing through competent person by supplier • Painted according to its color code.
Explosion	All Material handling areas	• Vapor explosion due to contact of spark to accumulated flammable vapor in confined area	• Improper discharge of static charge • Use of non FLP equipment for solvent handling • Metal to metal impact • Electrical short circuit • Open flame	• Flameproof electric installation areas & use spark less tools • Isolated storage of Flammable material drums • Hot work permit for hot working in the plant • Earthling for human static charge • Good ventilated area for Flammable material storage
Material handling	In Plant	• Flammable, eye irritating & body accident	• Fire and health Hazards	• Trained employee • Required PPE and Fire • Protective equipment Provided • Good engineering practice • Separate storage are with dyke valve system provided
Methanol, Formaldehyde and Melamine Fire Protective System	Storage and other Operation Area	• Spillage, Leakage and overflow,	• Fire Hazard	• Required Fire Extinguisher Provided • Flame Proof Electrical Fitting • Proper Earthling arrangement • Fire Hydrant System with Jockey Pump • Gas Detector

7.4.4 Safe Practice for Handling, Storage, Transportation and Unloading of Hazardous Chemicals

For Storage/Handling

- Separate from strong oxidant. & Keep it in well ventilated room.
- Dyke wall shall be provided to all above ground storage tank.
- Fire hydrant system shall be installed.
- Safety shower and eye washer shall be installed near storage area.
- Flame proof light fitting shall be provided at flammable storage area.
- Proper selection of MOC for chemicals storage tank.
- Sprinkler system shall be installed at flammable material storage area
- Earthing/bonding shall be provided for static charges.
- Flame arrestor shall be provided on flammable material storage tank vent.
- Level gauge and level measurement instrument shall be provided on material storage tank.
- Lightening arrestor on all chimney and building shall be provided.
- Hazardous material should be stored away from the plant and safe distance shall be maintained.
- Safety permit system shall be followed for loading, unloading of hazardous chemical.
- Fencing, caution note, hazardous identification board should be provided.
- Only authorized person shall be permitted in storage tank area and register will be maintained.

For Transportation & Unloading

- Solvent shall be received by road tanker and stored in above ground storage tank in separated bulk storage area.
- Loading and unloading procedure shall be prepared for material received through road tanker.
- Earthing/bonding shall be provided for static charges.
- Flexible steel hose shall be used for unloading from the road tanker.
- Flame proof electric motor shall be used during loading/unloading.
- NRV shall be provided on pump discharge line.
- Fixed pipeline with pumps shall be provided for transfer to vessel.
- TREM CARD will be provided to all transporters and shall be trained for transportation Emergency of hazardous chemicals.
- Personal Protective Equipment (safety goggles, hand gloves, apron, masks, gum boots etc.) shall be provided.

7.4.5 Occupational Health Surveillance Programme

Health surveillance is the monitoring of a person's health to identify changes in health status due to occupational exposure to a hazardous substance. It includes biological monitoring.

Ideally, the avoidance of work-related diseases should be achieved by the prevention or controlling exposures to hazardous substances in the workplace. Where a process cannot be designed or maintained to eliminate the risk of exposure, it may be necessary for workers to undergo health surveillance.

Aims of health surveillance:

i. Identify those at increased high risk

Health surveillance is used to identify workers who have an increased high risk of developing an occupational disease. For example, people who have existing skin, kidney, liver and eye disorders, heart problem; additionally smokers and pregnant women are at increased risk of being severely affected if exposed to Methanol.

ii. Compliance with regulations

Health surveillance is sometimes required by laws and codes of practice (for example, a worker exposed to lead in battery manufacture or a spray-painted exposed to isocyanates in two-pack paints). Each state or territory has regulations containing a schedule of hazardous substances for which health surveillance is mandated.

iii. Early detection

The major purpose of health surveillance is to detect adverse health effects at an early stage so that the worker may be protected from further injury, either by control of the process or by removal from exposure.

iv. Evaluating effectiveness of control measures

Health surveillance is not a control measure in itself and should not be the sole means of determining whether control measures are effective. However, it can provide useful information on the effectiveness of safe working practices.

v. Epidemiology and disease

Health surveillance can be used to evaluate the health experiences of groups of workers exposed to specific hazardous agents or working within a particular industry.

Workers should be made aware that health surveillance is sometimes necessary to ensure their ongoing health. Health surveillance is often used in addition to workplace monitoring. Workplace monitoring will only indicate the potential for exposure of workers to a hazardous substance. It can never be an indication of the actual amount of substance absorbed or the effect on the body of absorbing the hazardous substance. When a toxic substance (such as an industrial chemical) is present in the environment, it contaminates air, water, food, or surfaces in contact with the skin: environmental monitoring evaluates the amount of toxic agent in these media.

As a result of absorption, distribution, metabolism, and excretion, a certain internal dose of the toxic agent (the net amount of a pollutant absorbed in or passed through the organism over a specific time interval) is effectively delivered to the body and becomes detectable in body fluids.

Subsequent interaction with a receptor in the critical organ (the organ which, under specific conditions of exposure, exhibits the first or the most important adverse effect) leads to biochemical and cellular events. Both the internal dose and the elicited biochemical and cellular effects may be measured through biological monitoring.

7.5 Occupational Health Programme

- The health & physical hazards caused due to toxic, irritant, corrosive, flammable materials. All chemicals are within Threshold Limit Value as per ACGIH.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. will be carried out regularly and its record will be maintained.
- Good housekeeping, use of PPE, Engineering controls, Enclosure processes, scrubber system, display of safety boards, SOP of loading / unloading, local exhaust ventilation, safety shower etc. are important safety measures have taken to keep these chemicals within TLV.
- Appropriate personal protective equipments (gloves, boots, ear muffs, etc. will be provided & ensure their usage.
- Workers will be trained on safe material handling of hazardous chemicals.
- Prepare & display the safe operating procedure for hazardous chemicals storage, handling & transporting or using.
- Periodical medical examination of the workers & Liver Function Testes will be done.
- Register (form no.37) for work place air monitoring will be done.
- Employee training and education will be carried out.
- Control the noise at source by substitution, isolation, segregation, barriers etc.
- Local Exhaust ventilation and scrubber should be installed where it is required to reduce fumes, vapors, temperature and heat stress.
- Insulate all hot equipment to reduce air temperature.
- Reduce the level of physical activity by sharing workload with other or by using mechanical means.

7.6 Chemicals which are Exposed to Workers Directly or Indirectly

1. Formaldehyde (37%)
2. Phenol
3. Methanol

Pre-employment medical checkup and periodical medical examination will be done. Liver function test will be done during pre-placement and periodical examination. In addition to the above, following safety equipment will be provided;

- Fire extinguishers at prominent places in the premises
- First aid kit
- Portable eye wash station, capable of supplying 15 minutes of water
- Emergency shower
- Ample supply of potable water for washing and drinking
- Emergency communication devices such as mobile phones and two way radios
- Vehicle suitable for emergency transport

7.7 Treatment of Workers Affected by Accidental Spillage of Chemicals

Hazards with Acute Exposure

- Contact with skin may cause severe burns or systemic poisoning.
- Systemic effects may occur from any route of exposure, especially after skin absorption.

- Hazards with Chronic Exposure
- Repeated or prolonged exposure may harm the respiratory system. Can irritate and inflame the airways.
- Methanol affects the central nervous system, liver, and kidneys.

Special Safety Precautions

- Prevent contact with skin by wearing neoprene gloves, lab coat, and resistant apron.
- Wear safety glasses or a face shield if splashing may occur.
- Store in a cool, dry, well-ventilated area, away from heated surfaces or ignition sources.
- Skin contact requires immediate washing of the affected area with soap and water.
- Remove contaminated clothing and launder before wearing again.

Procedure for treating workmen after skin contact.

- Skin contact requires immediate flushing of the contaminated area with soap and water at a sink or emergency shower for a good fifteen minutes. Remove contaminated clothing. In case of eye contact, promptly flush the eyes with copious amounts of water for 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention. If methanol is ingested, obtain medical attention immediately. If large amounts of methanol are inhaled, move the person to fresh air and seek medical attention at once. It is recommended to provide the safety shower and eyewash station in plant.

7.7.1 Antidotes

Antidotes for Methanol

- Ethanol (30 % solution from inside, 5 % solution from outside i.e. by intravenous injection)
- Epicake syrup
- In case of acidosis give sodium bicarbonate
- In case of delirium give diazepam 10 mg by intravenous injection
- Folinic acid (leucovorin 1 mg/Kg iv, 4 hourly)

Antidotes for Formaldehyde

- Milk
- Activated Charcoal or Water

Antidotes for Phenol

- Polyethylene glycol 300 or 400
- Activated Charcoal and 240 ml Milk

7.7.2 Details of fire extinguishers

Unit will provide about 10 Nos. of fire extinguishers of DCP type at prominent places in the premises.

Sr. No.	Type	Capacity	Qty
1	DCP	5 kg	8

7.7.3 Minimization of The Manual Handling of Hazardous Substance

Whether moving materials manually or mechanically, employees should know and understand the potential hazards associated with the task at hand and how to control their work places to minimize the danger. Employers and employees should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take corrective action. Provide flameproof electrical motor & transfer chemicals through the pipelines. Use specially designed pallets to hold, move raw materials, finished products through work areas. Minimize lifting of raw materials, heavy loads by using appropriate platforms, trolleys etc. Avoid the moving, manual handling of hazardous material.

7.8 Do's and Dont's

Handling of Chemicals

Do's	Dont's
• Know the hazards of the chemical before handling. • Know the antidotes for chemical, which you are handling. • Do keep material safety data sheet in locations where chemicals are being handled and study it. • Use appropriate personal protective equipment like gloves, aprons, and respirator; face shield etc. depending upon nature of the work. • Label every chemical that you use and tightly close the container. • Use eye wash fountain / safety shower in case of splash of chemicals in the eye or body for at least 15 minutes. • Segregate toxic, flammable chemicals and keep them under control. • In addition to draining and closing valves, lines should be blanked before taking up maintenance work. • Provide proper ventilation at the chemical handling area to limit their concentration within prescribed level.	• Do not store the chemicals that are incompatible with other chemicals. • Do not spill the chemicals. • Do not dispose chemical without neutralizing. • Do not keep large inventory of chemicals. • Do not allow empty containers of hazardous chemicals to be used by others. • Do not use compressed air for transferring chemicals. • Do not stand near chemical transfer pump while it is in operation with temporary hose connection. • Pouring of chemicals by hand or doing siphoning by mouth should never be adopted. • Chemicals drums should never be moved without protection. • Do not attempt to neutralize the acid / alkali on the skin. Use water only. • Do not use solvent for cleaning hands.

Material Handling

Do's	Don'ts
• Use proper lifting tool and tackle having adequate capacity. • Only authorized persons should operate material handling equipments. • Each tool, tackle or equipment should have number and safe working load (SWL) marked on it. • Assess weight of the material, distance to be	• Do not use the equipment for the purpose other than its design intention. • Do not allow personnel to move underneath lifted load. • Do not load the equipment above its safe working load. • Do not use makeshift arrangements for lifting

Do's	Don'ts
carried and hazards etc. before lifting the load. • Inspect and test all the lifting tools and tackles regularly as per Factory Rules. • Wear Personal Protective Equipments while handling of material. • Wherever possible, mechanized material handling shall be adopted. • While lifting a load physically, keep the load as near as possible to the body with feet properly placed for body balance. • Bend knees, keep back straight, keep the load closed to the body and lift the load.	equipment without inspection and test. • Do not use defective tool and tackles. • Keep the tools & tackles free from adverse effect of atmosphere by applying suitable protective coating. • The angle between the legs of two leg sling should not exceed 90 degree. • Do not allow male and female adult to lift a load manually higher than 55 kgs and 30 kgs respectively. • Do not hold the load with tip of the fingers; grasp the load firmly with palm.

Fire Prevention

Do's	Don'ts
• Follow 'NO SMOKING' sign. • Deposit oily rags and waste combustible material in the identified containers and dispose them suitably. • Fire Hose used for any other purpose should be permanently marked and taken out of fire hydrant system. • Keep minimum inventory of flammable and combustible substances. • Take permission before breaking or removal of fire barrier and ensure subsequent relocation of fire barrier. • Check periodically the operability of fixed fire fighting system. • Attend any abnormality / deficiency with fire protection system promptly. • Provide earthling or bonding to prevent accumulation of static charges to tanks where flammable chemicals are stored / handled. • Use instruments that are intrinsically safe in explosive atmosphere.	• Do not leave flammable material like acetone, kerosene etc. used as cleaning agent at the work area. • Do not over tighten fire hydrant valves with F-lever. • Do not allow wild grass growth around storage of the gas cylinders and switchyard. • Do not obstruct accessibility to the fire related equipment. • Do not destroy the inspection tag provided with the fire equipment. • Do not misuse fire-fighting equipment other than intended purpose. • Do not store the flammable material in the open container. • Do not use instruments that are not intrinsically safe in the explosive atmosphere.

House Keeping

Do's	Don'ts
• Assign places for everything and maintain things at assigned places. • Clean the area after completion of work. • Use aisle space free for personnel and material movement. • Ensure adequate illumination and ventilation for the job. • Drop paper, plastic, glass, metal and bio-medical	• Do not leave combustible materials in the work area. • Do not smoke in the area of work. • Do not allow dust bin to overflow. • Do not generate extra waste. • Do not disturb the safety equipment from assigned location. • Do not block emergency switches and on/off

Do's	Don'ts
waste in a separate bin kept for this purpose. • Know the location where emergency equipment such as first aid box, fire fighting equipment, SCBA, Stretchers are kept. • Arrest all types of spills such as chemical, water, oil, air / gas, steam etc. and clean up the area immediately. • Ensure exits are indicated / painted for use during emergency.	switches of the equipment by storming of materials in front of work. • Do not leave cleaning agent like acetone, isopropyl alcohol, kerosene etc. at the work area after completion of work. • Do not block fire exit point by storing materials or by means. • Do not leave a spillage unattended.

7.9 Risk Assessment and Consequence Analysis

ALOHA is an air dispersion model, which you can use as a tool for predicting the movement and dispersion of gases. It predicts pollutant concentrations downwind from the sources of a spill, taking into consideration the physical characteristics of the spilled material. ALOHA also accounts for some of the physical characteristics of the release site, weather conditions, and the circumstances of the release. Like many computer programs, it can solve problems rapidly and provide results in a graphic, easy to use format. This can be helpful during an emergency response or planning for such a response.

Software used for calculation- ALOHA (Areal locations of Hazardous atmospheres)

Aloha is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA can predict the rates at which chemical vapors may escape into the atmosphere from broken gas pipes, leaking tanks and evaporating puddles. It can then predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.

ALOHA provides output as amount of chemical discharged from the source as well as its concentration in air it takes in to account different levels of concentrations for a specified chemical. Different concentration levels are given below:

ERPG 1: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

ERPG 2: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG 3: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

IDLH: The Immediately Dangerous to Life or Health (IDLH) level. A chemical's IDLH is an estimate of the maximum concentration in the air to which a healthy worker could be exposed without suffering permanent or escape-impairing health effects.

Table 7-3: Consequence Analysis

Sr. No.	Hazardous Chemical Stored	Temp.	Pressure	Equipment Considered	Scenario considered	Leak Size (dia.) meter	Release duration	Damage distance			Type of Consequence
								Red Threat Zone	Orange Threat Zone	Yellow Threat Zone	
1	Methanol (25MT)	Ambient	Ambient	MS tank 25 Tones	Catastrophic Failure	-	-	236 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)	340 (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	537 (2.0 kW/(sq m) = pain within 60 sec)	BLEVE (***Figure 7-1***)
					Leakage from tank - MCA	0.025 m	Max Burn Rate: 22.5 kilograms/min	less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially lethal within 60 sec)	less than 10 meters(10.9 yards) --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	10 meters --- (2.0 kW/(sq m) = pain within 60 sec)	Pool Fire
					Connection leak- MCA 100% pipe dai	1.5 inch pipe dia	Max Burn Rate: 52.2 kilograms/min	less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially lethal within 60 sec)	11 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	15 meters --- (2.0 kW/(sq m) = pain within 60 sec)	Pool fire (***Figure 7-2***)
					Connection		Max Burn	less than 10	less than 10	less than 10	Pool fire

Sr. No.	Hazardous Chemical Stored	Temp.	Pressure	Equipment Considered	Scenario considered	Leak Size (dia.) meter	Release duration	Damage distance			Type of Consequence
								Red Threat Zone	Orange Threat Zone	Yellow Threat Zone	
					leak -20 % of pipe dia.	0.3 inch pipe failure	Rate: 2.09 kilograms/min	meters(10.9 yards) --- (10.0 kW/(sq m) = potentially lethal within 60 sec)	meters(10.9 yards) --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	meters(10.9 yards) --- (2.0 kW/(sq m) = pain within 60 sec)	(***Figure 7-3***)
Toxic Dispersion											
2	Phenol	41 deg. C	Ambient	MS tank 25 Tones	Connection leak- MCA 100% pipe dai	1.5 inch pipe dia	2.39 kilograms/min	no recommended LOC value --- (N/A = AEGL-3 (60 min))	56 meters --- (23 ppm = AEGL-2 (60 min))	86 meters --- (15 ppm = AEGL-1 (60 min))	Toxic Dispersion (***Figure 7-4***)
					Connection leak -20 % of pipe dia.	0.3 inch pipe dia failure	Max Average Sustained Release Rate: 110 grams/min	no recommended LOC value --- (N/A = AEGL-3 (60 min))	13 meters --- (23 ppm = AEGL-2 (60 min))	19 meters --- (15 ppm = AEGL-1 (60 min))	Toxic Dispersion
3	Formaldehyde	Ambient	Ambient	MS tank 25 Tones	Connection leak- MCA 100% pipe dai	1.5 inch pipe dia	Max 6.05 grams/min	less than 10 meters(10.9 yards) --- (56 ppm = AEGL-3 (60 min))	less than 10 meters(10.9 yards) --- (14 ppm = AEGL-2 (60 min))	20 meters --- (0.9 ppm = AEGL-1 (60 min))	Toxic Dispersion

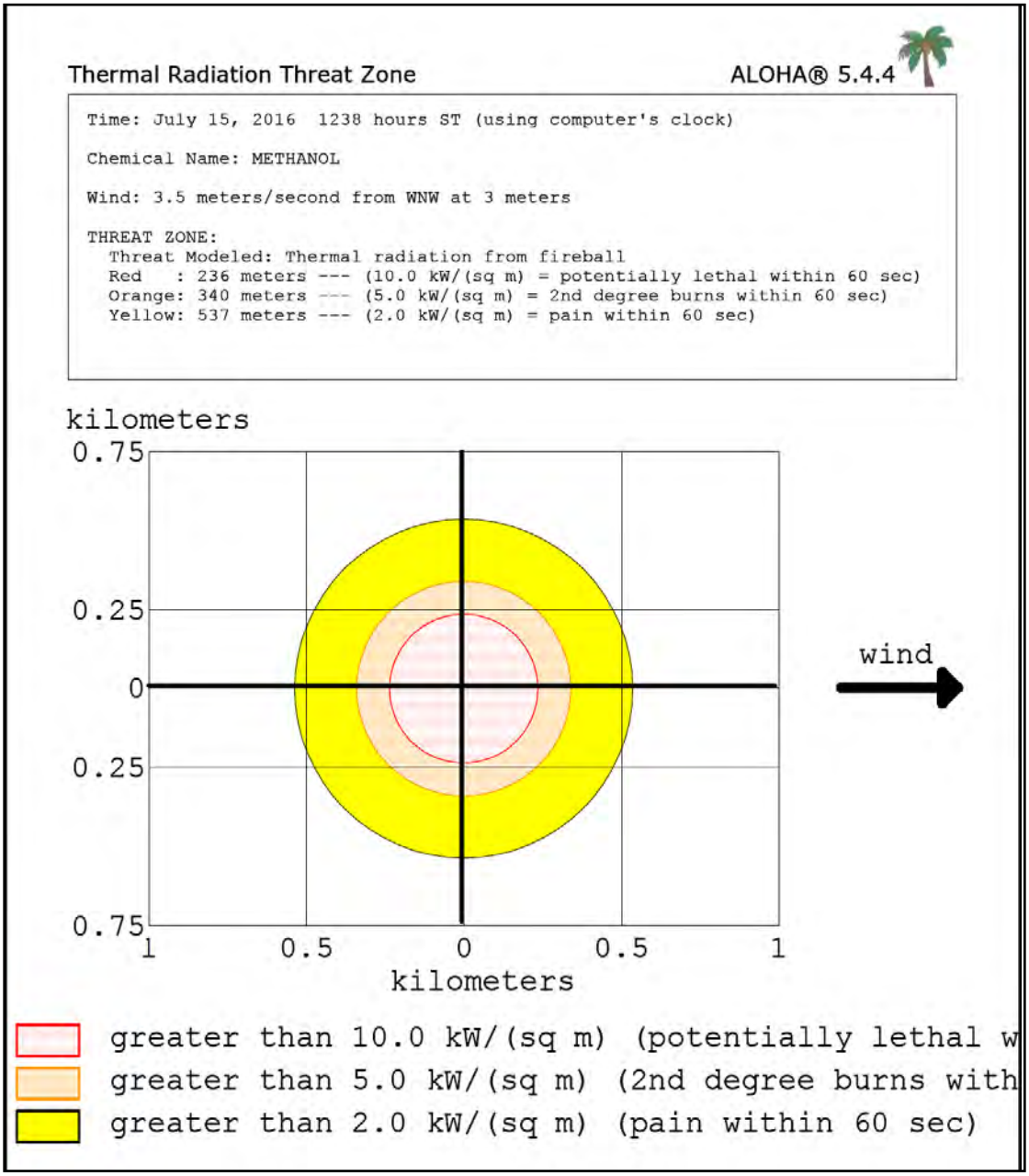


Figure 7-1: BLEVE Methanol

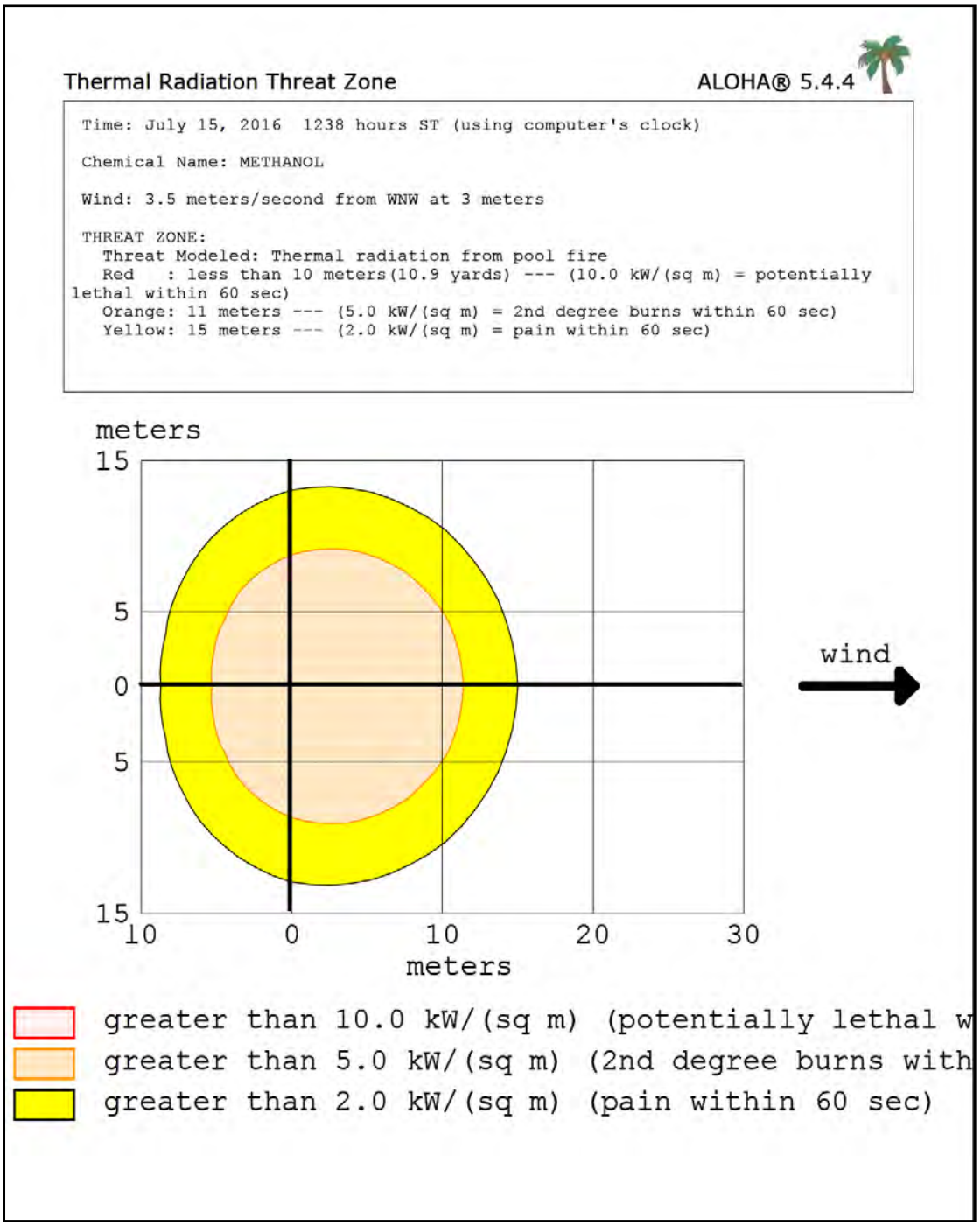


Figure 7-2: Methanol Connection Leak-Pool Fire

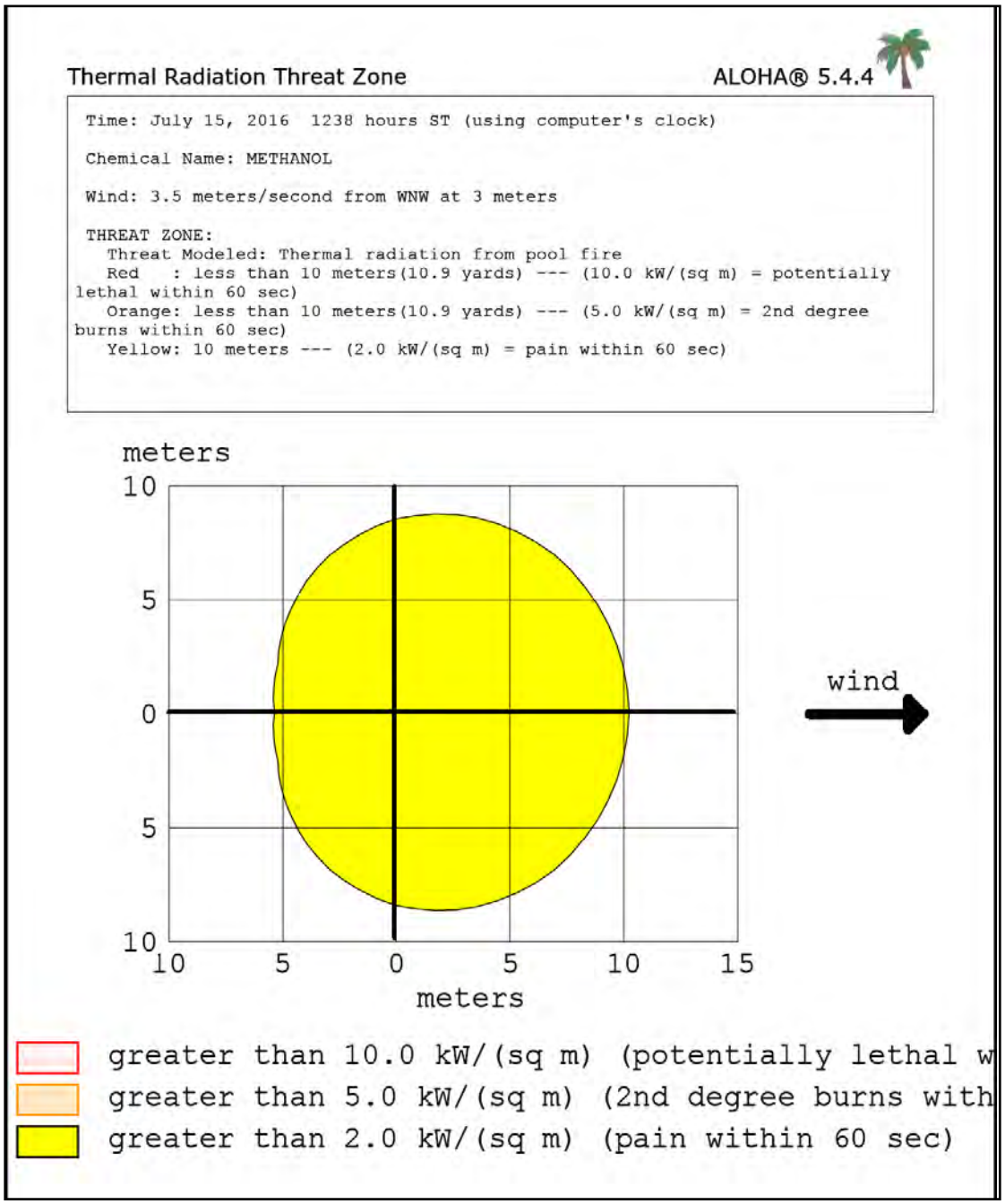


Figure 7-3: Methanol Connection Leak-Pool Fire

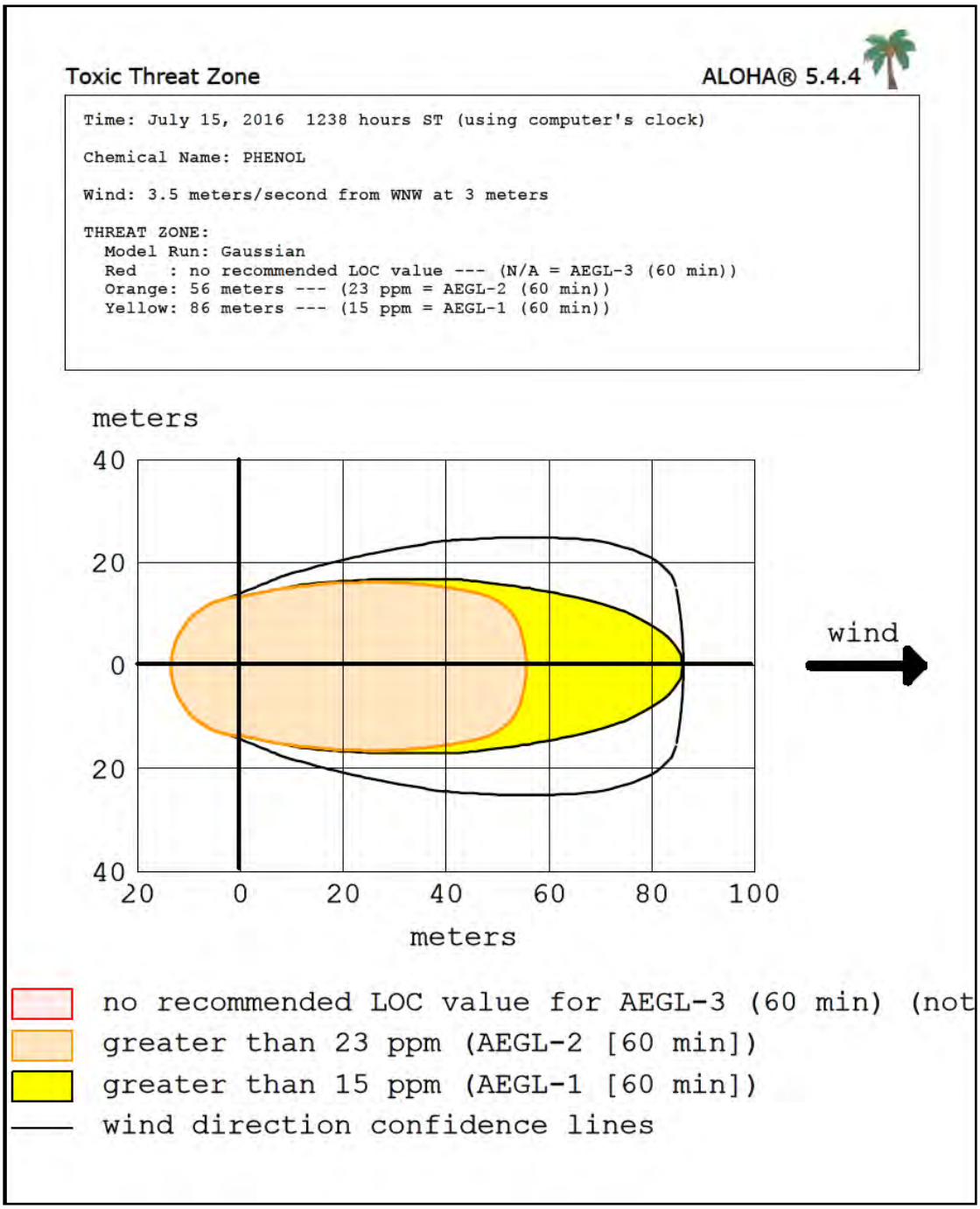


Figure 7-4: Toxic Dispersion Phenol

7.10 Risk Reduction Measurement & Recommendation in View of Safety Consideration

- Storage tank of Formaldehyde, Ammonia and methanol should be installed away from the plant area.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Containment dykes with proper sloping and collection sumps should be provided so that any spillages in the bulk storage and other handling areas shall not stagnate and shall be quickly lead away to a safe distance from the source of leakage. This reduces the risk of any major fire on the bulk storages and the risk to the environment shall be minimized/ eliminated.
- Inspection of the storage tanks as per prefixed inspection schedule for thickness measurement, joint and weld efficiency etc.
- Provision of flameproof electrical fittings / equipment's.
- Proper maintenance of earth pits.
- Strict compliance of security procedures like issue of identity badges for outsiders, gate passes system for vehicles, checking of spark arrestors fitted to the tank lorries etc.
- Strict enforcement of no smoking.
- Periodic training and refresher courses to train the staff in safety fire fighting.
- Employee training and education will be carried out.
- Structural fireproofing in the process area could be considered as a safety measure in the light of probable spill and fires in the area.
- Emergency drills should be carried out periodically to ensure preparedness must continue.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Many operations involve use of highly toxic/flammable materials and these needs to be documented as SOPs. These must be made and kept updated on priority.
- Extensive training on use of Self Contained Breathing apparatus (SCBAs) must be ensured for emergency control.
- Many of the raw materials used for resin are either toxic or flammable. It is therefore important to ensure that these materials are stored in closed, well ventilated totally safe areas. A fire alarm system (heat and smoke detection) should be provided for the storage area where the material is stored as toxic fumes arise on combustion.
- Loose drums of waste materials, often solvent laden, must be removed from the working areas and close watch kept.
- Proper Earthing needs to be provided through plug type systems or through the agitators/liquid.
- Ventilation should be provided for any enclosed are where hydrocarbon or toxic vapors may accumulate. Several such areas were noticed- these may be surveyed and tackled accordingly.
- All personnel should be trained in handling emergency situations and should be apprised of their role in handling emergency situation and to ensure adequacy of the emergency procedures simulated exercise should be carried out. This was found wanting.
- Flame arrestor should be provided.

- Adequate number of caution boards highlighting the hazards of chemicals should be provided at critical locations.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. will be carried out regularly and its record will be maintained.
- Good housekeeping, use of PPE, Engineering controls, Enclosure processes, scrubber system, display of safety boards, SOP of loading / unloading, local exhaust ventilation, safety shower etc. are important safety measures have taken to keep these chemicals within TLV.
- Appropriate personal protective equipment will be provided & ensure the usage of them.
- Workers will be trained on safe material handling of hazardous chemicals.
- Prepare & display the safe operating procedure for hazardous chemicals storage, handling & transporting or using.
- Local Exhaust ventilation and scrubber should be installed where it is required to reduce fumes, vapors, temperature and heat stress.
- Reduce the level of physical activity by sharing workload with other or by using mechanical means.

Following FIRE safety devices WILL BE PROVIDED to protect from any malfunctioning of plant equipments. Following fire protection systems will be provided.

- Water storage of adequate capacity to meet the requirements of water for firefighting purposes.
- Fire hydrants and automatic sprinkler system. Diesel driven pumps and headers to supply water to fire hydrant network.
- Adequate Portable fire extinguishers, sand bucket, wheeled fire & safety equipment should be provided at the required places.
- Equipment required for personal safety like blankets, gloves, apron, gum boots, face mask helmets, safety belts, first aid boxes etc. are provided. Proximity suits and self-contained breathing apparatus to be provided.

Health arrangements will be provided to workers engage in handling of toxic material.

- The health & physical hazards caused due to toxic, irritant, corrosive, flammable materials. All chemicals are within Threshold Limit Value as per ACGIH.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. will be carried out regularly and its record will be maintained.
- Pre-employment medical checkup and periodically medical examination will be done. Medical Check-up of Employees will include Chest X rays, Audiometry, spirometry, Vision testing, ECG, during pre placement and periodic intervals.
- Liver function test will be done during pre-placement and periodical examination.

7.11 Disaster Management Plan

Disaster

An emergency is said to have arisen when operations in the plant are not able to cope up with a potential hazardous situation i.e. loss of control of an incident cause the plant to go beyond its normal operating conditions, thus creating danger. When such an emergency evolves chain of events affect the normal working within the factory area and/ or which may cause injuries, loss of life, substantial damage to property and environment both inside and outside the factory and a disaster is said to have occurred.

The various steps involves in the process of Disaster Management can be summarized as:

- Minimize Risk Occurrence (Prevention)
- Rapid Control (Emergency Response)
- Effectively Rehabilitate Damaged Areas (Restoration)
- Disaster Management Plan is involved by careful scrutiny and interlinking of:
- Types and causes of disaster
- Technical know-how
- Resource availability

The various type of Disaster that may occur is

- Due to the fire and
- Major spillage from tank
- Hurricane, cyclone and other natural calumniates.

Objectives of the Plan

The plan will set into action immediately after a fire occurs inside the plant. However fire hazard will be restricted to fuel tank storage area only and hence to major disaster is envisage. The plan is developed to make best possible of unit,

- Rescue the victims and treat them suitable.
- Safe guard others (evacuating them to safer places).
- Contain the incident and control it with minimum damage.
- Identify the persons affected.
- Preserve relevant records and equipment needed as evidence incase on inquiry.
- Rehabilitate the affected areas.

Basis of Plan

Unit will prepare an onsite emergency plan. The basic guideline of the Plan is as given below:

- Informative broacher on emergency will be distributed to each staff member of the plant and telephone numbers of key personnel to be contacted during an emergency will be placed at all the operator placement point in the plan.
- Workers would be trained regularly on fire hazard drill, which will be organized once in a here mock drill from the safety and fire agency.
- The industry will provide the wall surrounding the methanol storage area.
- 24 hours vehicle for service and in-plant first aid emergency kit would be provided.

7.11.1 Post Disaster Analysis and Evaluation

When emergency is over, it is desirable to carry out a detailed analysis of the causes of the accident to evaluate the influence of various factors involved and to propose methods to eliminate them in future. Simultaneously, the adequacy of the disaster preparedness plan will be evaluated and any short comings will be rectified.

7.11.2 General Recommendations

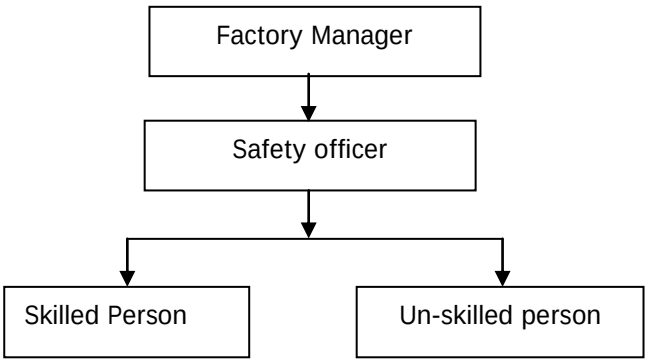
- All non-routine work etc. should be carried out under a permit system.
- Adequate number of caution boards high lighting the hazards of chemicals to be handled, eye bath and emergency showers should be provided at critical location.

- Adequate number of absorbents should be placed at accessible locations in the tank farm area as well as in the pump house that would enable to contain spills immediately.
- Adequate color coding and labeling of the pipelines should be provided for easy identification of products proposed to be handled through them.
- The damage distance due to any failure could be reduced, by reducing the time required to stop the leak, which in turn would reduce the quantity of spillage. The response time could be reduced by installing /maintaining instruments, effective communication system, etc.
- It is recommended that rubber mats be provided in front of electrical panel of the entire plant with a view to prevent employees from receiving electric shocks.
- It is suggested that all type of fire extinguishers be placed at appropriate places for easy access in case of emergency.

7.11.3 The Availability, Organization, and Utilization of Resources for Emergency

The organizational set-up necessary for chain of commands during emergency situation, which may arise in the premises. The system is described in following Subsections.

Organizational Set-up



Functions and Responsibilities of Factory Manager

- He shall be the main guiding person for direct emergency operations.

Safety officer

- The main responsibility of safety officer is safety management.
- The Safety management includes the implementation of prevention methods to avoid incident or accident and handling of emergency in case of accident.

Skilled person

- He shall be responsible for the operation and maintenance.

Skilled person

- He shall be arranging the safety equipment accordingly.
- He shall be followed the instruction of supervisor and officer.

7.11.4 Emergency Response Room (Safety officer room)

The place identified as Emergency Response Center will be considered as the Security Gate Office. The location of the Emergency Response Center may change in future as per convenience. The facilities available at the Emergency Response Center shall include:

- Internal Telephone
- External Telephone
- Manual Fire/Emergency Siren
- Siren Actuation Switch
- Important Address and Telephone Numbers
- Emergency Vehicles
- Confined Space Entry Procedure
- List of Antidote/actions to be taken in case of hazardous chemical/materials.
- Material Safety Data Sheets of chemicals
- A copy of On-Site Disaster Management Plan

All communications after General Shift working hours and on Sundays/ Holidays are to be routed through the Security Gate Office.

General Rules

- Follow sense of discipline and do not pain.
- Do not rush and endanger your personnel safety
- Use personnel protective equipment according to the situation
- Do not block any passages, which may hinder the movement of emergency vehicles.
- In case you have to shut down your plant operation, do it in an orderly manner as per standard operating procedures.
- In situation when you have to leave your work and evacuate to identify places out of operating areas, do it in an orderly manner.
- Follow instructions of the Safety officer.
- Understand the Disaster Management Plan well and take interest in practice mock drill.

7.11.5 Fire Fighting Facilities

Fire Buckets / Fire Extinguishers

Fire buckets and portable fire extinguishers will be provided in all the areas depending upon the specific needs of the area. Some spare equipment will also be maintained in the inventory at an identified fire & safety equipment store.

Fire Alarm Sirens

It shall be provided to alert all the employees inside the premises about the situation of an emergency.

Sand Buckets

5 nos. of sand buckets will be provided within the industrial premises in case of emergency fire.

Oxygen cylinder

8 no. of oxygen cylinder will be provided for emergency.

Safety Equipment

All types of personnel protective safety equipment required for handling the emergency are to be arranged in the M/s. Highborne Laminates Pvt. Ltd. site. Some of the protective equipment is as follow:

- Canister/Cartridge type masks
- Dust Masks
- PVC suits, Aprons
- Safety showers/ Eye Wash fountains
- Other personnel protective appliances, like safety glasses, gumboots, helmets, hand gloves, face shields, safety belts, safety ladders, safety torches, blankets.

7.11.6 Other Key Personnel

All key personnel will wear red helmet for their identification and easy recognition. The responsibilities and duties of key personnel include.

Safety

The safety officer/ supervisor will carry out the following:

- To provide necessary equipment like fire fighting equipment (FFE) and personal protective equipment (PPE).
- To accompany factory inspector during investigation of the emergency.
- To train workers/ supervisors in safety and safe operating procedures.
- To assist the site main controller, incident controller in preparing a brief report of the incident.

Assembly Points:

- The assembly points for gathering non-essentials workers / persons will be fixed and will be clearly marked as per the wind direction.

Fire Control Arrangement:

Fire fighting trained personnel will be made available in all the shifts. The responsibilities and duties include:

- To fight the fire with available internal fire fighting equipment and to stop leakage of liquid etc.
- To provide personal protective equipment to the team.
- To cordon the area and inform incident controller or site main controller about the development of emergency.
- To train the persons (essential workers) to use personal protective equipment and fire-fighting equipment.

Medical Arrangement:

The responsibilities and duties include:

- To provide first aid to the affected persons, and, if necessary, send them to hospitals for further treatment.
- To keep a list of blood groupings ready and update.

Transport Evacuation Arrangement:

- For transportation of people, company's vehicles, cars, rickshaws etc. will be utilized.

7.11.7 On Site Emergency Plan

An emergency in the premises has the potential to cause serious injury or loss of lives or extensive damage to the property and/or environment and serious disruption both inside and outside the plant. In such cases sometimes outside agencies are required to call for help in handling the situation. The causative factors like plant/equipment failure, human error, earth quake, sabotage etc. will normally manifest in various forms viz. Fire, Explosion, Toxic release, structure collapse etc.

This OEP lays down the code of conduct of all personnel in the Plants and the procedures to be adopted by them in the event of an "Emergency". These procedures have been prepared taking into account the minimum strength of manpower available at all times in the premises. The individuals under the direction of the respective Team Leaders shall carry out the responsibilities assigned.

The emergency procedures outlined are suitable for round the clock coverage including holidays. These emergency procedures shall be followed as outlined in the OEP during general shifts as well.

The overall objectives of OEP are:

- To control the situation and if possible eliminate as quickly as possible.
- To avoid confusion/panic and to attend the emergency with clear-cut line of action.
- To minimize the loss of property to the plant as well as to our neighborhood.
- To safe guard the non-affected areas.
- To alert the neighborhood.
- To arrange head-count and rescue operations.
- Treatment of the injured.
- To safeguard others by timely evacuation.
- To prevent any cascade of emergencies.

Accident:

An accident is an unplanned event, which has a probability of causing personal injury or property damage or both. It may result in physical harm (injury or disease) to person (s), damage to property, loss to the company, a near miss or any combination of the effect.

A Major accident is a sudden, unexpected, unplanned event, resulting from uncontrolled developments during and industrial activity, which causes or has a potential to cause

- Serious adverse effects immediate or delayed (death, injuries, poisoning or hospitalization) to a number of people inside the installations and/ or to persons outside the establishment.
- Significant damage may be caused to crops, plants or animals or significant contamination of land waters or air.
- An emergency intervention outside the establishment (evacuation of local population, stopping of local traffic).
- Any combination of above.

Emergency:

An emergency is the situation, which has potential to cause a large-scale damage or destruction to life or property or Environment or combination of these within or outside the factory. Therefore it is essential to have a laid down procedure to meet emergency systematically. In any industry, emergency can arise at any moment and this depends on the type of:

- Structure
- Raw materials
- Machines
- Nearby Industries
- Location of the Industry etc.

Nature of emergency:

The "Emergency" specified in this plan will refer to occurrence of one or more of the following natural/manmade events.

- Fire
- Explosion
- Release of Toxic Gas/Vapour
- Spillage of flammable liquid /gas
- Deliberate Sabotage, Terrorism, Air Raid etc.
- Natural Calamities: - Lightening, Storm, Earthquake, Flood etc.
- Collapsing of structure
- Overturning of tanker containing flammable / toxic substances.

Medical help:

First Aid Boxes have been provided at various strategic locations. Requisite number employees are trained about First Aid, Liaison with nearest hospitals.

Communication system:

- Alarm Raising for Emergency by blowing the sirens installed
- The siren will be used for raising the emergency alarm and also for all clear signals.
- Emergency Siren: The wailing alarm will be sounded intermittently at fixed interval of 30 seconds for a period of two minutes in case of emergency, such alarm will signify the employees that an emergency has occurred and that the emergency services should be put into operation.
- Incident Controller after assessing the situation will declare that emergency is over. Till the Incident Controller issues the declaration, all the leaders will adhere to the task and be present at the prescribed location.
- All clear signal will be sounded through continuous siren for 1 minute. Even after the emergency is over a skeleton staff of the Rescue/Evacuation Team will be available at the site of emergency for at least 30 minutes to ensure that the situation is absolutely free from danger.
- After the emergency is over, all the team leaders should meet at the Emergency Control Center and each team leader should submit a report to the Incident Controller about team performance and other details observed.
- In addition to the above systems, Internal telephones, P.A.System, Mobile telephones, Computer System etc. will be used for communication.

- If situation is beyond the control, the external agencies will be informed accordingly and asked for the help. Direct telephone, cell phone or messengers / runners may achieve this.

Assembly point:

In case of emergency some locations are considered as Assembly Points. Depending on the wind direction and location of emergency, Assembly Point will be declared. The employees should run across the wind direction and not against the wind direction.

Depending upon the location of the emergency the Incident Controller will fix the Assembly Point and Officer will announce the location of the Assembly Point. Employee's attendance, visitors and contractors workmen register will be made available at the Assembly Point for head count.

Emergency control center:

Factory Manager Office will be declared as an Emergency control center. Emergency control center is facilities with:

- Address and Telephone numbers of the Factory Inspectorate, Gujarat Pollution Control Board, Police, Fire Brigade, Hospitals and OEP Team Members
- Plant layout-indicating storage of hazardous materials, layout of fire Hydrants/extinguishers, entrances/exits, roads etc.
- Portable P.A. System, Manual Siren, flood lights, Torches, Pickaxe, Saw, Nylon Ropes.
- Fire Blankets / Fire Proximity Suit, Breathing Apparatus, First Aid Box etc.
- List of employees with address, telephone number, blood group etc.
- Material Safety Data Sheets of all chemicals handled.

Wind Socks:

Wind direction will be determined with the help of installed windsocks.

Mock drill:

Mock drills are carried out regularly to familiarize the staff with their roles, fire protection equipment/system installed in the plant and use of personnel protective equipment. Senior officials monitor this and shortcomings are thoroughly studied and necessary corrective measures are taken.

Procedures for Mock Drills

- Inform all the employees about mock drills and the signal to be given.
- Fix the date and location of the emergency for mock drills.
- Mock drills will be monitored by observers.
- Raise the siren for emergency.
- After hearing the siren the Incident Controller, Site Controller, Officers and Team Members should actuate the "On-site Emergency Plan".

Procedure on Noticing an Emergency

- If anybody notices any situation, which may lead to a disaster, should be immediately inform the Shift In-charge / site controller / Incident Controller / Fire & Safety Supervisor / Security.
- Take charge of the situation as Incident Controller.

- Rush to the site of emergency to get the correct picture and then to Emergency Control Center for speedy control over the situation by making an arrangement for raising the alarm.
- On arrival of Team members, he shall assign duties as required and activate the On-Site Emergency Plan.
- Ensure safety of the plant and the personnel in the plant. He will make an assessment of the emergency and decide on external assistance.
- Communicate and Coordinate among the Incidents Controller/ Site Controller/ Factory manager/ fire safety supervisor etc. and will be the final authority on all matters related with management of emergency such as:
    - Fire fighting.
    - Welfare and rescue operations.
    - Arrange for Civil/Mechanical/Electrical work during emergency.
    - Transport.

Incident controller / site controller:

Rush immediately to the scene of the fire/emergency, select and set out appropriate fire/emergency equipment. He will take the below mentioned actions at the earliest opportunity, if the fire/emergency is not controlled.

He will

- Call the security personnel from their residences for additional manpower if required.
- Regulate entry and exit of personal required for controlling the fire/emergency.
- Restrict exit of personal required for controlling the fire/emergency.
- Arrange for Personnel Protective Equipment required for the emergency.
- Call, the local Fire Brigade, Police in case of necessity in consultation with the Incident controller.
- Arrange transport facilities for removal of causalities to dispensary / hospital.
- Take responsibility of law and order.
- Keep detailed records of the incident and progress of operations to fight the emergency.

Factory manager:

He will rush to the Emergency Control Centre and collect the information from the Incident Controller. Further he will,

- Announce the location of the Assembly Point after getting information from Incident Controller / site controller.
- Take the list of persons to be communicated internally and externally.
- Maintain liaison with the press, government agencies i.e. Police, Fire Brigade etc. and the neighborhood regarding the emergency under instructions from Incident Controller.
- Courteously Receive officers from the State Government or neighbors to the Administration Block only and inform to Incident Controller that they can be taken care off.
- Take all the steps required for the welfare such as providing tea, snacks, emergency temporary Medical Center in consultation with the incident controller/site controller.
- Disclose all the necessary information in the plant and media so as to avoid rumors and Confusion.

- Also be responsible for the head counts at the Assembly Points.

Fire & Safety Supervisor/ Shift Incharge & Security:

- Proceed to the scene; establish contact with firemen and incident controller to supplement efforts in fire fighting.
- Assist in searching casualties and help to remove them to the medical center.
- Organize outside assistance in fire fighting and rescue operations if required.
- Mobilize personal protective equipment and safety appliances and assist personnel handling emergency in using them.
- Keep and check on any new development of unsafe situation and report the same to Site Main Controller.
- Collect and preserve evidence to facilitate future inquiries.
- Effectively cordon off the emergency area and will prevent unauthorized people entering the scene.
- Permit the Fire tenders or Ambulance requisitioned by Incident Controller to the plant.
- Ensure that vehicles and trolleys are sent out of the plant premises.
- Ensure that all the employees are conducted out of plant and assembled at Assembly Point.
- Control Traffic Movement.
- Remove tankers, tanker drivers outside.
- Entry of unauthorized public to be prevented.
- Arrange for vehicles for shifting casualties and essential workers to safe assembly points.

Engineering/ operation & maintenance:

- Ensure the safety of the remaining part of the plant.
- Take necessary steps for plant shutdown in consultation with the site controller.
- Ensure that an Operator is immediately available at the Water Pump House for fire fighting.
- Mobilize with necessary tools and tackles to handle any repair work on an emergency basis.

7.11.8 Locating the plant in open area instead of covered to be reviewed in view of safety consideration

Storage tank of phenol, Formaldehyde and methanol should be installed away from the plant area.

- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Containment dykes with proper sloping and collection sumps should be provided so that any spillages in the bulk storage and other handling areas shall not stagnate and shall be quickly lead away to a safe distance from the source of leakage. This reduces the risk of any major fire on the bulk storages and the risk to the environment shall be minimized/ eliminated.
- Inspection of the storage tanks as per prefixed inspection schedule for thickness measurement, joint and weld efficiency etc.

- Provision of flameproof electrical fittings / equipment's.
- Comprehensive colour code scheme to identify different medium pipes.
- Proper maintenance of earth pits.
- Strict compliance of security procedures like issue of identity badges for outsiders, gate passes system for vehicles, checking of spark arrestors fitted to the tank lorries etc.
- Strict enforcement of no smoking.

7.11.9 Offsite Emergency Preparedness Plan

Offsite emergency plan would follow the onsite emergency plan. When the consequences of an emergency situation go beyond the plant boundaries, it becomes an offsite emergency.

Offsite emergency is essentially the responsibility of the public administration. However, the plant management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighboring population. The offsite plan in detail will be based on those events, which are most likely to occur, but other less likely events, which have severe consequence, will also be considered. Incidents which have very severe consequences yet have a small probability of occurrence would also be considered during the preparation of the plan. However, the key feature of a good offsite emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan.

The roles of the various parties who will be involved in the implementation of an offsite plan are described below. Depending on local arrangements, the responsibility for the offsite plan would either rest with the plant management or with the local authority. Either way, the plan would identify an emergency coordinating officer, who would take the overall command of the offsite activities. As with the onsite plan, an emergency control centre would be setup within which the emergency coordinating officer can operate.

An early decision will be required in many cases on the advice to be given to people living "within range" of the accident - in particular whether they should be evacuated or told to go indoors. In the latter case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors: In the case of a major fire. Only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically; and if a fire is escalating and in turn threatening a store of hazardous material, it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people should be advised to stay indoors and shield them from the fire. This later case particularly applies if the installation at risk could produce a fireball with very severe thermal radiation effects.

Although the plan will have sufficient flexibility built in to cover the consequences of the range of accidents identified for the onsite plan, it will cover in some detail the handling of the emergency to a particular distance from each major hazard works.

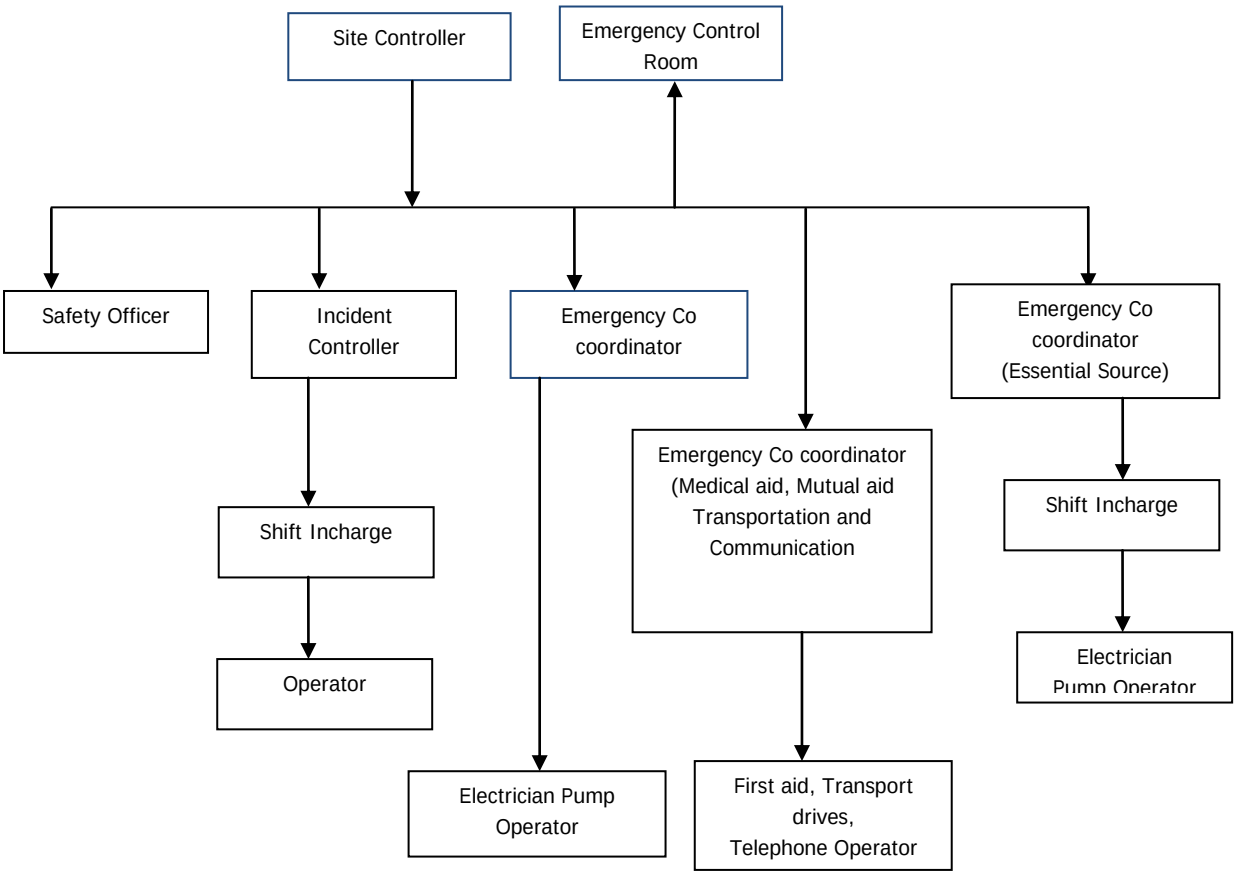


Figure 7-5: Off-Site Disaster Management Plan

A. Aspects Proposed to be considered in the Offsite Emergency Plan

The main aspects, which should be included in the emergency plan, are:

Organization

Detail of command structure, warning systems, and implementation procedures, emergency control centres. Names and appointments of incident controller, site main controller, their deputies and other key personnel.

Communications

Identification of personnel involved, communication center, call signs, network, list of telephone numbers.

Specialized Knowledge

Details of specialist bodies, firms and people upon whom it may be necessary to call e.g. those with specialized fuel knowledge, laboratories.

Voluntary Organizations

Details of organizers, telephone numbers, resources etc

Fuel Information

Details of the hazardous substances stored and a summary of the risk associated with them.

Meteorological Information

Arrangements for obtaining details of weather forecasts and weather conditions prevailing at that time

Humanitarian Arrangements

Transport, evacuation centres, emergency feeding, treatment of injured, first aid, ambulances and temporary mortuaries.

Public Information

Arrangements for (a) Dealing with the media press office; (b) Informing relatives

Assessment of Emergency Plan

Arrangements for:

Collecting information on the causes of the emergency; and Reviewing the efficiency and effectiveness of all aspects of the emergency plan.

B. Role of the Emergency Co-ordinating Officer

The various emergency services would be co-ordinated by an Emergency Coordinating Officer (ECO), who will be designated by the district collector. The ECO would liaison closely with the site main controller. Again depending on local arrangements, for very severe incidents with major or prolonged offsite consequences, the external control would be passed to a senior local authority administrator or even an administrator appointed by the central or state government. The ECO will be equipped with address and phone numbers of important agencies.

Role of the Local Authority

The duty to prepare the offsite plan lies with the local authorities. The emergency planning officer (EPO) appointed should carry out his duty in preparing for a whole range of different emergencies within local authority area. The EPO should liaison with the plant, to obtain the information to provide the basis for the plan. This liaison should ensure that plan is continually kept up to date. It will be responsibility of the EPO to ensure that all those organizations which will be involved offsite in handling the emergency, know of their role and are able to accept it by having for example, sufficient staff and appropriate equipment to cover their particular responsibilities. Rehearsals for offsite plans should be organized by the EPO.

Role of Police

Formal duties of the police during an emergency include protecting life and property and Controlling traffic movements. Their functions should include controlling bystanders, evacuating the public, identifying the dead and dealing with casualties, and informing relatives of death or injury.

Role of Fire Authorities

The control of a fire should be normally the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer should also have a similar responsibility for other events,

such as explosions. Fire authorities in the region should be appraised about the location of all stores of flammable materials, water and foam supply points, and firefighting equipment. They should be involved in onsite emergency rehearsals both as participants and, on occasion, as observers of exercises involving only site personnel.

Role of Health Authorities

Health authorities, including doctors, surgeons, hospitals, ambulances and so on, should have a vital part to play following a major accident, and they should form an integral part of the emergency plan. For major fires, injuries should be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle this in all but extreme cases may be generally available in most hospitals.

Major off site incidents are likely to require medical equipment and facilities additional to those available locally, and a medical "mutual aid" scheme should exist to enable the Assistance of neighboring authorities to be obtained in the event of an emergency.

Role of Government Safety Authority

This will be the factory inspectorate available in the region. Inspectors are likely to satisfy themselves that the organization responsible for producing the offsite plan has made adequate arrangements for handling emergencies of all types including major emergencies. They may wish to see well documented procedures and evidence of exercise undertaken to test the plan. In the event of an accident, local arrangements regarding the role of the factory inspector will apply. These may vary from keeping a watch, to a close involvement in advising on operations.

Offsite Action Plan			
Sr. No.	**Action Required to be taken to Mitigate Disaster by Aid giving agency**	**Responsible Agencies for taking action**	**Equipments/Material facilities required at site to mitigate Emergency**
A 1	Arrangements for evacuation/ rescue of persons from zone of influence to predetermined camps	Police Department	Self Breathing apparatus with spare cylinder Chemical gas mask with spare canister Vehicle with PA system Transportation for evacuation of people
2	Caution to public by announcement		
3	Traffic control by cordoning of the area		
4	Law & order		
5	Request to railway authority for keeping the nearest railway gate open & to stop the trains at the nearest railway station		
B	Control of fire	District Fire Brigade	Self breathing apparatus with spare cylinders Foam /water fire tenders Gas mask with spare canisters Lime water Neck to toe complete asbestos suit, PVC hand gloves, gumboots, safety goggles
1	Scrubbing of the flashed off gas cloud with water curtain		
2	To rescue trapped persons		
3	If fire is big, keep surrounding area cool by spraying water		
4	Communication to State Electricity Board to continue or cut off electric supply		

Offsite Action Plan			
Sr. No.	**Action Required to be taken to Mitigate Disaster by Aid giving agency**	**Responsible Agencies for taking action**	**Equipments/Material facilities required at site to mitigate Emergency**
5	Communication to water supply department for supplying water		Mobile scrubbing system alongwith suction arrangement.
C	Medical facilities for affected persons (first aid and treatment)	Hospital and public health	Ambulance with onboard resuscitation unit, first aid, stretchers
D	Identification of concentration of gas in zone of influence	Pollution Control Board	Gas detector
E	Removal of debris and damaged structures	Municipal corporation	Provide bulldozers Provide cranes
F 1	Monitor the incoming and out going transports	Transport department	Provide traffic police at site Provide emergency shifting vehicles at site Provide stock of fuel for vehicles.
2	Arrange emergency shifting of affected persons and non affected person to specified area		
3	Arrange diesel/petrol for needed vehicles		
G 1	Give all information related to Meteorological aspects for safe handling of affected area for living beings	Meteorological Department	Provide wind direction and velocity instruments with temperature measurements
2	Forecast important weather changes, if any		Mobile van for Meteorological parameter measurements
H 1	Representatives of all departments are in the local crisis group; therefore they are expected to render services available with them. Since it is a group of experts with authority, the mitigating measures can be implemented speedily. The representatives from locals are also there so that communication with local people is easy and quick.	Local Crises Group	Must have all resources at hand, specially disaster management plan and its implementation method. All relevant information related to hazardous industry shall available with crisis group Newspaper editor shall be a part of the group so that right and timely media release can be done
2	The district emergency or disaster control officer / collector shall be the president and he shall do mock drill etc so that action can be taken in right direction in time		
I 1	Collector shall be the President of District Crisis Group therefore all district infrastructure facilities are diverted to affected zone	District Crisis Group	All necessary facilities available at district can be made available at affected zone
2	All other functions as mentioned for local crisis group		Control of law and order situation