RISK ANALYSIS & DISASTER MANAGEMENT PLAN – (UNIT-IV)

1.0 Definition of Risk

Risk (R) is thus defined as function of possibility of occurrence of hazard (f) and magnitude of its consequence (D).

Risk (R) = f (Hazard, Probability, Consequence)

In most of the applications, however, risk may be defined as

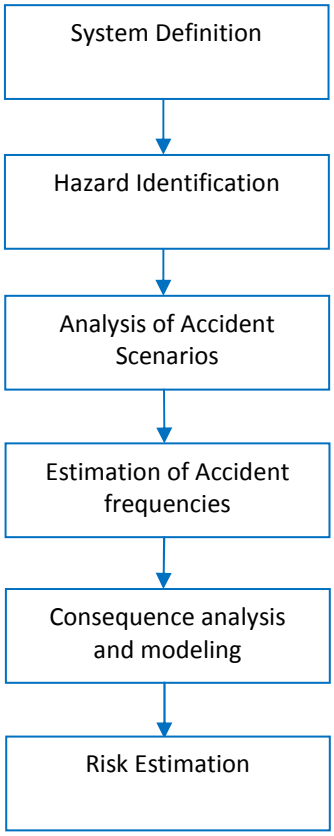
Risk (R) = Probability (f) * Consequence (D)

2.0 METHODOLOGY

1. All the Raw Materials are listed to identify Hazardous chemicals as per MSIHC Rule –1989 and PLI Act/ rule.
2. All the Hazardous Chemicals are categorized in two category a) Hazardous chemicals from RM list of existing facility and b) from RM list of proposed facility.
3. Hazardous chemicals from both the list are further classified as per their potential hazardous property and physical property.
4. All the hazardous chemicals are assessed for their potential risk, using 3 x 3 Risk Assessment Matrix. Procedure for risk assessment by 3 x 3 Risk Assessment Matrix is explains at Para 5(B).
5. a. Significant hazard/ risk is identified as “Heavy spillage of liquid chemical with evolution of toxic gas” or “ Toxic gas release” with Emergency status, in risk assessmentby3 x 3 Risk Assessment Matrix, n then such hazard/risk are further assessed for Gas Dispersion, using ALOHA software, approved by EPA-USA. Result of Risk Assessment and Gas dispersion modeling are taken in to account or RISK MANAGEMENT PLAN(RMP) and EMERGENCYRESPONSEPLAN(ERP).

5. b. If the potential hazard is identified as “fire” or “explosion”, with Emergency status, in risk assessment using 3x3 Risk Assessment Matrix, then such situation/hazards are compared with the risk assessment done by District Crisis group-Bharuch and Local Crisis group-Jhagadia, Ankleshwar area. Findings of the District Crisis group and Local Crisis group are also taken in to account for RISK MANAGEMENT PLAN (RMP)and EMERGENCYRESPONSEPLAN.(ERP).

Quantitative risk assessment(QRA) is ameansofmakingasystematic analysis of the risks from hazardousactivities, and forminga rational evaluationoftheirsignificance,in order to provide inputtoa decision-making process. The term‘quantitativerisk analysis’iswidely used,butstrictlythisreferstothepurelynumericalanalysisofriskswithoutanyevaluation oftheirsignificance. The study has been conductedbasedonthe premisesofa traditional QuantitativeRiskAssessment.ThekeycomponentsofaQRAareexplainedbelow,& illustrated in Figure 1.



3.0 STORAGE AND HANDLING OF HAZARDOUS CHEMICALS

The properties of the important raw materials and the safety precautions to be taken to prevent an accident are detailed in 'Material Safety Data Sheets'(MSDS)

The details of storage of Hazardous chemicals along with measures taken are given in Table 1.

TABLE :1

STORAGE DETAILS OF HAZARDOUS CHEMICALS

Sr. No.	Name of Hazardous Chemical	Type	MOC	Size KL	No	Dimension
1	DEG/PEG	liquid	MS	60	2	5.0 m x 4.0m
2	Sulphuric Acid	liquid	MS	50	3	4.5 m x 3.8 m
3	Hydrochloric Acid	liquid	FFFRP / HDPE	20	2	5.3 m x 2.5 m
4	Nitric Acid	liquid	Aluminum coated tank	10	1	4.0 m x 2.0 m
5	Benzene	liquid	MS	50	2	4.5 m x 3.8 m
6	Iso Propyl Alcohol	liquid	MS	20	1	5.3 m x 2.5 m
7	Chloro Benzene	liquid	MS	20	2	5.3 m x 2.5 m
8	Methanol	liquid	MS	20	1	5.3 m x 2.5 m
9	EDC	liquid	SS 304	20	2	5.3 m x 2.5 m
10	Ortho Di Chloro Benzene(ODCB)	liquid	MS	20	1	5.3 m x 2.5 m
11	Ammonia	Liquid	MS	20	1	5.3 m x 2.5 m
12	Sodium Hydroxide Lye	liquid	MS	25	1	5.5 m x 2.5 m
13	m-Dichlorobenzene	Liquid	MS	75	1	5.5 m x 4.25 m
14	Meta Di Nitro Benzene (MDNB)	Liquid	MS	25 KL	3	5.5 m x 2.5 m
15	Chlorine	Gas	Tonner/Pipeline from the nearby manufacturer	900 Kg	5	----
16	3- Nitro -4- Methyl Benzoic Acid	Liquid	Drum	200 Liter	10	----
17	2- Methyl -5- Nitro Phenol	Liquid	Drum	200 Liter	10	----
18	Iso Butyl Alcohol	Liquid	Drum	200 Liter	10	----
19	Benzene Sulphonyl Chloride	Liquid	Drum	200 Liter	10	----
20	2- Chloro Ethanol (O - Chloro Ethanol)	Liquid	Drum	200 Liter	10	----
21	2,4 – Dichloro Phenol	Liquid	Drum	200 Liter	10	----
22	Para Chloro Phenol (PCP)	Liquid	Drum	200 Liter	10	----
23	Dimethyl Sulfate	Liquid	Drum	200 Liter	10	------
24	Phenol	Liquid	Drum	200 Liter	10	----
25	Nitro Benzene	Liquid	Drum	200 Liter	10	----

Chemical Properties of the Hazardous Chemical

SR. NO.	NAME OF THE RAW MATERIALS	HAZARD	FP deg C	BP deg C	SP.GR. 20 deg C	VD vs air	SOLUBILITY WITH WATER at 20 deg C	VP mm Hg 20C	LEL%	UEL%	LD50 ORAL mg/kgs	LD50 DARMAL mg/kgs	LC 50 mg/L
1	Methanol	Flammable, Toxic	12	64.7	0.791	1.11	Miscible	128 kPa	6	31	5658 Rat	15800 Rabbit	
2	Benzene CAS # 71-43-2	Flammable, Toxic	-11	81.1	0.879	2.8	Insoluble	--	1.3	7.9	-	--	83.2 Rat 4hour
3	Sulphuric Acid	Corrosive	-	100	1.3	3.4	Soluble	2.3 kPa	-	-	4280 Rat	-	24 ml/kg for rat for 2H
4	Chloro Benzene CAS # 108-90-7	Flammable/Toxic	29.4	132	1.10	3.88	Soluble	8.8	1.3	7.1	10 ppm	2300 ppm	-
5	Ethylene Dichloride	Flammable/Toxic	13	81-85	1.25	3.4	8.7 g/l	65mmHg	6.2	15.9	625 Rat	2800 Rabbit	22,000 ppm Rat
6	Chlorine	Toxic	-	100	1	0.62	Soluble	17.53	-	-	-	-	28.79 Rat 1h
7	Phenol	Flammable	79-84	182	1.057	3.24	Soluble	--	1.7	8.6	317mmg/ kg [Rat]	630 mg/kg [Rabbit]	1017 ppm
8	Ortho Dichloro Benzene (ODCB) CAS # 95-50-1	Flammable, Toxic	66	180-183	1.3	5.1	Insoluble	-	2.2	9.2	--	--	--
9	m- Di chloro Benzene	Toxic	--	297	1.37	--	Insoluble	negligible	NA	NA	59.5 mg/ Kg	1900 mg/ Kg	8150 mg/m3 for 4H Rat
10	Nitric Acid	Corrosive/oxidizing	--	121	1.408	2.5	Soluble	6 KPa	--	--	--	----	---
11	Sodium Hydroxide	Corrosive	---	1390	1.48	2.3 (hydrate)	Miscible	< 2 KPa	---	---	---	----	---
12	Meta Di Nitro Benzene	Toxic	---	301	1.368	5.8	Slightly Soluble	---	---	----	74.4 mg/ kg	---	-----
13	Chloro Benzene	Flammable/ Toxic	29.4	132	1.10	3.88	Soluble	8.8 KPa	1.3	7.1	10 ppm	2300 ppm	-----
14	Nitro Benzene	Flammable/ Toxic	87.78	201.8	1.2	34.25	Slightly Soluble	0.15 KPa	1.8	---	590 mg/ Kg	---	22000 ppm Rat
15	30 % Hydrochloric Acid	Corrosive	--										----
16	Iso Propyl Alcohol	Flammable	12	81-83	0.785	2.1	Miscible	43 mm Hg	2.0	12.0	4396 mg. Kg Rat	12800 mg/ Kg Rat	

TABLE 2

STORAGE HAZARDOUS AND CONTROLS -- Proposed

Details of all (A) Products (B) Raw materials (C) Intermediates & (D) Bi-products

Sr. No.	Name of the material (Mention Concentration if any)	Total storage Cap. MT	Actually stored (total) MT	Actually Stored in the biggest container MT	Place of its Storage	State, pressure (Kg/cm^2) & Temp. (°C)	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided	Emergency Action
1.	Meta Di Nitro Benzene	25 X 3 tank	75	25	**UNIT - 4 Anupam Rasayan India Ltd.**	Ambient	Toxic.	1) Tank, valve, pipeline are checked and maintain, in good condition. 2) All Gaskets are checked periodically & if found defective are replaced by new one. 3) Joints are checked regularly to found any Leakage. 4) PPE is kept to handle the Hazard. 5) Sufficient amount of sand/soil are kept to control any spillage. 6) Vent line & level indicator provided. 7) Eye washer cum shower is provided near tank-farm area. 8) Dyke wall provided. 9) Fire Hydrant system installed. 10) Portable fire extinguisher provided 11) DCS / PLC control System installed. 12) Vent line deep in water.	

Sr. No.	Name of the material (Mention Concentration if any)	Total storage Cap. MT	Actually stored (total) MT	Actually Stored in the biggest container MT	Place of its Storage	State, pressure (Kg/cm2) & Temp. (°C)	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided	Emergency Action
2.	Benzene	50 X 2 tank	100	50	**UNIT - 4 Anupam Rasayan India Ltd.**	Ambient	Toxic / Flammable	(1) to (11) 12) Proper ear-thing & bonding provided. 13) No Smoking board display. 14) Flame arrester with breather valve provided.	
3.	Caustic Soda Lye 48%	25 X 1 tank	25	25	-DO-	Ambient	Corrosive & Spill, if leak from tank	(1) to (11)	
4.	Sulphuric Acid 98%	50 X 3 tank	150	50	-DO-	Ambient	Corrosive & Spill, if leak from tank	-DO-	
5.	Hydrochloric Acid	20 X 1 tank	20	20	-DO-	Ambient	Corrosive & Spill, if leak from tank	-DO-	
6.	Nitric Acid	10 X 1 tank	10	10	-DO-	Ambient	Oxidizer, corrosive	(1) To (11)	
7.	Di ethelene glycol (DEG)	60 X 2 tank	120	60	-DO- .	Ambient	Fire, if spill from tank & comes in contact with spark.	(1)to (11) 12) Proper ear-thing & bonding provided. 13) No Smoking board display. 14) Flame arrester with breather valve provided.	
8.	Meta Di Chloro Benzene	75 X 1 Tank	75	75	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	

Sr. No.	Name of the material (Mention Concentration if any)	Total storage Cap. MT	Actually stored (total) MT	Actually Stored in the biggest container MT	Place of its Storage	State, pressure (Kg/cm2) & Temp. (°C)	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided	Emergency Action
9.	Iso Propyl Alcohol	20 X 1 Tank	20	20	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	
10.	Chloro Benzene	20 X 2 Tank	40	20	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	
11.	Methanol	20 X 1 Tank	20	20	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	
12.	EDC	20 X 2 Tank	40	20	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	
13.	Ortho Di Chloro Benzene (ODCB)	20 X 1 Tank	20	20	-DO-	Ambient	Fire, if spill from Tank& comes in contact with spark	-DO-	
14.	Ammonia	20 X 1 Tank	20	20	-DO-	Ambient	Toxic	(1)to (11)	
15.	Chlorine	0.9 X 5 Tonners	4.5	0.9	-DO-	Ambient	Toxic	(1) to (11) 12) Chlorine Kit & FRP hood with scrubbing system provided	

Sr. No.	Name of the material (Mention Concentration if any)	Total storage Cap. MT	Actually stored (total) MT	Actually Stored in the biggest container MT	Place of its Storage	State, pressure (Kg/cm2) & Temp. (°C)	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided	Emergency Action
16.	3- Nitro -4- Methyl Benzoic Acid	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Corrosive	(1) to (11)	
17.	2- Methyl -5- Nitro Phenol	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	(1) to (11)	
18.	2,4 – Dichloro Phenol	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	-DO-	
19.	Para Chloro Phenol (PCP)	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	-DO-	
20.	Phenol	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	-DO-	
21.	Iso Butyl Alcohol	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Fire, if spill from Tank & comes in contact with spark	(1) to (11) (12) Separate storage	
22.	2- Chloro Ethanol (O - Chloro Ethanol)	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Fire, if spill from Tank & comes in contact with spark	-DO-	
23.	Nitro Benzene	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Fire, if spill from Tank & comes in contact with spark	-DO-	
24.	Benzene Sulphonyl Chloride	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	(1) to (11)	
25.	Dimethyl Sulfate	0.200 X 50 Drums	10	0.200	-DO-	Ambient	Toxic	-DO-	

Sr. No.	Name of the material (Mention Concentration if any)	Total storage Cap. MT	Actually stored (total) MT	Actually Stored in the biggest container MT	Place of its Storage	State, pressure (Kg/cm2) & Temp. (°C)	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided	Emergency Action
26.	NSA (By Product)	150 X 1 tank	150	150	-DO-	Ambient	Toxic, Oxidizer	(1) To (12)	
27.	Dilute Sulphuric Acid 65- 70 % (By Product)	50 X 1 tank	50	50	-DO-	Ambient	Corrosive & Spill, if leak from tank	-DO-	
28.	1-4 Dioxane	50 X 1 Tank 30 X 1 tank	80	50	-DO-	Nitrogen Blanketing	Fire, if spill from Drum & comes in contact with spark	(1) to (11) 12) Proper ear-thing & bonding provided. 13) No Smoking board display. 14) Flame arrester with breather valve provided.	

PROCESS HAZARDS & CONTROL-- Existing

PROCESS AND VESSEL HAZARDS AND ITS CONTROL

Sr. No.	Name of the Plant or Place	Name of hazardous process.	Materials in the process / operation with their quantity.	Name of the vessel & its location.	Operating parameters pressure, temperature etc.	Type of hazards possible	Control measures / provided.	In charge Person / Telephone number.
1	2	3	4	5	6	7	8	9
1	1,4 Dioxane Plant	Dehydration & distillation	As per raw material details given on Page-13	-	Atmospheric Temperature & Pressure	Fire, Chemical Spillage	• Adequate quantity of fire extinguishers provided. • Adequate number of safety shower provided • PPE has been selected as per materials and packaging process	Mr. Jitendra Pawaday . Manager – Works (O)8238035675
2	Drum filling room	Packing & Filling	As per raw material details given on Page-13	-	Atmospheric Temperature & Pressure	Fire, Explosion, Toxic Release	• Shock proof electrical equipment provided to avoid electrical hazard • Transfer of material by closed circuit only and by pump using PPE's • Earthing bonding provided to avoid static charge hazard • The production areas provided flame proof fittings	

PROCESS AND VESSEL HAZARD AND CONTROLS --- Proposed

Details of the manufacturing process - plant and/or product wise.

Sr. No.	Name of Plant, Department or Place	Name of the Hazardous Process and Operation	Materials in the process/ operation with their quantity and concentration	Name of the Vessel and its Location	Operating Parameters - pressure, temp., flow etc.	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided & Emergency action
1.	**UNIT :- 4 Anupam Rasayan India Ltd.**	Chlorination	MDNB / Chlorine	GLMS Vessel	< 170 - 180 ˚C Vacuum = < 500 mmHg	Fire Spill Toxic Gas release	(1) All Vessels are well designed to withstand the pressure, temperature and the reaction carried out inside it. (2) All Vessels are provided with pressure gauges and temperature indicator. (3) Jacket cooling system through Brine water / Plant water / Tower water circulation provided on all vessels. (4) All vessels are hydraulically pressure tested and record is maintained in Foam No. 11. (5) All the plants, departments are provided with fire extinguishers as per requirement. (6) Process area provided with flameproof electrical fittings and pumps. Plant declared "Fire Zone". No smoking board displayed in plants. Fire extinguishers are provided. All the pipelines are bounded and ear-thing provided.
2.		Washing	Acidic MDCB/ Nitric Acid	SS Vessel	Atmospheric	Fire Spill	
3.		Distillation	Crude MDCB	SS Vessel	< 125-135 ˚C Vacuum= 750 mmHg	Fire Spill	

4.		1,4 Dioxine	DEG	GL MS Vessel	< 106 ˚C Atmospheric	Fire Spill	(7) Workers/Supervisors/Officers working on process are well trained in safe operating procedures. (8) All plants are provided with eye washer cum safety shower. (9) Fire Hydrant System Installed. (10) DCS / PLC control System installed.

PROCESS AND VESSEL HAZARD AND CONTROLS --- Proposed

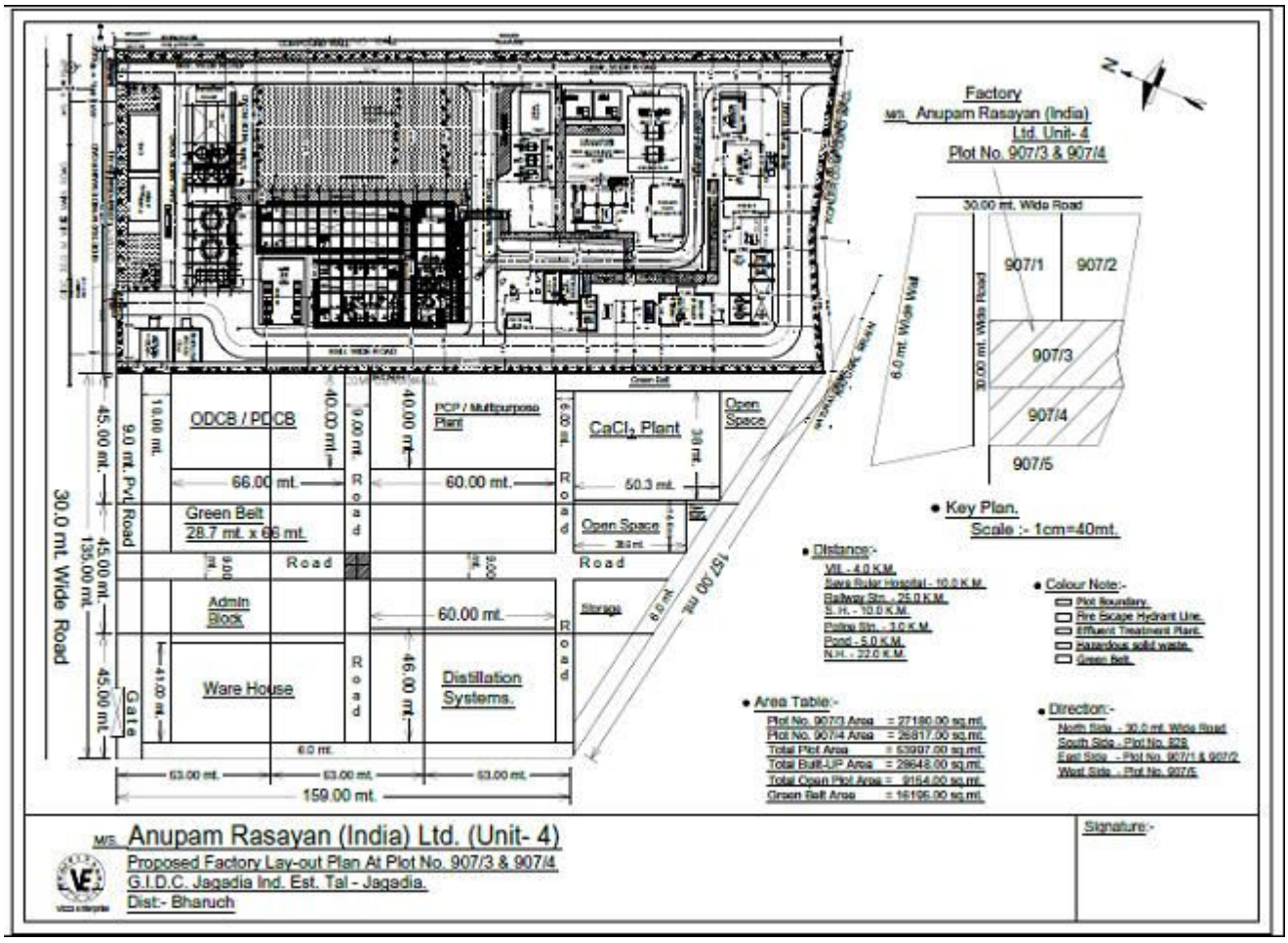
Details of the manufacturing process - plant and/or product wise.

Sr. No.	Name of Plant, Department or Place	Name of the Hazardous Process and Operation	Materials in the process/ operation with their quantity and concentration	Name of the Vessel and its Location	Operating Parameters - pressure, temp., flow etc.	Types of hazards Possible (Fire, Explosion, Toxic Release, Spill etc.)	Control Measures Provided & Emergency action
5.	**UNIT :- 4 Anupam Rasayan India Ltd.**	Nitration	Benzene/ Nitric Acid	SS Vessel	< 50 ^{0}C Atmospheric	Fire Spill, Toxic Gas release	(1) All Vessels are well designed to withstand the pressure, temperature and the reaction carried out inside it. (2) All Vessels are provided with pressure gauges and temperature indicator. (3) Jacket cooling system through Plant water / Tower water circulation provided on all vessels. (4) All vessels are hydraulically pressure tested and record is maintained in Foam No. 11. (5) All the plants, departments are provided with fire extinguishers as per requirement (6) Process area provided with flameproof electrical fittings and pumps. Plant declared "Fire Zone". No smoking board displayed in plants. Fire extinguishers are provided. All the pipelines are bounded and ear-thing provided. (7) Workers/Supervisors/Officers working on process are well trained in safe operating procedures. (8) All plants are provided with eye washer cum safety shower. (9) Fire Hydrant System Installed. (10) DCS / PLC control System installed. (11) Provision of Safety Valve, Rupture Disc & Blow Down Tank System.

TABLE 3
OTHER HAZARDS & CONTROL

Sr. No.	Name of the possible hazard or emergency	Its source & reasons (Activity)	Its effect on persons, property & environment	Place of effects	Control Measure
01	Boiler 1. Burning 2. Physical Injury 3. Explosion	Boiler-likely to cause due to temperature /pressure build up	Person and property	Factory Premises	Standard and necessary fittings to be provided regular inspection to be carried out.
02	Spillage from pipe lines 1. Toxic gas release 2. Fire	Pipe line & vessels -By not adhering safety norms and by negligence	Person	- Do -	Regular inspection of pipelines and vessels. The damaged pipes, flanges to be replaced regular painting of pipe lines
03	Electricity 1.Burning 2. Shock 3. Fire	Loose contact of wires, weak earthing Short Circuit, Improper Insulation.	Person Property	- Do -	Regular inspection of electrical fitting, flameproof fittings provided in flammable areas, proper earthing.
04	Bad House Keeping 1. Injury 2. Burning 3. Fire 4. Chemical hazards	Bad House Keeping	Person & Property	Factory Premises	Regular inspection of plant on day-to-day basis, Proper placement of materials.
05	Structural Collapse 1. Injury	Due to over loading of machinery, bad workman ship of construction Earthquake	- Do -	- Do -	Structural stability to be obtained from Chartered engineer, load bearing capacity to be checked, regular inspection of plant.

Figure -2
Layout of the Plant



Risk Assessment by 3 x 3 Risk Assessment Matrix

(1) Corrosive Liquid

Activity: Sulfuric acid: Storage Tank And Transfer By Pump To Receiver OfSulphuric Acid / Nitrosyl Sulfuric Acid/Nitric Acid

No.	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Leakage & spillage from tank cell or valve and splashing of material	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall will be provided. Periodi testing of tanks- once in two years regular painting per year. Apron, Hand gloves, gumboot, goggles and helme will be provided. Good house keepin is maintained. SBA set, Canister mas and airline mask is provided. Ey washer & shower will be provided.
		Skin contact	A	Moderate	Unlikely	Moderate	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation	Property loss and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size will be provided. Tank's thickness measured on regular interval. Painting on tanks is done on regular basis.
3	Broken Railing and broken steps of ladder.	Fall from height.	A	Serious	Highly unlikely	Moderate	Railing will be provided, Apron, Hand gloves, gumboot, goggles and helmet will be provided.
4	Leakage from glass level tube	Toxic gas release	E	Moderate	Unlikely	Moderate	Sound guard will be provided on level indicator and dyke wall will be provided.
5	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. ADEQUATE PPE as above is kept and warned. Dry sand is kept in sufficient quantity. Level gauge and level indicator with guard is provided. Overflow and return line will be provided on receiver.
6	Moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard will be provided.
7	Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE will be provided.

(2) Flammable liquid

Activity: **1-4 DioxineL**oading From Store inStorage Tank to And Transfer By Pump toRoad Tanker.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles & helmet provided. Good house keeping is maintained. Eye washer & shower provided. CCE approved premises with door having locking arrangement provided. Flame proof electrical connection provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. RCC foundation provided. Paintings of tanks are done on regular basis.
3	Leakage in present of ignition source.	Fire	E	Serious	Highly unlikely	Moderate	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. FFE in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed. Portable water monitor provided. Foam solution sufficient quantity provided.
4	Spillage due to overflow from Storage tank or Road Tanker.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(3) Combustible Material

Activity: DEG&PEG:,UNLOADING FROM ROAD TANKER BY PUMP, STORE IN STORAGE TANK AND TRANSFER BY PUMP TO RECEIVER TANK.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles and helmet provided. Good house keeping is maintained. SBA set, Canister mask and airline mask is provided. Eye washer & shower provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. RCC foundation provided.
3	Leakage in present of ignition source.	Fire	E	Moderate	Highly unlikely	Tolerable	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. Fire Extinguisher in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guard and fan guards provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and adequate PPE provided.

(4) Flammable liquid

Activity: **Petroleum Class 'B' (Diesel - HSD)** Unloading From Road Tanker, Store In Storage Tank And Transfer By Pump To Receiver Tank.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles & helmet provided. Good house keeping is maintained. Eye washer & shower provided. CCE approved premises with door having locking arrangement provided. Flame proof electrical connection provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. RCC foundation provided. Paintings of tanks are done on regular basis.
3	Leakage in present of ignition source.	Fire	E	Serious	Highly unlikely	Moderate	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. FFE in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed. Portable water monitor provided. Foam solution sufficient quantity provided.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

Risk assessment by 3 x 3 Risk Assessment Matrix for proposed facility:

(1) TOXIC RELEASE & CORROSIVE:

Activity: **CHLORINE (CL_2):** Storage Of Chlorine Tonner At Storage Facility And Handling Of Chlorine:

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Fall of Tonner from FLT.	Body injury and property damage	A	Serious	Highly unlikely	Moderate	FLT will be maintained in good condition. Train driver will be employed. Good road condition will be maintained. Tonner will be transferred only when Tonner with Valve protecting cap. SBA sets, Cl_2 Emergency Kit, Air line Respirator, All ADEQUATE PPE etc. Will be provided as required. FRP hood with alkaline scrubber will be provided. Continuous monitoring system for chlorine will be installed and maintained. On site Off site Emergency plan will be revised, amended and rehearsed on regular basis.
		Toxic gas release if Tonner valve breakage.	E	Serious	Highly unlikely	Moderate	
2	Bursting of Tonner / Valve due to storage in open area.	Toxic gas release	E	Serious	Highly unlikely	Moderate	Same as above and chlorine will be stored and used under Shed to protect from direct sun light. Tested Tonner will only be utilized & CCE approval will be taken. Hot work will be performed under safety work permit only.
3	Leakage from transfer line.	Eye contact	A	Serious	Highly unlikely	Moderate	Chlorine transfer line will be maintained in good condition. Will be checked periodically. Good and sound material will be used for transfer line. Apron, Hand gloves, gumboot, goggles, helmet and canister mask will be provided Ammonia torch will be provided.
		Skin contact	A	Moderate	Unlikely	Moderate	
		Inhalation of gas	A	Serious	Unlikely	Significant	

(2) Corrosive Liquid

Activity: Sulfuric acid: Storage Tank and Transfer by Pump to Receiver of Sulphuric Acid / Nitrosyl Sulfuric Acid/Nitric Acid /HCL

No.	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Leakage & spillage from tank cell or valve and splashing of material	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall will be provided. Periodi testing of tanks- once in two years regular painting per year. Apron, Hand gloves, gumboot, goggles and helme will be provided. Good house keepin is maintained. SBA set, Canister mas and airline mask is provided. Ey washer & shower will be provided.
		Skin contact	A	Moderate	Unlikely	Moderate	
		Slip & fall	A	Serious	Highly unlikely	Moderate	

No.	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
2	Heavy spillage due to collapse of storage tank from foundation	Property loss and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size will be provided. Tank's thickness measured on regular interval. Painting on tanks is done on regular basis.
3	Broken Railing and broken steps of ladder.	Fall from height.	A	Serious	Highly unlikely	Moderate	Railing will be provided, Apron, Hand gloves, gumboot, goggles and helmet will be provided.
4	Leakage from glass level tube	Toxic gas release	E	Moderate	Unlikely	Moderate	Sound guard will be provided on level indicator and dyke wall will be provided.
5	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. ADEQUATE PPE as above is kept and warned. Dry sand is kept in sufficient quantity. Level gauge and level indicator with guard is provided. Overflow and return line will be provided on receiver.
6	Moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard will be provided.
7	Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE will be provided.

(3) Flammable & Corrosive Material

Activity: EDC: UNLOADING FROM ROAD TANKER BY PUMP, STORE IN STORAGE TANK AND TRANSFER BY PUMP TO RECEIVER TANK.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles and helmet provided. Good house keeping is maintained. SBA set, Canister mask and airline mask is provided. Eye washer & shower provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. Tanks kept on sound foundation.
3	Leakage in present of ignition source.	Fire	E	Serious	Highly unlikely	Moderate	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. Fire Extinguisher in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(4) Flammable Material (Liquid)

Activity: Benzene, Methanol: Under Ground Storage In Ms Tank.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Leakage of material due to corrosion.	Soil with Ground water may contaminate.	E	Serious	Highly Unlikely	Moderate	Separate storage area will be provided. Tanks will be kept under RCC dyke. Perforated Dip pipe in dyke wall will be provided to monitor and detect any leakage from the U/G tank. Sump will be made under dyke to recover leakage material from dyke. LEL sensors to be installed.
2	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Moderate	Unlikely	Moderate	Vent at sufficient height will be provided. Close system. Apron, Hand gloves, gumboot, goggles and helmet will be provided. Canister mask will be provided.. LEL sensors to be installed.
		Fire if ignition source available.	E	Serious	Highly Unlikely	Moderate	FFE in sufficient quantity will be provided. Well-trained fire staff with Fire hydrant system will be installed. No smoking zone. Auto & manual Water sprinklers, water curtain will be provided. Vent line will be kept at sufficient height with flame arrester and breather valve.. LEL sensors to be installed.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
3	Rain water getting inside tank	Over flow & fire in present of heat & ignition source	E	Moderate	Unlikely	Moderate	Storage tank under CCE approved shed, periodic inspection for any leakage, stored in closed system, flame arrester with birthing valve will be provided. Tanks will be kept under shed. Tank farm area will be connected to ETP.
4	Static charge	Fire	E	Serious	Highly Unlikely	Moderate	Earthing& bonding on tanks and transfer line, flameproof electrical installation, flame arrester with breather valve will be provided.
5	Implosion of the tank	Heavy Spillage	E	Serious	Highly Unlikely	Moderate	Bird guard will be provided on vent line. . LEL sensors to be installed.

(5) Combustible Material

Activity: ODCB, Chlorobenzene, MDNB/ Iso Propyl Alcohol & MDCB:,UNLOADING FROM ROAD TANKER BY PUMP, STORE IN STORAGE TANK AND TRANSFER BY PUMP TO RECEIVER TANK.

No	**Hazard**	**Sub Hazard**	**Status**	**Risk Assessment with consideration of control measures**			**Existing Control Measure**
				Severity	**Probability**	**Risk**	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles and helmet provided. Good house keeping is maintained. SBA set, Canister mask and airline mask is provided. Eye washer & shower provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. RCC foundation provided.
3	Leakage in present of ignition source.	Fire	E	Moderate	Highly unlikely	Tolerable	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. Fire Extinguisher in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guard and fan guards provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and adequate PPE provided.

(6) Flammable & Corrosive Material

Activity: UNLOADING FROM ROAD TANKER BY PUMP, STORE IN STORAGE TANK AND TRANSFER BY AIR PUMP TO RECEIVER TANK.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles and helmet provided. Good house keeping is maintained. SBA set, Canister mask and airline mask is provided. Eye washer & shower provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. Tanks kept on sound foundation.
3	Leakage in present of ignition source.	Fire	E	Serious	Highly unlikely	Moderate	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. Fire Extinguisher in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size is provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(7) Corrosive Material

Activity: Caustic Soda Lye**:** Unloading From Road Tanker, Store In Storage Tank And Transfer By Pump To Receiver.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage and spillage of material from tank cell or from bottom valve.	Eye contact	A	Serious	Highly unlikely	Moderate	Periodic testing of tanks & pipelines, Painting Done on regular basis. Goggles provided.
		Skin contact	A	Moderate	Unlikely	Moderate	Apron, Hand gloves, gumboot, goggles and helmet provided.
		Slip & fall	A	Serious	Highly unlikely	Moderate	Periodic testing of tanks & pipelines, Painting Done on regular basis. Gumboot with Helmet provided.
2	Heavy spillage of corrosive chemicals due to collapse of storage tank from foundation.	Property loss and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. Painting on tanks is done on regular basis.
3	Broken Railing and broken steps of ladder.	Injury due to fall from height.	A	Serious	Highly unlikely	Moderate	Railing provided, hand gloves, gumboot, goggles, helmet. Ladders having hooks on top is provided. Step are maintain in good condition.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. ADEQUATE PPE as above is kept and warned. Dry sand is kept in sufficient quantity. Level gauge and level indicator with guard is provided. Overflow and return line is provided on receiver.
5	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
6	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(8) Corrosive Material

Activity: Ammonia 24 %**:** Unloading From Road Tanker, Store In Storage Tank And Transfer By Pump To Receiver.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Leakage and spillage of material from tank cell or from bottom valve.	Eye contact	A	Serious	Highly unlikely	Moderate	Periodic testing of tanks & pipelines, Painting Done on regular basis. Goggles provided.
		Skin contact	A	Moderate	Unlikely	Moderate	Apron, Hand gloves, gumboot, goggles and helmet provided.
		Slip & fall	A	Serious	Highly unlikely	Moderate	Periodic testing of tanks & pipelines, Painting Done on regular basis. Gumboot with Helmet provided.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
2	Heavy spillage of corrosive chemicals due to collapse of storage tank from foundation.	Property loss and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. Tank's thickness measured on regular interval. Painting on tanks is done on regular basis.
3	Broken Railing and broken steps of ladder.	Injury due to fall from height.	A	Serious	Highly unlikely	Moderate	Railing provided, hand gloves, gumboot, goggles, helmet. Ladders having hooks on top is provided. Step are maintain in good condition.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size is provided. ADEQUATE PPE as above is kept and warned. Dry sand is kept in sufficient quantity. Level gauge and level indicator with guard is provided. Overflow and return line is provided on receiver.
5	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
6	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(9) Flammable & Combustible Material (Storage tank)

Activity: Phenol, PCP, OCP, Nitro Benzene, DEGetc (Tank): STORAGE IN ST. TANK AND & HANDLING

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided
				Severity	Probability	Risk	
1	Leakage from tank cell or valve and splashing of material.	Eye contact	A	Serious	Highly unlikely	Moderate	Dyke wall will be provided. Periodic testing of tanks- once in two years, regular painting per year. Apron, Hand gloves, gumboot, goggles & helmet provided. Good house keeping is maintained. Eye washer & shower provided. Flameproof electrical connection will be provided. Separate storage area will be provided.
		Inhalation of gas	A	Moderate	Highly unlikely	Tolerable	
		Skin contact	A	Moderate	Highly unlikely	Tolerable	
		Slip & fall	A	Serious	Highly unlikely	Moderate	
2	Heavy spillage due to collapse of storage tank from foundation.	Property damage and injury.	E	Serious	Highly unlikely	Moderate	Dyke wall having sufficient size provided. Tank's thickness measured on regular interval. RCC foundation provided. Paintings of tanks will be done on regular basis.

No	Hazard	Sub Hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided
				Severity	Probability	Risk	
3	Leakage in present of ignition source.	Fire	E	Serious	Highly unlikely	Moderate	Earthing& bonding on tanks and transfer line, flame proof electrical installation, flame arrester provided. FFE in sufficient quantity is provided. Well-trained fire staff with Fire hydrant system as per TAC guideline installed. Portable water monitor provided. Foam solution sufficient quantity provided.
4	Spillage due to overflow from Storage tank or receiver.	Injury and material loss.	A	Moderate	Unlikely	Moderate	Dyke wall having sufficient size provided. Material can be recovered from dyke wall. Dry sand is kept in sufficient quantity. Level gauge is provided. Overflow with return line from Receiver to st. tank is provided. Apron, Hand gloves, gumboot, goggles and helmet provided.
5	Escape of vapour from vent line during Un loading.	Inhalation of vapour	N	Minor	Likely	Moderate	Good ventilation in the area. Vent line provided at sufficient height.
6	Injury due to moving rotating part of transfer pump.	Injury	N	Moderate	Unlikely	Moderate	U- Guards and fan guard is provided.
7	Injury due to Electrical shock.	Injury	A	Serious	Highly unlikely	Moderate	Proper enclosure of Electrical equipments with earthing and ADEQUATE PPE provided.

(10) Flammable & Combustible Material (Drums)

Activity:-3- Nitro -4- Methyl Benzoic Acid, Iso Butyl Alcohol, 2- Chloro Ethanol (O - Chloro Ethanol), NITRO BENZENE Storage In Drums & Handling

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Drum falling from palette from height.	Spillage	A	Moderate	Unlikely	Moderate	Good quality palate used. Apron, Hand gloves, gumboot, helmet, goggles will be provided. Dry sand will be kept in sufficient quantity.
		Injury	A	Moderate	Unlikely	Moderate	
2	Leakage from drums.	Eye contact	A	Serious	Highly unlikely	Moderate	Apron, Hand gloves, gumboot, helmet, goggles will be provided. Dry sand will be kept in sufficient quantity.
		Inhalation of vapor	A	Minor	Unlikely	Tolerable	
		Skin contact	A	Minor	Highly unlikely	Insignificant	
3	Injury due to forklift.	Body injury	A	Serious	Highly unlikely	Moderate	Preventive maintenance of FLT. Train and license driver are employed to drive FLT.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
4	Leakage and Ignition source available	Fire	E	Serious	Highly unlikely	Moderate	Flameproof electrical installation. Fire Extinguisher in sufficient quantity will be provided. Well-trained fire staff with Fire hydrant system will be installed. Dry sand in sufficient quantity will be kept. Will be stored in segregated area and in Licence premises, approved by CCE.

(11) Combustible material

Activity: Combustible material: Storage Of EDC / DMS / P. Chloro Phenol 2- Methyl -5- Nitro Phenol , 2,4 – Dichloro Phenol,Phenol, Benzene Sulphonyl Chloride, Storage In Drums & Handling

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided.
				Severity	Probability	Risk	
1	Drum falling from palette from height.	Spillage	A	Moderate	Unlikely	Moderate	Good quality palate used. Apron, Hand gloves, gumboot, helmet, goggles will be provided. Dry sand will be kept in sufficient quantity
		Injury	A	Moderate	Unlikely	Moderate	
2	Leakage from drums.	Eye contact	A	Serious	Highly unlikely	Moderate	Apron, Hand gloves, gumboot, helmet, goggles will be provided. Dry sand will be kept in sufficient quantity.
		Inhalation of vapor	A	Minor	Unlikely	Tolerable	
		Skin contact	A	Minor	Highly unlikely	Insignificant	
3	Injury due to forklift.	Body injury	A	Serious	Highly unlikely	Moderate	Preventive maintenance of FLT. Train and license driver are employed to drive FLT.

(12) Combustible, Corrosive, Oxidizer& Toxic Material (Solid & liquid)

Activity: Storage of Caustic Flakes,Dichloro Phenol Solid In Bags, O-Dichloro Benzene, Liquid in Drums.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided
				Severity	Probability	Risk	
1	Accident due to improper driving / break failure/ bursting of Tyre / material having more height.	Physical injury / property damage	A	Serious	Highly unlikely	Moderate	Preventive maintenance of FLT. Drive by trained licensed driver only.
2	Falling from the FLT	Physical injury and property damage.	A	Moderate	Highly unlikely	Tolerable	Apron, Hand gloves, gumboot, helmet, goggles will be provided.
3	Skin contact while bag lifting.	----	N	Moderate	Unlikely	Moderate	Apron, Hand gloves, gumboot, helmet, goggles will be provided.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Control Measures will be provided
				Severity	Probability	Risk	
4	Slip and fall	Physical injury	A	Serious	Highly unlikely	Moderate	
5	Toppling of bags from trolley/forklift palate	Physical injury	A	Moderate	Unlikely	Moderate	Good palate condition and proper stacking of bags on palate. Good road condition will be maintained.

(13) Combustible Material

Activity: Di-ethylene Glycol: STORAGE OF DIETHYLENE GLYCOLIN DRUMS.

No	Hazard	Sub hazard	Status	Risk Assessment with consideration of control measures			Existing Control Measure
				Severity	Probability	Risk	
1	Drum falling from palette from height.	Spillage	A	Moderate	Unlikely	Moderate	Good quality palate used. Apron, Hand gloves, gumboot, helmet, goggles provided. Dry sand is kept in sufficient quantity.
		Injury	A	Moderate	Unlikely	Moderate	
2	Leakage from drums.	Eye contact	A	Serious	Highly unlikely	Moderate	Apron, Hand gloves, gumboot, helmet, goggles provided. Dry sand is kept in sufficient quantity.
		Inhalation of vapor	A	Minor	Unlikely	Tolerable	
		Skin contact	A	Minor	Highly unlikely	Insignificant	
3	Injury due to forklift.	Body injury	A	Serious	Highly unlikely	Moderate	Preventive maintenance of FLT. Train and license driver are employed to drive FLT.

3.1 TRANSPORTATION OF HAZARDOUS CHEMICALS

3.1.1 Emergency Action Plan for Transportation

Role of Transporter:

- "Tremcard" must be obtained from the respective supplier and to be kept on vehicle with driver.
- Emergency information panel shall be placed on the front sides and rear.
- The Driver must hold valid driving license for HMV.
- The driver must possess a certificate for transportation of hazardous goods.
- First-aid, Safety and fire appliances shall be kept in vehicle and maintained properly.
- In case of emergency, the driver should inform immediately to Colourtex, Transporter, Fire Brigade, Police and Ambulance.
- The tanker driver shall initiate emergency actions as per the TREMCARD.

3.1.2 INCASE OF EMERGENCY, DIAL POLICE (100), FIRE BRIGADE (101) AND AMBULANCE (102)

Role of Fire Brigade:

- On being received the emergency call the officer of fire brigade shall rush immediately to incident site with water tender and adequate fire squad to deal the emergency in case of fire, spillage as indicated under Tremcard.
- Assess the situation on arrival and decide whether the appliances and equipment he has, or will shortly have, are sufficient to control the fire
- Rescue arrangement shall be made for injured persons.
- Due to sudden accident, panic situation may be controlled by use of P.A. System.
- Other emergency services i.e. police; hospital and local authority are to be informed through control room for follow up action.
- Serious injured person is to be sent immediately to the hospital as soon as possible
- Arrangement is to be made to stop leakage from the tanker.
- Arrangement is to be made to contain spilled material immediately by with inert materials like sand or earth.
- Stop smoking & other ignition source in vicinity.
- Mobilization of vehicles and crowd is to be controlled.
- Line of hose is to be laid down to tackle fire if occurs in the spilled or in the tanker.
- Stop the engine in case of running.
- Name and address of victims, who was rescued / given first-aid / sent to hospital, shall be noted and written in occurrence book and other copy is to be submitted to the nearest police station.
- On completion of operation incidence report is to be submitted to the CFO, Head Quarter.

Role of Medical Wing:

- At the time of emergency, providing quick and adequate medical relief to the victims of incidence will have to be given on top most priority.
- Provide emergency aid at site of incident by special unit equipped.
- Make arrangement for adequate stock of antidotes, life saving drugs &medicines.
- Make arrangement for ambulance, stretchers, First-aid kits etc.
- Get the details from first-aid post, casualty-receiving center & prepare report.

Role of Police:

- Control and regulate the traffic within the area of incident.
- Assist the fire brigade by cordoning off the affected area and help the fire fighting by supplementing fire fighting personnel to the extent possible.
- Assist the medical personnel in evacuating causalities.
- Prevent unauthorized entry into the affected area.
- Control general law and order.

Role of Anupam Rasayan India Ltd.:

- Provide the driver with a "TREMCARD" written in Gujarati, Hindi and English language that explained him emergency actions i.e. what to do in case of fire, spillage and contact telephone numbers.
- Provide the transport route of the carrier to the port. This route must stay constant all the time.
- Inform the local authorities along the route of what actions to take if an incident occurs and to avoid contaminating the area.
- If disposal is necessary, follow the disposal procedure as per guidelines of R&H.
- Investigate the incident and develop report to prevent recurrence.

"RUSH TO THE INCIDENT SITE IMMEDIATELY AS AND WHEN RECEIVE THE EMERGENCY CALL"

3.1.3 TRANSPORT EMERGENCY CARD (Road):

CARGO	Distillation Residue Semisolid Black cast crystalline semisolid form. Insoluble in water. This material is considered stable. Avoid contact with strong oxidizers.
NATURE OF HAZARD	Heated material can form flammable or explosive vapors with air. Closed containers may rupture via pressure build up when exposed to fire or extreme heat. Combustion generates toxic fumes.
PROTECTIVE DEVICES	Suitable respiratory protective devices. Use safety goggles. Chemical-resistant gloves, gumboot should be worn whenever this material is handled. Use chemically resistant apron. Eye wash bottle with clean water.
EMERGENCY ACTION	**Contact immediately AnupamRasayan as per detail given below** and Notify police, Fire Brigade & Ambulance immediately. **Telephone: Police- 100, Fire- 101, Ambulance-102 & 108.** Avoid contact with solid & vapors. Stop the Engine. No naked lights. No Smoking. Mark road & warn other road users. Keep public away from danger area. Stay upwind.
SPILLAGE	Appropriate protective equipment must be worn when handling a spill of this material. Shut off leak if without risk. Prevent semisolid entering sewers, basements & work pits. Evacuate the spill area. Eliminate all ignition sources including those beyond the immediate spill area. Ventilate the spill area. Contain spills immediately with inert materials (e.g. sand, earth). Transfer solids dyking material to separate suitable containers for recovery or disposal. Avoid breathing vapor.
FIRE	Use the following extinguishing media when fighting fires involving this material. Foam, Carbon Dioxide (CO_2), Dry chemical powder (DCP), Water spray. Move containers promptly out of fire zone.
FIRST AID	(1) If substance got into the eyes, immediately wash out with plenty of water at least 15 minutes. (2) Move victim to fresh air. Give artificial respiration if breathing has stopped. If breathing is difficult, give oxygen. Get prompt medical attention. (3) Wash affected skin areas thoroughly with soap & water. Remove & wash contaminated clothing thoroughly. (4) Never give anything by mouth to an unconscious person. Do not induce vomiting. Careful gastric lavage may be indicated.

Additional information provided by Manufacturer or Sender:

Name & Address of Company	**AnupamRasayan India Ltd. (Unit-IV)**

Emergency Contact Person	**Mobile No.**	**Residence No.**	
a) Mr. Nitesh Ahir	08238035661	----	**Anupam Rasayan**
b) Mr. Jitendra Pawaday	07567311251	---	
c)	08238035675	---	
d)			**Transporter**
e)			
f)			

KINDLY CONTACT NEAREST POLICE STATIONFOR REPORT & HELP

3.1.4 Transportation, Unloading and handling procedure

SR.NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	MITIGATION MEASURES
1	Transportation of Chemicals like Hazardous Chemicals & Solvents by road tanker	Leakage& Spillage	• Check the source of leakage point. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Stop leak if you can do it without risk.
		Fire,& explosion,	• Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container. • Keep combustibles (wood, paper, oil, etc.) away from spilled material.
		Toxic release	• Isolate the area • Isolate the container • Training will be provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling. • TREM card will be kept with TL. • Fire extinguishers will be kept with TL. • Flame arrestor will be provided to TL exhaust. • Instructions will be given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number will be displayed as per HAZCHEM CODE. • Appropriate PPEs will be kept with TL.
2	Hazardous Chemicals & Solvents Road tanker unloading at project site.	Leakage& Spillage	• Check the source of leakage point. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Stop leak if you can do it without risk.
		Fire,& explosion,	• Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container. • Keep combustibles (wood, paper, oil, etc.) away from spilled material.
		Toxic release	• Isolate the area • Isolate the container • Check the source of leakage point.

			• Spray the water on leakage • Priority will be given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check License, TREM CARD, Fire extinguisher condition; Antidote Kit, required PPEs as per SOP laid down. • Store officer will take sample as per sampling SOP from sampling point. • After approval of QC department unloading procedure will be allowed be started. **Following precautions will be adopted during unloading** • Wheel stopper will be provided to TL at unloading platform. • Static earthing will be provided to road tanker. • Tanker unloading procedure will be followed according to check list and implemented. • Flexible SS hose connection will be done at TL outlet line. • The quantity remaining in the hose pipeline will be drained to a small underground storage tank, which will be subsequently transferred by nitrogen pressure to the main storage tank thus ensuring complete closed conditions for transfer from road tanker. • All TL valves will be closed in TL. • Finally earthling connection and wheel stopper will be removed. • Only day time unloading will be permitted.
3	Hazardous Chemicals & Solvents Storage tank safety	Leakage& Spillage, Fire, Explosion Toxic release.	• Check the source of leakage point. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Stop leak if you can do it without risk. • Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container. • Keep combustibles (wood, paper, oil, etc.) away from spilled material. • Isolate the area • Isolate the container • Check the source of leakage point. • Spray the water on leakage • SS storage tank will be provided as per IS code.

			• Dyke wall will be provided to storage tank. • Level transmitter will be provided with low level high level auto cut-off provision. • Vent will be connected to water trap and vent of water trap will be provided with flame arrestor. • Water sprinkler system will be provided to storage tank. • Fire hydrant monitor with foam attachment facility will be provided. • Dumping / Drain vessel/alternate vessel will be provided to collect dyke wall spillage material. • FLP type pump will be provided. • Nitrogen blanketing will be provided to storage tank. • Double static earthing will be provided to storage tank. Double Jumper clip will be provided to all Solvent handling pipeline flanges.
4	Hazardous Chemicals & Solvents transfer from storage tank to Day tank	Leakage& Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Double mechanical seal type FLP type pump will be provided. • Double on / off switch will provided at tank farm and process area near day tank. Pump auto cut off with day tank high level will be provided. • Flame arrestor will be provided on day tank vent. • Over flow will be provided for additional safety and it will be connected to main storage tank. • NRV will be provided on pump discharge line. • Double Jumper clip will be provided to all solvent handling pipeline. Double static earthing will be provided to day tank.
5	Hazardous Chemicals & Solvents transfer from Day tank to reactor.	Leakage, Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Gravity transfer. • Total quantity of day tank material will be charged in to reactor at a time. • Static earthing will be provided to storage tank. • Double Jumpers will be provided to pipeline flanges.

4.0 Components of Risk Assessment

4.1 Hazard

Hazard is an inherent property of a substance, agent and source of energy or situation having the potential to cause undesirable consequence (e.g. properties that can cause adverse effects or damage to health, the environment or property).

4.1.1 Major Hazards:

1) Fire hazards
2) Toxic gas release hazards
3) Explosion hazards
4) Corrosion hazards

Fire Hazards

When a liquid is used having flash point below the normal ambient temperature, it could, in suitable circumstances, liberate a sufficient quantity of vapor to give rise to flammable mixtures with air. If this mixture is then heated further to its ignition point, combustion starts. Similarly, a combustible gas or vapor mixture burns if it is heated to a sufficiently temperature.

Toxic Hazards

Toxic substances affect in three ways by ingestion, absorption & inhalation. The vapor released may be toxic. Dispersion is important for predicting the distance necessary for the concentration of release gas to come down a specified end point.

Corrosion Hazards

Corrosion is a chemical reaction-taking place at the surface of metal. These chemicals have their typical hazard when it comes in contact with human tissues. Most corrosive substances will produce chemical burns, while certain chemical produce deep ulceration.

4.2 Hazard Identification

Hazard identification is systematic investigation of the possible hazards associated with an installation, particularly identification of the hazards of the chemicals (s) that can cause injury or death to people or damage to property by the release of the chemical or by the release of energy in the event of an accident. The hazard identification is described below:

4.2.1 Physical Hazard

Temperature - Heat / Cold →from Chemical Reaction

Illumination →from Electricity

Noise →from Machinery

Vibration →from Machinery

Radiation →from Process

Atmospheric pressure → from Process

4.2.2 Chemical Hazard

Solids, liquids or gases, vapors, fumes, dusts, smoke, mist, fog or smog.

- M/s. Anupam Rasayan India Limited will use hazardous chemicals such Chlorine, EDC, etc. which is toxic materials.
- M/s. Anupam Rasayan India Limited will use hazardous chemicals such Benzene, Methanol, etc. which is flammable materials.
- M/s. Anupam Rasayan India Limited will use hazardous chemicals such Hydrochloric Acid, Sulphuric Acid, Nitric Acid etc. which is corrosive materials.
- Possibility of injury during chemicals handled, during operations and due to intoxication.

4.2.3 Electrical Hazards

- Electrical hazards due to the electrical major equipment/ machinery, operations, welding, motors, and heavy lift devices, cabling, human intervention (short circuit possibility), maintenance work (due to machinery breakdown etc.), plant lighting related electrical hazards in Anupam Rasayan India Limited.
- Possibilities of fire hazards at transformers, switchgear and other electrical equipment etc.

4.2.4 Mechanical hazards

Defective design of machinery, defective procedures, unguarded machinery, protruding & moving parts, falling heavy objects & poor ergonomics.

- Possibility of human injury due to working with mechanical machines, manual handling etc.

4.2.5 Psychosocial hazards

Type of work, risks involved in work, monotony, and long working hours, lack of recognition & job satisfaction, poor man made management, lack of welfare activities, tensions at home & work place.

- Major dropped objects hazard due to large number of physical handling steps / operations involved with crane/ overhead lifting/ hoisting equipment.
- Fires in any part of the plant working areas – there is a possibility of rapid escalation if it is not brought under control quickly.

4.2.6 Biological hazards

Viruses, rickettsiae, bacteria, fungi, protozoa and helminthes transmitted in certain occupations.

5.0 Determining Significance

Determining Significance is evaluation of the significance of the risk estimation and each of the components of the risk assessment process, including elements of risk perception and cost/benefit consideration.

6.0 Risk Management

M/s. Anupam Rasayan India Limited will be managed the economical and social aspects of risk. Improvement in scientific and factual basis for risk assessment is necessary for better risk management decisions and public creditability of those decisions. However, M/s. Anupam Rasayan India Limited has done the QRA to be undertaken prior to risk management decisions.

M/s. Anupam Rasayan India Limited will be considered the Risk management strategies including all the specific activities. First step involves taking a decision about the weather any actions are necessary and if so, what nature of the action should it be. Industries' risk management decision shall be based not only computed risk in terms of fatality probability (fatality/year), but also on judging the acceptability of the risk – a matter of personal and social value judgment. The risk management includes implementing the actions, decided upon and evaluating their effects.

The fatality probability is function of:

- Probability of occurrence of hazardous events
- Probability of weather condition, wind direction
- Probability of number of persons exposed which depends on the severity of the consequences
- Lethality factor
- Probability of ignition source

On the basis of risk Assessment, Company has defined its own risk management plan, which is explained as follow.

7.0 Safety Precaution

Following measure will be provided, proactively and maintained, to control / reduce the risk

1. Sulphuric Acid/ Nitric Acid

1) Dyke wall- filled with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) All Gaskets are checked periodically & if new one replaces found defective.
4) Joints are checked regularly to found any Leakage.
5) ADEQUATE PPE is kept to handle the Hazard.
6) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
7) Sufficient amount of sand/soil are kept to control any spillage.
8) Flame proof fitting provided.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) Spark arrester are installed on all vehicles in side the premises.
12) SBA set, Canister mask and airline mask is provided.
13) Earthing& bonding on tanks is provided.
14) Vent line provided at sufficient height.
15) Tanks kept on sound foundation.

2. 1-4 Dioxane

1) Dyke wall- filled with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) All Gaskets are checked periodically & if new one replaces found defective.
4) Joints are checked regularly to found any Leakage.
5) Apron, Hand gloves, gumboot, goggles and helmet provided.
6) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
7) Sufficient amount of sand/soil are kept to control any spillage.
8) Flame proof fitting provided.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) Spark arrester are installed on all vehicles in side the premises.
12) SBA set, Canister mask and airline mask is provided.
13) Earthing& bonding on tanks is provided.

14) Always stored under INERT gas (N_2) atmosphere Blanketing

15) Vent line provided at sufficient height.

16) Level indicator provided.

3. DEG / PEG

1) Dyke wall will be provided.

2) Dyke wall- filled with sufficient size is provided.

3) Tank, valve, pipeline are checked and maintain, in good condition.

4) Apron, Hand gloves, gumboot, goggles and helmet will be provided.

5) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.

6) Flameproof electrical connection will be provided.

7) Separate storage area will be provided.

8) Sufficient amount of sand/soil are kept to control any spillage.

9) Eye washer cum shower is provided near tank-farm area.

10) Level indicator provided.

11) RCC foundation will be provided

4. Petroleum Class 'B' (Diesel - HSD)

1) Dyke wall- filled sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) All Gaskets are checked periodically & if new one replaces found defective.
4) Joints are checked regularly to found any Leakage.
5) Apron, Hand gloves, gumboot, goggles & helmet provided
6) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
7) Sufficient amount of sand/soil are kept to control any spillage.
8) Flame proof fitting provided.
9) Level indicator provided.
10) Spark arrester are installed on all vehicles in side the premises.
11) Earthing& bonding on tanks is provided.
12) Vent line provided at sufficient height.

Following measure will be provided- proactively and maintained, to control / reduce the risk, for PROPOSED FACILITY:

1. CHLORINE (CL_2)

1) CCE approved premises with door having locking arrangement provided.
2) Apron, Hand gloves, gumboot, goggles & helmet provided
3) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
4) Sufficient amount of sand/soil are kept to control any spillage.
5) Flame proof fitting provided.
6) Emergency CL_2 kit.
7) Ammonia Torch.
8) FRP Hood with blower with & pack tower with dil. NaOH circulation tank for emergency scrubbing
9) Sufficient Nos. of SBA sets & 2 No. of Air line mask.
10) Continuous monitoring system.
11) OHT crane for Cylinder handling.
12) Water pit.
13) Wind Cock for wind direction.
14) Preventive maintenance on regular basis.

5. Nitric Acid / NSA

1) Dyke wall with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) Apron, Hand gloves, gumboot, goggles and helmet will be provided.
4) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
5) Sufficient amount of sand/soil are kept to control any spillage.
6) Eye washer cum shower is provided near tank-farm area.
7) Level indicator provided.
8) SBA set, Canister mask and airline mask is provided.
9) Vent line dipped in dilute caustic will be provided.

10) RCC foundation will be provided.

11) Transfer material to another empty tank/ Vessel.

6. Sulfuric acid / HCL

1) Dyke wall provided.
2) Dyke wall with sufficient size is provided.
3) Tank, valve, pipeline are checked and maintain, in good condition.
4) Apron, Hand gloves, gumboot, goggles and helmet will be provided.
5) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
6) Sufficient amount of sand/soil are kept to control any spillage.
7) Eye washer cum shower is provided near tank-farm area.
8) Level indicator provided.
9) Vent line dipped in water will be provided.
10) RCC foundation will be provided.
11) Transfer material to another empty tank/ Vessel.

7. Ethylene Dichloride

1) Dyke wall with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) All Gaskets are checked periodically & if new one replaces found defective.
4) Joints are checked regularly to found any Leakage.
5) Apron, Hand gloves, gumboot, goggles and helmet provided.
6) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
7) Sufficient amount of sand/soil are kept to control any spillage.
8) Flame proof fitting provided.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) Spark arrester are installed on all vehicles in side the premises.
12) SBA set, Canister mask and airline mask is provided.
13) Earthing& bonding on tanks is provided.
14) Vent line provided at sufficient height above roof building.
15) Level indicator provided.

8. Methanol / Benzene

1) Tank, valve, pipeline are checked and maintain, in good condition through preventive maintenance.
2) Joints are checked regularly to detect any Leakage.
3) ISI Portable fire extinguisher & Fire Hydrant line is provided as per TAC norms.
4) Flame proof electrical fittings / installation provided.
5) Proper Earthing, Bonding & flange-to-flange jump ring is provided.
6) Flame arrester provided on vent line.
7) CCE approved Separate Storage area with door having locking arrangement.
8) Auto & manual sprinkler provided.
9) Spark arrester are installed on all vehicles inside the premises.
10) Apron, Hand gloves, gumboot, goggles and helmet provided.
11) Train operator employed.
12) Eye washer & shower provided.
13) Tank's thickness measured on regular interval.
14) Good ventilation in the area.
15) Flame arrester with breather valve.
16) Perforated dip pipe in dyke wall will be provided to monitor & detect any leakage from tank.
17) Sump will be made under dyke to recover leakage material from dyke.
18) Tanks will be kept under RCC dyke.
19) Tanks will be kept under shed.
20) All tanks will be connected to ETP.

9. Chloro Benzene / MDNB/MDCB / Iso Propyl Alcohol / ODCB

1) Dyke wall will be provided.
2) Dyke wall calculated with sufficient size is provided.
3) Tank, valve, pipeline are checked and maintain, in good condition.
4) Apron, Hand gloves, gumboot, goggles and helmet will be provided.
5) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.

6) Flameproof electrical connection will be provided.
7) Separate storage area will be provided.
8) Sufficient amount of sand/soil are kept to control any spillage.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) RCC foundation will be provided.

10. Caustic Soda Lye

1) Dyke wall with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) Apron, Hand gloves, gumboot, goggles and helmet provided.
4) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
5) Sufficient amount of sand/soil are kept to control any spillage.
6) Eye washer cum shower is provided near tank-farm area.
7) Level indicator provided.

11. AMMONIA (NH_3) 24%

1) Dyke wall- filled with sufficient size is provided.
2) Tank, valve, pipeline are checked and maintain, in good condition.
3) All Gaskets are checked periodically & if new one replaces found defective.
4) Joints are checked regularly to found any Leakage.
5) ADEQUATE PPE is kept to handle the Hazard.
6) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
7) Sufficient amount of sand/soil are kept to control any spillage.
8) Flame proof fitting provided.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) Spark arrester are installed on all vehicles in side the premises.
12) SBA set, Canister mask and airline mask is provided.
13) Earthing& bonding on tanks is provided.
14) Vent line dipped in water will be provided.
15) RCC foundation will be provided.
16) Transfer material to another empty tank/ Vessel.

12. Nitro Benzene, DEG, and Phenol

1) Dyke wall will be provided.
2) Dyke wall- filled with sufficient size is provided.
3) Tank, valve, pipeline are checked and maintain, in good condition.
4) Apron, Hand gloves, gumboot, goggles and helmet will be provided.
5) ISI Portable fire extinguisher & Hydrant line is provided as per TAC norms.
6) Flameproof electrical connection will be provided.

7) Separate storage area will be provided.
8) Sufficient amount of sand/soil are kept to control any spillage.
9) Eye washer cum shower is provided near tank-farm area.
10) Level indicator provided.
11) RCC foundation will be provided
12)

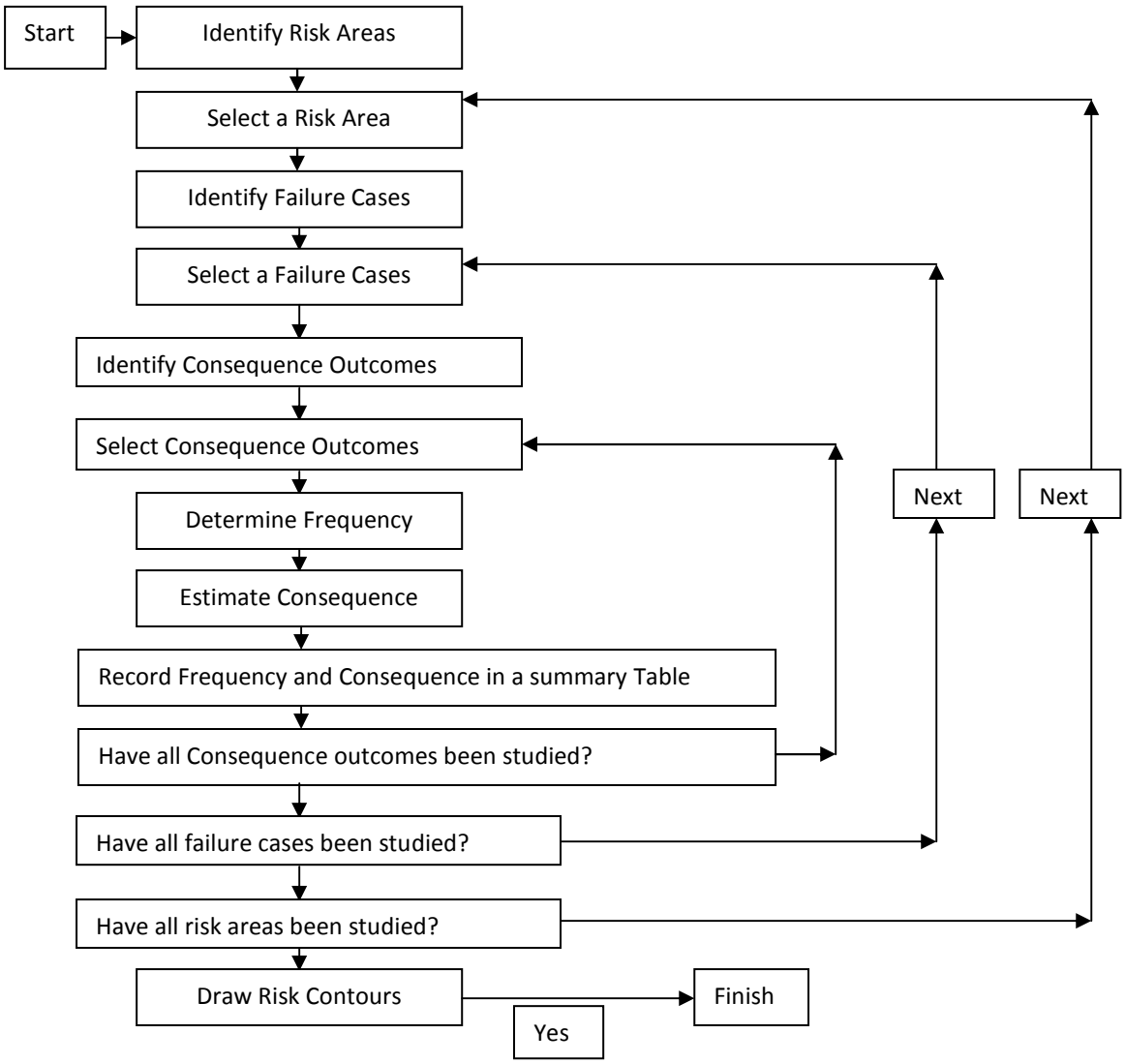
13. 3- Nitro -4- Methyl Benzoic Acid, Iso Butyl Alcohol, 2- Chloro Ethanol (O - Chloro Ethanol), NITRO BENZENE Storage In Drums & Handling.

1) Separate storage godown.
2) Flame proof fittings provided.
3) Fire hydrant & extinguishers provided.
4) Sufficient amount of sand/soil are kept.
5) Apron, Hand gloves, gumboot, helmet, goggles provided.

14. 2- Methyl -5- Nitro Phenol , 2,4 – Dichloro Phenol,Para Chloro Phenol (PCP), Phenol, Benzene Sulphonyl Chloride, Dimethyl SulfateStorage In Drums & Handling

1) Separate storage godown.
2) Flame proof fittings provided.
3) Fire hydrant & extinguishers provided.
4) Sufficient amount of sand/soil are kept.
5) Apron, Hand gloves, gumboot, helmet, goggles provided.

8.0 Quantitative Risk Assessment



8.1 Identification of Risk Areas

The procedure for QRA starts with identification of major risk areas in the installation. Operation carried out in pesticide Industries usually come under certain board, general categories. In M/s. Anupam Rasayan India Limited, major risk areas will storage tank area, plant area and utility area.

- Solvent Storage Area
- Chlorine Tonner Storage Area
- Drum Storage Area

Majority of the major accident hazard in the above operations arise from the flammable property of the chemicals involved. Therefore, majority of the actual accident events in pesticide plants are fire and explosion. Where toxic substances such as, EDC and chlorine are used in significant quantities in M/s. Anupam Rasayan India Limited.

8.2 Identification of Failure cases for risk areas

- Release due to catastrophic failure of storage tanks or process vessels.
- Rupture of connected pipe with storage tank or process vessels.
- Continuous release at significant rates for long durations transfer pipelines caused by sudden, major break of the pipeline.
- Continuous release at low rate through small holes or cracks in piping and vessels, flange leaks, and leakage from pump glands and similar seals.

9.0 CONSEQUENCE ANALYSIS

In a plant handling hazardous chemicals, the main hazard arises due to storage, handling & use of these chemicals. If these chemicals are released into the atmosphere, they may cause damage due to resulting fires or vapour clouds.

Operating Parameters

Potential vapour release for the same material depends significantly on the operating conditions. Especially for any liquefied gas, the operating conditions are very critical to assess the damage potential.

Inventory

Inventory Analysis is commonly used in understanding the relative hazards and short listing of release scenarios. Inventory plays an important role in regard to the potential hazard. Larger the inventory of a vessel or a system, larger the quantity of potential release. The potential vapour release (source strength) depends upon the quantity of liquid release, the properties of the materials and the operating conditions (pressure, temperature). If all these influencing parameters are combined into a matrix and vapour source strength estimated for each release case, a ranking should become a credible exercise.

Loss of Containment

Plant inventory can get discharged to Environment due to Loss of Containment. Certain features of materials to be handled at the plant need to the clearly understood to firstly list out all significant release cases and then to short list release scenarios for a detailed examination. Liquid release can be either instantaneous or continuous. Failure of a vessel leading to an instantaneous outflow assumes the sudden appearance of such a major crack that practically all of the contents above the crack shall be released in a very short time. The more likely event is the case of liquid release from a hole in a pipe connected to the vessel. The flow rate will depend on the size of the hole as well as on the pressure, which was present, in front of the hole, prior to the accident. Such pressure is basically dependent on the pressure in the vessel. The vaporisation of released liquid depends on the vapour pressure and weather conditions. Such consideration and others have been kept in mind both during the initial listing as well as during the short-listing procedure. In the study, Maximum Credible Loss accident methodology is to be used, therefore, the largest potential hazard inventories have been considered for consequence estimation.

9.1 DAMAGE CRITERIA

In consequence analysis, use is made of a number of calculation models to estimate the physical effects of an accident (spill of hazardous material) and to predict the damage (lethality, injury, material destruction) of the effects. The calculations can roughly be divided in three major groups:

a) Determination of the source strength parameters;

b) Determination of the consequential effects;

c) Determination of the damage or damage distances.

The basic physical effect models consist of the following.

Source strength parameters

- Calculation of the outflow of liquid, vapour or gas out of a vessel or a pipe, in case of rupture. Also two-phase outflow can be calculated.
- Calculation, in case of liquid outflow, of the instantaneous flash evaporation and of the dimensions of the remaining liquid pool.
- Calculation of the evaporation rate, as a function of volatility of the material, pool dimensions and wind velocity.
- Source strength equals pump capacities, etc. in some cases.

Consequential effects

- Dispersion of gaseous material in the atmosphere as a function of source strength, relative density of the gas, weather conditions and topographical situation of the surrounding area.
- Intensity of heat radiation [in kW/ m^2] due to a fire or a BLEVE, as a function of the distance to the source.
- Energy of vapour cloud explosions [in N/m^2], as a function of the distance to the distance of the exploding cloud.
- Concentration of gaseous material in the atmosphere, due to the dispersion of evaporated chemical.

It may be obvious, that the types of models that must be used in a specific risk study strongly depend upon the type of material involved:

- Gas, vapour, liquid, solid
- Inflammable, toxic, toxic combustion products
- Stored at high/low temperatures or pressure
- Controlled outflow (pump capacity) or catastrophic failure?

Selection of Damage Criteria

The damage criteria give the relation between extent of the physical effects (exposure) and the percentage of the people that will be killed or injured due to those effects. The knowledge about these relations depends strongly on the nature of the exposure. For instance, much more is known about the damage caused by heat radiation, than about the damage due to toxic exposure, and for these toxic effects, the knowledge differs strongly between different materials.

In Consequence Analysis studies, in principle three types of exposure to hazardous effects are distinguished:

1. Heat radiation, from a jet, pool fire, a flash fire or a BLEVE.
2. Explosion
3. Toxic effects, from toxic materials or toxic combustion products.

In the next three paragraphs, the chosen damage criteria are given and explained.

9.2 MAXIMUM CREDIBLE LOSS ACCIDENT SCENARIOS

A Maximum Credible Accident (MCA) can be characterised as the worst credible accident. In other words: an accident in an activity, resulting in the maximum consequence distance that is still believed to be possible. A MCA-analysis does not include a quantification of the probability of occurrence of the accident. Another aspect, in which the pessimistic approach of MCA studies appears, is the atmospheric condition that is used for dispersion calculations. As per the reference of the study, weather conditions having an average wind speed of 2.00 m/s have been chosen.

The Maximum Credible Loss (MCL) scenarios have been developed for the Facility. The MCL cases considered, attempt to include the worst “Credible” incidents- what constitutes a credible incident is always subjective. Nevertheless, guidelines have evolved over the years and based on basic engineering judgement, the cases have been found to be credible and modelling for assessing vulnerability zones is prepared accordingly. Only catastrophic cases have been considered and not partial or small failures (as is the case in Quantitative Risk Assessment where contributions from low frequency - high outcome effect as well as high frequency - low outcome events are distinguished). The objective of the study is emergency planning; hence only holistic & conservative assumptions are used for obvious reasons. Hence though the outcomes may look pessimistic, the planning for emergency concept should be borne in mind whilst interpreting the results.

9.3 CONSEQUENCE ANALYSIS CALCULATIONS

The Consequence Analysis has been done for selected scenarios. This has been done for weather conditions having wind speed **2.03** m/s. In Consequence Analysis, geographical location of the source of potential release plays an important role. Consideration of a large number of scenarios in the same geographical location serves little purpose if the dominant scenario has been identified and duly considered.

9.3.1 SOFTWARE USED FOR CALCULATIONS

1. PHAST MICRO:

Phast is the most comprehensive software available for performing Process Hazard Analysis (PHA), Quantitative Risk Assessment (QRA) and Financial Risk Analysis (FRA). Our extensively validated software for consequence and risk analysis is used by governments and industry helping them to comply with local safety regulation and their own corporate best practice. Phast contains all the discharge, dispersion, effects and risk models you will need to accurately assess all your major hazards and associated risks. Phast Consequence provides you with comprehensive hazard analysis facilities to examine the progress of a potential incident from the initial release to its far-field effects.

TOXIC AND FLAMMABLE IMPACT

It calculates the initial discharge, as the material expands from its storage conditions to atmospheric, through dispersion, as the material mixes with air and dilutes, and the subsequent toxic or flammable effects. Phast includes a wide range of models for discharge and dispersion as well as flammable and toxic effects.

DISCHARGE

- Phast requires basic information about storage or process conditions and material properties in order to perform discharge calculations
- The software comes with an integrated material property database containing more than 1,600 pre-defined pure component chemicals
- Various discharge scenario options have been implemented to represent common process failures, and model their behavior. These include:
    - ❖ Leaks and line ruptures from long & short pipelines

- ❖ Catastrophic ruptures
- ❖ Relief valve and disc ruptures
- ❖ Tank roof collapse
- ❖ Vent from vapour spaces
- ❖ In building release effects

DISPERSION

The dispersion models within Phast are able to model the following phenomena

- Dispersion of gas, liquid and two-phase releases
- Liquid droplet thermo dynamics calculations and liquid droplet rainout
- Pool spreading and vaporization
- Building wake dispersion effects for vapor releases

FLAMMABLE EFFECTS

For releases of flammable material Phast calculates

- Radiation profiles and contours from a range of fire scenarios including pool fires, flash fires, jet fires and fire balls, including cross-wind effects on a jet fire
- Vapor Cloud Explosion modeling using industry standards models including the TNO Multi-energy, Baker Strehlow Tang and TNT Equivalence models
- Overpressure contours from Boiling Liquid Expanding Vapor Explosions

TOXIC EFFECTS

- Graphs of toxic concentration profile
- Indoor and outdoor toxic dose prediction
- Reporting of distance to specific dose and concentration
- Calculated exposure time and use as “averaging time” for passive dispersion effects

PHAST RISK

Phast Risk allows you to combine the flammable and toxic consequences from each scenario in your QRA model with their likelihood to quantify the risk of fatalities. Phast Risk allows you to take account of local population distribution, sources of ignition, land usage and local prevailing weather conditions. It is designed to perform all the analysis, data handling and results presentation elements of a QRA within a structured framework.

Phast Risk allows you to quickly identify major risk contributors so that time and efforts can be directed to mitigating these highest risk activities. Based on effects calculations and population vulnerabilities, Phast Risk can integrate over all scenarios and weather conditions to estimate the total risk. The established individual and societal risk indicators are predicted by Phast Risk across your facility and surrounding area using the classical QRA methodology. Risk ranking reports can be produced at points of strategic importance to show the relative influence of the various failure scenarios and their contribution to both the individual and societal risk metrics.

A key benefit of Phast Risk is the ability to identify major risk contributors and differentiate these from incidents with worst case consequences which might otherwise dominate the safety reviews. Whilst medium scale incidents have lesser consequences, they may have a higher frequency, which, when combined with their hazardous effects, generate a higher level of risk. Time and effort directed to mitigating high consequence but often low frequency events may not be well spent. Phast Risk helps you direct this effort more effectively.

Phast Risk also provides facilities to help you manage large quantities of input data, including scenarios, parameters, wind roses, ignition and population, and combine these in many ways. This is critical when looking at sensitivity analyses and assessing the merits of a range of risk reduction measures.

Benefits

- Facilitates cost reduction in terms of losses and insurance
- Allows optimization of plant and process design
- Assist in compliance with safety regulators
- Enables quicker response to hazardous incidents
- Improve engineer's understanding of potential hazards
- Regular software upgrades incorporate industry experience and expertise, and advances in consequence modeling technology.

Financial Extension

The Financial Consequence extension is used to assess situations which present potential hazards not only to life but also to the environment, property and business and help quantifying their severity in financial terms. Phast Financial helps you to estimate the cost of a particular release of a given material under specified conditions. The Financial Risk extension helps you to calculate the

broader financial risks associated with accidents and can be used to help manage your business risk and assess appropriate levels of insurance.

Blast Extension for Explosion Risk

The Blast extension permits more accurate explosion modeling and thus better risk predictions. It provides all the extra functionality required to assess overall risks taking account of protection provided by different types of structure and areas of congestion on your plant. Models supported include the Multi Energy and Baker Strehlow Tang explosion models and a number of industry standard vulnerability models

Multi-Component Extension

The multi-component extension to Phast provides greater accuracy for liquid or two-phase mixture releases compared to the standard pseudo-component approach. The composition of each component of the mixture is calculated throughout the discharge and dispersion phases of the release.

2. HAMS-GPS

HAMS-GPS Software Package is a professionally built Window based Software. HAMS-GPS enables from advanced Training to Research oriented HSE-Management Studies including Risk Assessment (including FAR, FN-Curve and ISO-Risk), Accident Analysis, ASCLAP-Distribution, Plume, Puff, Spill Pool evaporation dispersion modeling, Safety Audits, Emergency Management Planning and Control, PROBIT computations, Percent and Absolute Fatality, Injury computations, Fire (Pool Fires, Jet Fires) & Explosion (Vapor Cloud, BLEVE, Confined, Unconfined, Mechanical) Modeling, Explosion Prevention (Inerting, Static Charge development), DOW-Fire & Explosion computations, EIA, Developing and Establishing an Integrated System on EMS& OHSMS under International Standards, on Personal Health and Fitness and more.

Comprises of Expert Modules: Dispersion with PROBITS, Fire, Explosion, DOW-Index, Safety-Audit, ASCLAP, EIA, SMOD, Risk Assessment, EMP Evaluation, Accident Analysis (Database), Dispersion, PRTOBITs, Fire Analysis (Database), Limits curve, Absolute Fatality/Injury (Dispersions, Explosions and Fire-Balls), OHSMS- Evaluation against OHSAS-18001 (Database), House Keeping Evaluation, Unitcon (Unit conversion) and More.

Other releases: BLEVE, Oil/Gas well blow out scenarios, SWOT analysis, Safety manual review, QRA-review, Hydraulics, and Industrial Work Hygiene index (Database), HAZOP Study Software and More.

SMOD

Source Models: Liquid flow through a hole in a tank, Liquid flow through a hole under constant pressure, Liquid flow through a pipe, Vapor/gas flow through hole, Vapor/gas flow through a pipe, Flashing liquids stored above atmospheric Boiling Point., pool evaporation by substrate heat conduction and wind, Tank dimensions, Dyke dimensions, LPG-bund computations. Options for converting Density, mass, force, latent heat, specific heat, pressure, temperature, computing vapor density, vol. of vapor from P1T1 to P2 T, and Calculator.

DISPERSION WITH PROBITS MODULE

Plume, Puff, Spill Dispersions with tabular and graphic display with 5-User defined Isopleths in XY-Slice and Isoelevets in XZ-Plane at Y-Cross wind distance. Full 3-D "CAT-Scan" output possible with dispersion "Cake slicing in XY (Isopleths) and XZ (Isoelevets) Graphs. Graphics are in color as Custom color, Default color or BW. It is a complete CAT-Scan with Probits (PROBIT short for Probability Unit, is the percent Fatality and Injury due to exposure to any hazardous agent). This Advanced Dispersion provides for Mass and volumes of various concentration zones and concentration zone shells of Plumes, Puffs and Spill pool evaporation dispersions. Options for Conc. Conversion, computing: mol. Wt., IDLHTWA & LEL-UEL of mixtures, LEL-UEL at any temperature, LC-50 of man from animal data, LC/RIC of mixtures, weighted average, Temperature conversion and calculator.

FIRE MODULE

Pool fire, liquid jet fire, Turbulent and diffusion jet fires with PROBITs. Graphics are in color as Custom color or Default color or BW. Options for density conversion and calculator.

RISK ASSESSMENT

FAR, FN-Curve, ISO-Risk, Individual Risk computations. Graphics are in color as Custom color or Default color or BW.

SCENARIO DEVELOPER

This module enables development of maximum Credible Loss Scenarios (MCLS) also called Maximum credible Accident Scenarios (MCAS) for QRA Study conforming to International guidelines under World bank Technical Ppers-55. This module provides for over 200 Chemicals and select parameters for Scenario development with options for user defined chemicals and parameter selections.

9.4 SCENARIOS

TABLE - 4

POSSIBLE ACCIDENT SCENARIOS

Scenario	MCL Scenario	Pressure & Temp.	Quantity
1	Release of Sulphuric acid	NTP	50 KL
2	Release of EDC	NTP	20 KL
3	Release of Chlorine	Liquefied 7 kg/cm^2 @ RT	0.9 MT
4	Release of HCl	NTP	20 KL
5	Release of Nitric Acid	NTP	10 KL
6	Release of Benzene	NTP	50 KL
7	Release of IPA	NTP	20 KL
8	Release of Chloro Benzene	NTP	20 KL
9	Release of Methanol	NTP	20 KL
10	Release of ODCB	NTP	20 KL
11	Release Ammonia	NTP	20 KL
12	Meta Di Nitro Benzene	NTP	25 KL
13	Release of DEG	NTP	60 KL
14	Unconfined Pool Fire Simulations for Drum Storage Area	NTP	10 MT

DETAILED SUMMARY OF RESULTS:

Detailed Results of the consequence analysis of above-mentioned scenarios have been given below:

Scenario 1: Release of Sulphuric Acid

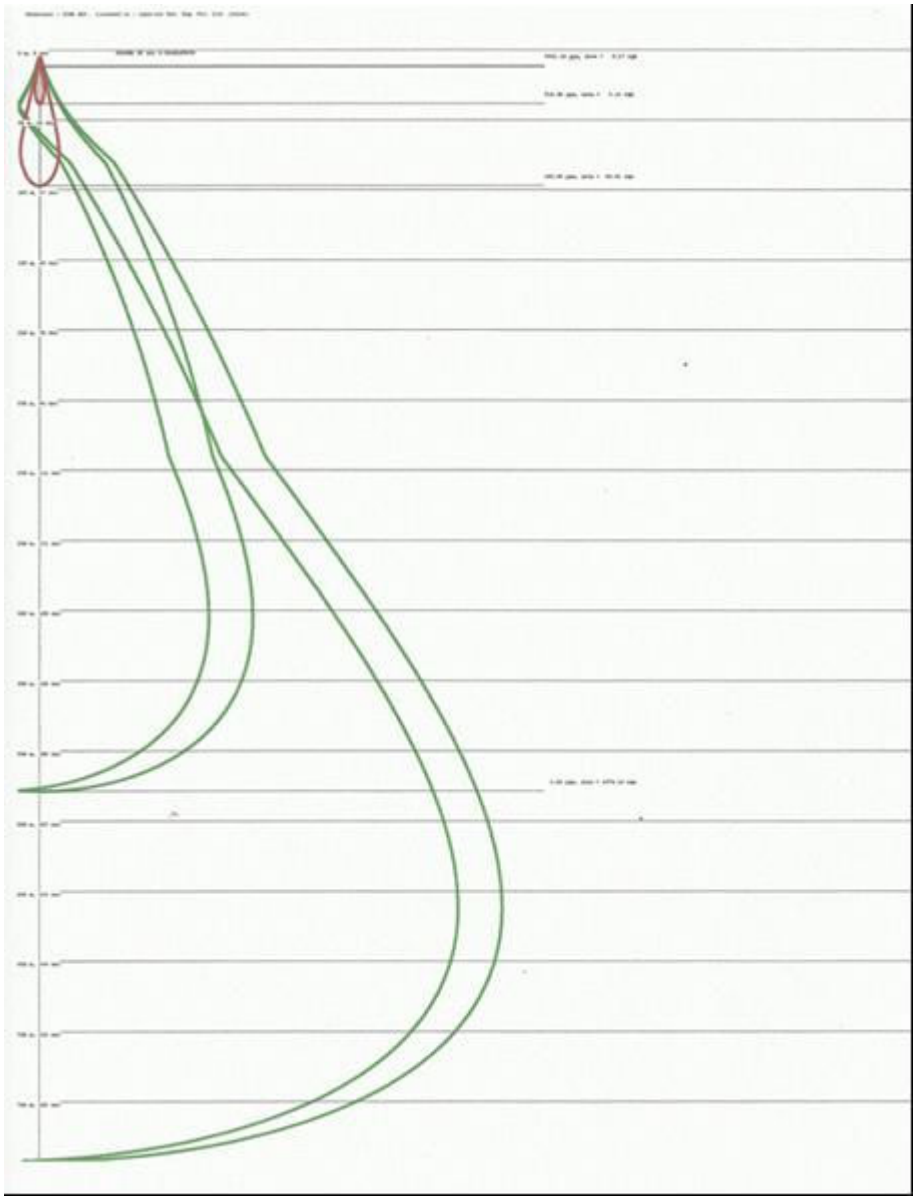
Spill pool evaporation module for Sulphuric Acid due to Catastrophic Rupture of 50 KL Storage Tank	
Input Data	
Stored quantity - 50 KL	
Molecular weight -98.08	
Wind speed – 2.2 m/s	
Failure Mode: Catastrophic failure of 4" bottom nozzle and loss of containment	
Density (Air) – 1840 kg/m^3	
Release rate: 1000 g/s	
Results indicate	
LC50 – 510 ppm	38.26 meter
IDLH – 3 ppm	528.56 meter
TLV –1 ppm	792.29 meter

Results:-

- LC50 HUMAN (510 ppm) area is up to 38.26 meter,
- IDLH (3 ppm) concentration area is up to 528.56 meter and
- TLV (1 ppm) area is up to 792.29meter.

Therefore, 528.56 meter area in wind direction is considered as evacuation area.

Scenario:



MITIGATION MEASURES FOR SULPHURIC ACID LEAKAGE:

- ✓ Isolate the source if possible without risk.
- ✓ If leakage is small, dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.
- ✓ Absorb with DRY earth, sand or other non-combustible material.
- ✓ Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift.
- ✓ Use water spray to reduce vapors.
- ✓ Prevent entry into sewers, basements or confined areas.
- ✓ Neutralize the residue with a dilute solution of sodium carbonate.

PREVENTIVE MEASURES TO AVOID SULPHURIC ACID LEAKAGE:

- ✓ A dike will be provided to accommodate the full quantity in tank.
- ✓ Periodic testing of storage tank will be done by competent person.
- ✓ Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective TLVs. Storage tank vent is connected to scrubber system.
- ✓ Flange guard provided to prevent splash of material.
- ✓ Level interlock
- ✓ Keep container dry. Never add water to this product.
- ✓ In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label.
- ✓ Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture.
- ✓ Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.
- ✓ While handling always use face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent.
- ✓ Ensure that eyewash stations and safety showers are proximal to the work-station location.

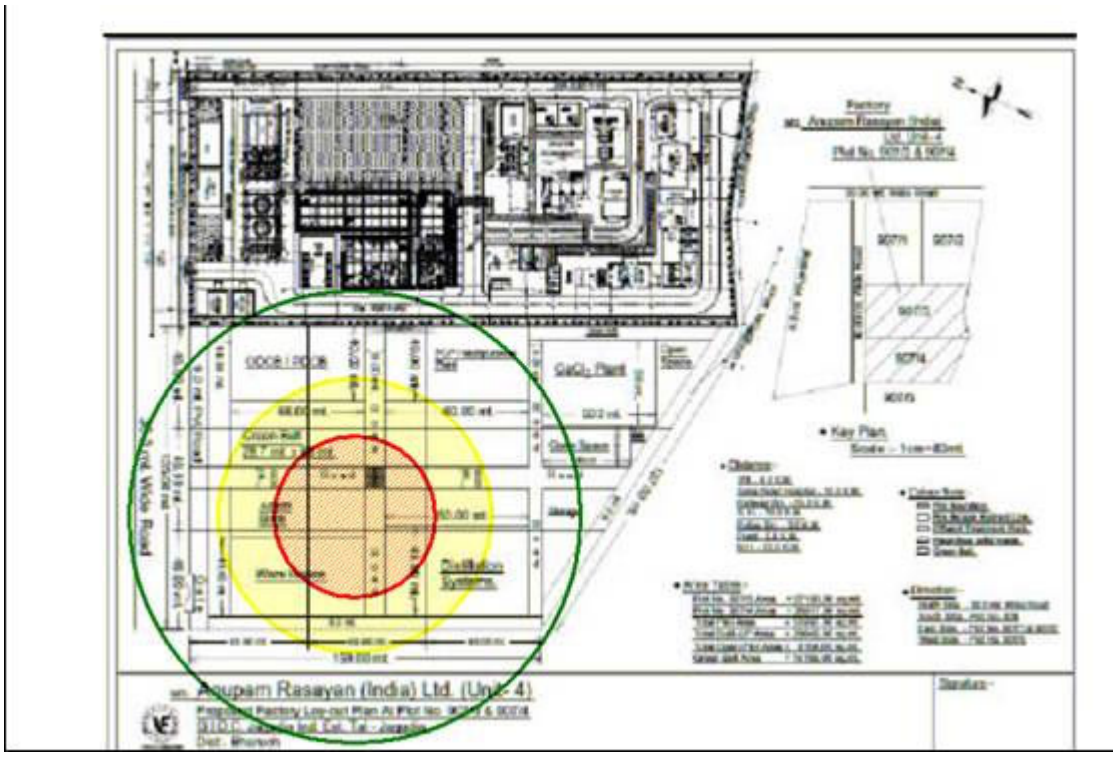
Scenario: 2 Release of EDC

Catastrophic Rupture			
Input Data			
Stored quantity - 20 KL			
Molecular weight -96.94			
Wind speed - 2.2 m/s			
Vapor density (air=1)– 3.34			
Results indicate			
Pool Fire Scenario			
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**	
4	90.71	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality	
12.5	54.94	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.	
37.5	32.1	This level of radiation is assumed to give 100% fatality as outlined above.	
Dispersion			
Release Rate	**1000 gms/sec. (assumption)**		
Hazard Level	**Concentration (ppm)**	**Distance (meter)**	
LC50	1414.2	23.61	
IDLH	300	48.93	
TWA/ TLV	75	115	

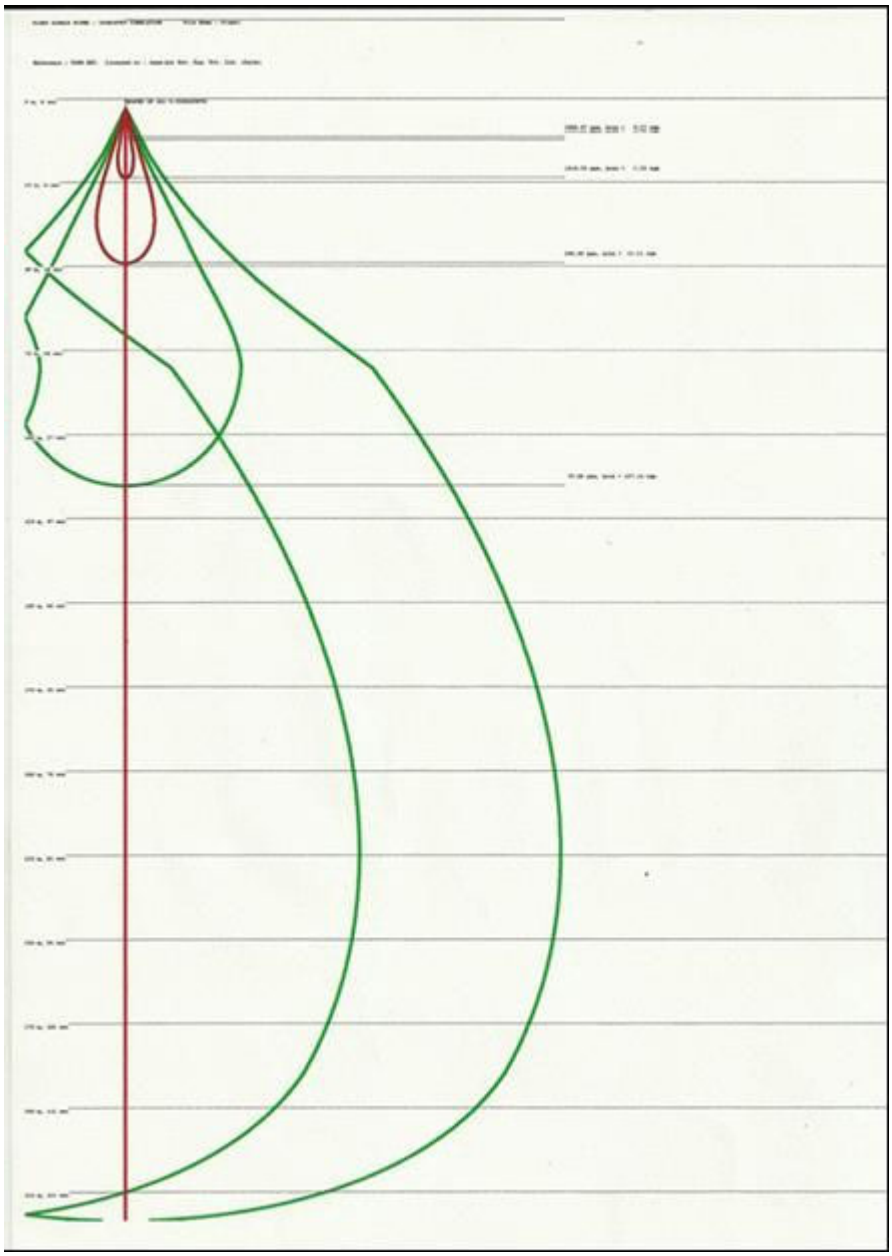
SAFETY PRECUASION:

- Flame proof pumping and other equipments will be provided.
- Transfer will be done in close process,
- Double Static earthling and Jumper clips will be provided on flanges,
- Hydrant system and Fire extinguishers will be provided.
- Automatic Sprinklers will be provided.
- Tanker unloading procedure will be made and followed..
- Dyke around the tank will be provided.

Release of EDC (Pool Fire Scenario)



DISPERSION ISOPLETH FOR EDC TANK CATASTROPHIC FAILURE



Scenario: 3 Release of Chlorine

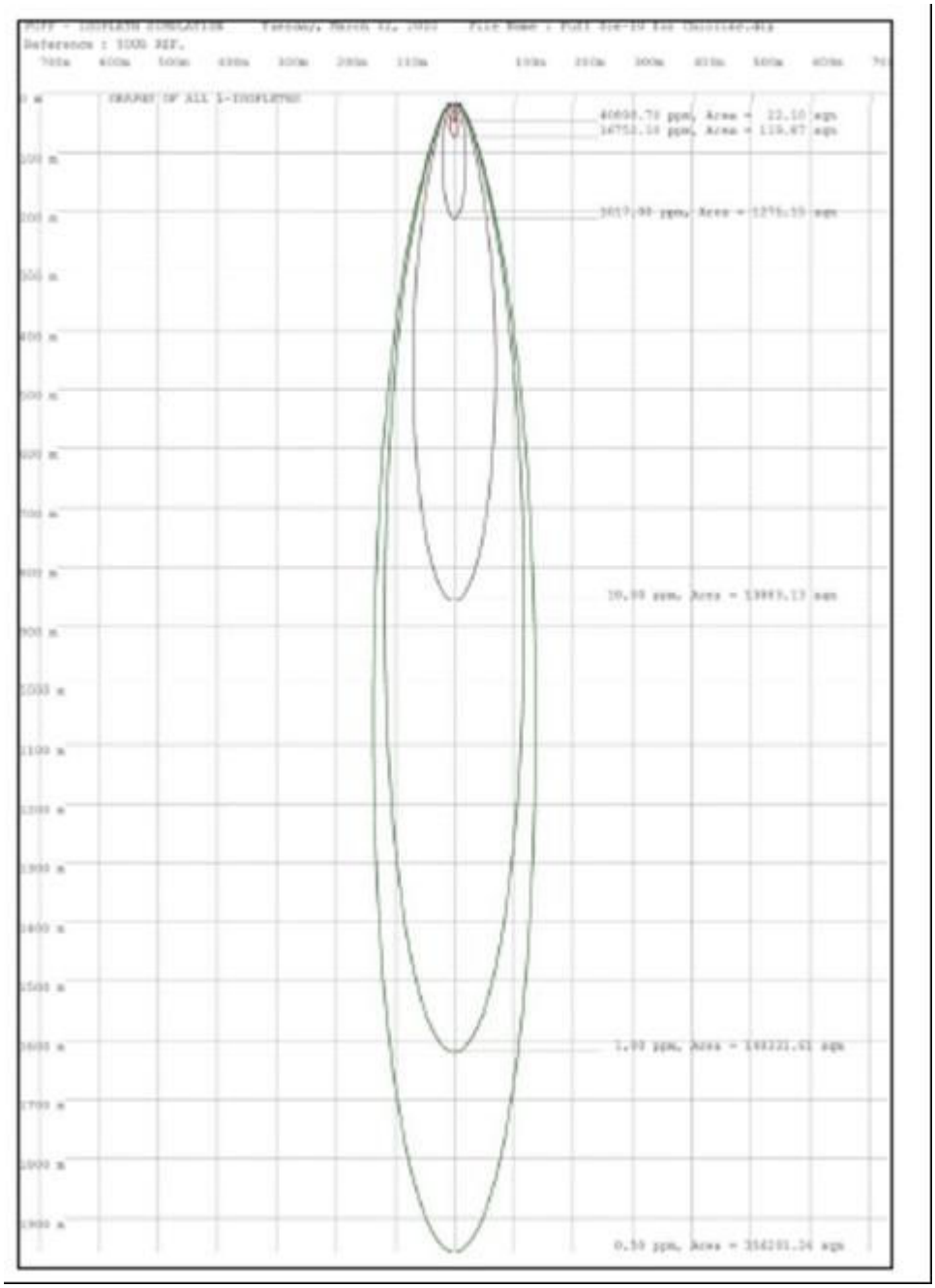
Catastrophic Rupture	
Input Data	
Stored quantity - 0.9 MT	
Molecular weight -70.90	
Wind speed - 2.2 m/s	
Density (Air) – 2.49kg/m^3	
Results indicate	
LC50 – 1017 ppm	210.30
IDLH – 10 ppm	856.39
TWA/TLV – 1 ppm	1619.16

Mitigation Measures in case of Chlorine Leakage:

- **Evacuate the area in down wind direction:** Evacuate area in down wind direction up to 300 meter.
- Do not direct water at spill or source of leak.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use Chlorine Emergency Kit to attend the leak.
- Absorb the fumes through Chlorine Hood with blower.

Preventive measures to avoid such emergency:

- Chlorine Emergency Kit will be procured and kept ready at chlorine shed.
- Chlorine Hood with blower will be provided with scrubbing arrangement.
- SCBA sets will be kept ready at chlorine handling area.
- Safety Shower and eye wash will be provided in Chlorine shed area.
- Chlorine absorption system will be provided. In case of chlorine leakage in chlorine shed it will be suck through blower and it will be scrubbed in Caustic scrubber.
- Emergency siren and wind sock will be provided.
- Tele Communication system and mobile phone will be used in case of emergency situations for communication.
- First Aid Boxes and Occupational health centre will be made at site.
- Emergency organization and team will be prepared as per On site-Off site emergency planning.
- Full body protection suite and other PPEs will be kept ready in ECC at site.
- Emergency team will be prepared and trained for scenario base emergency. Like Toxic control team, Fire control team, First aid team, Communication and general administration team, Medical team etc.

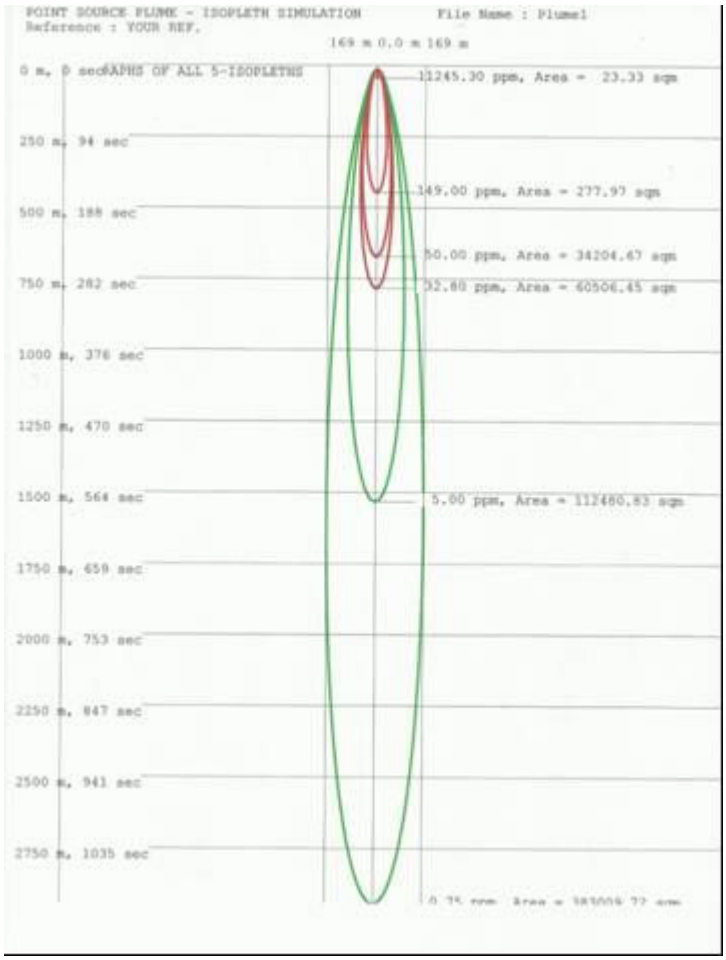

Reference : 1000 MSL.
40693.71 ppm, Area = 22.10 sqm
16751.16 ppm, Area = 116.87 sqm
3017.90 ppm, Area = 1275.55 sqm
10.00 ppm, Area = 53883.13 sqm
1.00 ppm, Area = 149221.61 sqm
0.50 ppm, Area = 354201.34 sqm

Scenario: 4 Spill Pool evaporation modules for HCl Storage Tank catastrophic failure

Catastrophic Rupture	
Input Data	
Stored quantity - 20 KL	
Molecular weight - 36.46	
Wind speed - 2.2 m/s	
Vapor Density (Air=1) – 1.25	
Results indicate	
LC50 – 149 ppm	**44.69 meter**
IDLH – 5 ppm	**1532.66 meter**
TLV – 5 ppm	**2943.00 meter**

Results:

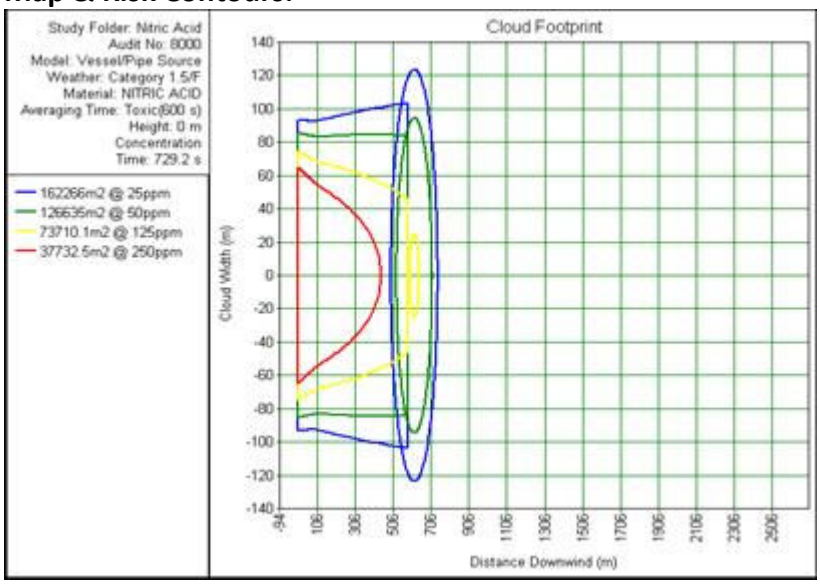
LC50 (149 ppm) area up to 44.69 meter, Immediate danger to life and health (5 ppm) concentration area up to 1532.66 meter and TLV (5 ppm) area up to 2943 meter. Therefore 1532.66 meter area in wind direction is considered as evacuation area.

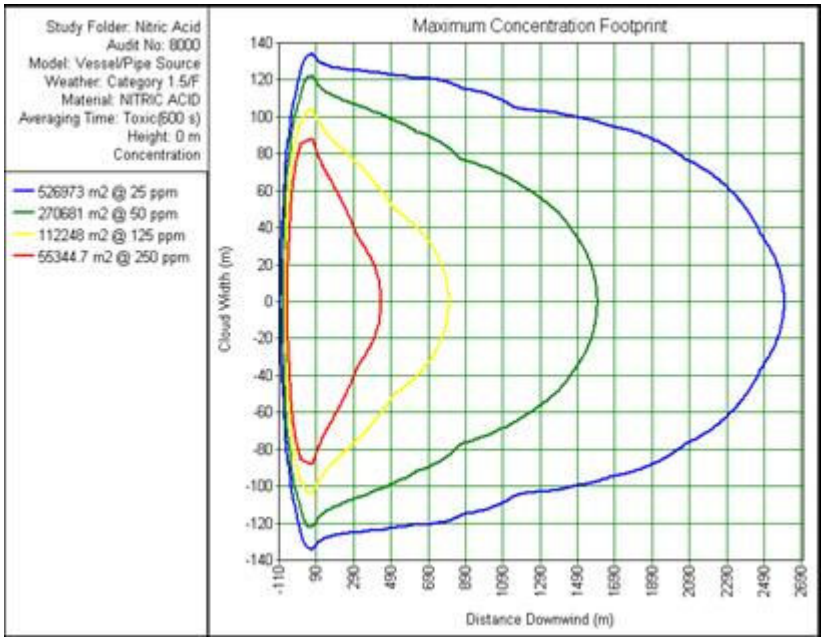


Scenario: 5 Release of Nitric Acid

Catastrophic Rupture	
Input Data	
Stored quantity - 10 KL	
Molecular weight – 63.01	
Wind speed - 2.2 m/s	
Density (Air) – >1	
Boiling point - 121 °C	
TWA/TLV – 2 ppm	
Results indicate	
IDLH – 25 ppm	2628 m

Map & Risk Contours:





Scenario: 6: Release of Benzene

This scenario considers release of Benzene from Storage Tank:

Results indicate:

Unconfined Pool Fire for Benzene tank catastrophic failure			
SCENARIO : UNCONFINED POOL FIRE			
Input Data		**Results of Computations**	
Stored quantity	50 KL	**Max. IHR at flame centre height**	180 Kw/m^2
Pool diameter	25(m)	**Flame centre height**	9.6 meter
Pool liquid depth	0.1 (m)	**Maximum Flame width**	9.59 meter
Wind speed	2.2 m/s	**Mass burning rate liquid**	1.34 kg/ m^2/min.
Liquid Density	878 kg/m^3	**Flame burnout time**	58.82 Mims.
Incident Intensity of Heat Radiation (IHR) at ground level KW /m^2	**IHR- Isopleth Distance (Meters)**	**Effect if IHR at Height of Simulation**	
37.5	13.5	Damage to process equipment. 100 % Fatal in 1 Min. 1 % fatal in 10 sec.	
25.0	15.6	Min. to ignite wood (without flame contact). 100 % fatal in 1 Min. Significant injury in 10 sec.	
12.5	22.1	Min. to ignite wood (with flame contact). 1 % fatal in 1 min. 1st deg. burn in 10 sec.	
4.0	39.0	Pain after 20 secs. Blistering unlikely.	
1.6	61.6	No discomfort even on long exposure.	

Results

- In the 13.5 meter radius area is considered as 100% fatality in 1 min.
- In the 22.1 meter radius first degree burn in 10 sec.
- In the 39 meter radius area will give pain after 20 seconds. Blistering unlikely.
- In the 61.6 meter radius area is considered as safe area and no discomfort even on long exposure.

Fire Ball Scenario: Benzene

Fire Ball simulation Benzene Tank catastrophic failure			
SCENARIO : FIRE BALL			
Input Data		**Results of Computations**	
Stored quantity	50 KL	**Fire Ball radius**	14.66 meter
Mass of vapour Between LEL-UEL%	184 Kgs.	**Fire ball Intensity of Heat radiation**	243 KW /m^2
Heat of combustion	40153 KJ/Kg	**Fire Ball rate of energy release**	658492 KJ/ sec.
Wind speed	2.2 m/s	**Fire- Ball total energy release**	3.9e +006 KJ
Liquid Density	878 kg/m^3	**Fire ball duration**	5.98 sec.

Incident Intensity of Heat Radiation (IHR) at ground level KW /m^2	**IHR- Isopleth Distance (Meters)**	***Damage effects***
37.5	30	100 % Fatal. Min. to ignite wood (without flame contact)
25.0	38	Min. to ignite wood (without flame contact). Significant injury.
12.5	54	Min. to ignite wood (with flame contact). 1st deg. burn.
4.0	94	Pain after 20 secs. Blistering unlikely.
1.6	180	No discomfort even on long exposure.

Results

- In the 30 meter radius area is considered as 100 % fatality in 1 min. and first degree burn in 10 sec.
- In the 54 meter radius first degree burn in 10 sec.
- In the 94 meter radius area will give pain after 20 seconds. Blistering unlikely.
- In the 180 meter radius area is considered as safe area and no discomfort even on long exposure.

Flash Fire Scenario: Benzene

Flash Fire simulation for Benzene Tank catastrophic failure			
SCENARIO : FLASH FIRE			
Input Data		**Results of Computations**	
Stored quantity	50 KL	**Visible Flash Fire Height**	34.38 meter
Mass of Gas	184 Kgs.	**Visible Flash Fire Width**	17.19meter
Heat of combustion	40153 KJ/kg	**Duration of Flash-Fire in Sec.**	5.99 sec.
Fuel-Air volume ratio in Flash fire cloud	0.600	**Radius of fuel-air cloud mixture**	14.67 meter
Stochiometric Fuel-Air Mixture	0.133	**Total energy release**	2622000 KJ
Wind speed	2.2 m/s	**Max. Heat Radiation from 1 m from Flash Fire**	162 KW/ m^2
Gas Density	2.7 kg/m^3	**Combustion efficiency**	0.5

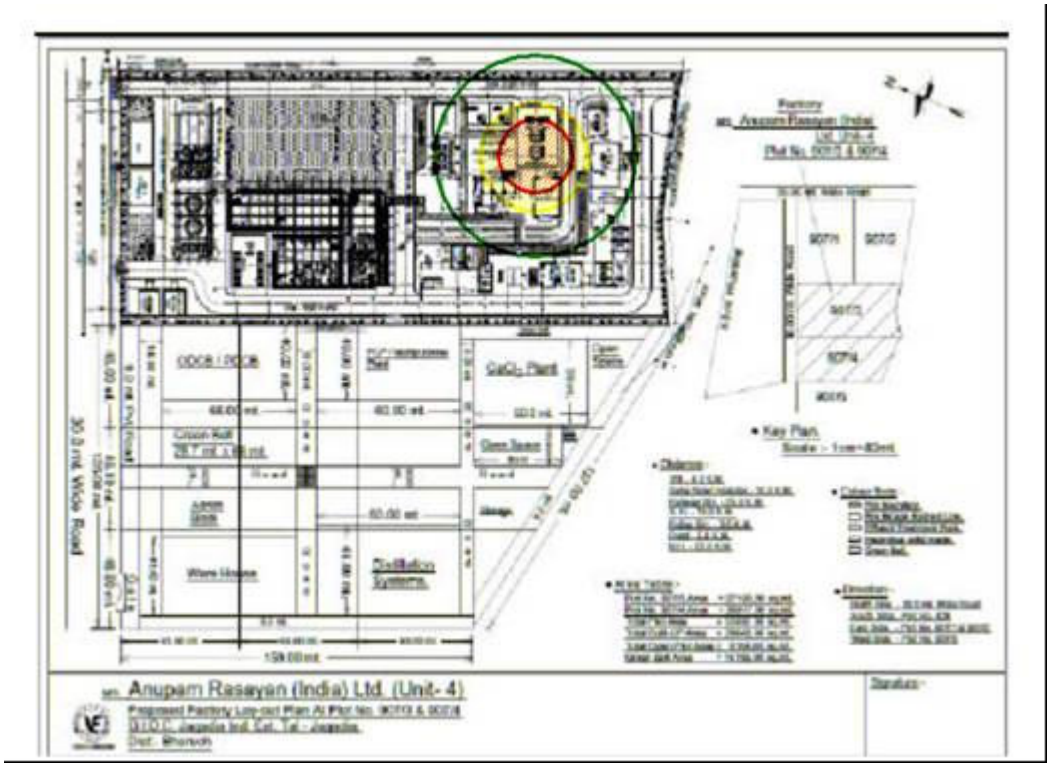
Incident Intensity of Heat Radiation (IHR) at ground level KW /m^2	**IHR- Isopleth Distance (Meters)**	**Damage effects**
37.5	20	100 % Fatal. Min. to ignite wood (without flame contact)
25.0	28	Significant injury. Min. to ignite wood (without flame contact).
12.5	44	Min. to ignite wood (with flame contact). 1^{st} deg. burn.
4.0	82	Pain after 20 secs. Blistering unlikely.
1.6	135	No discomfort even on long exposure.

Results

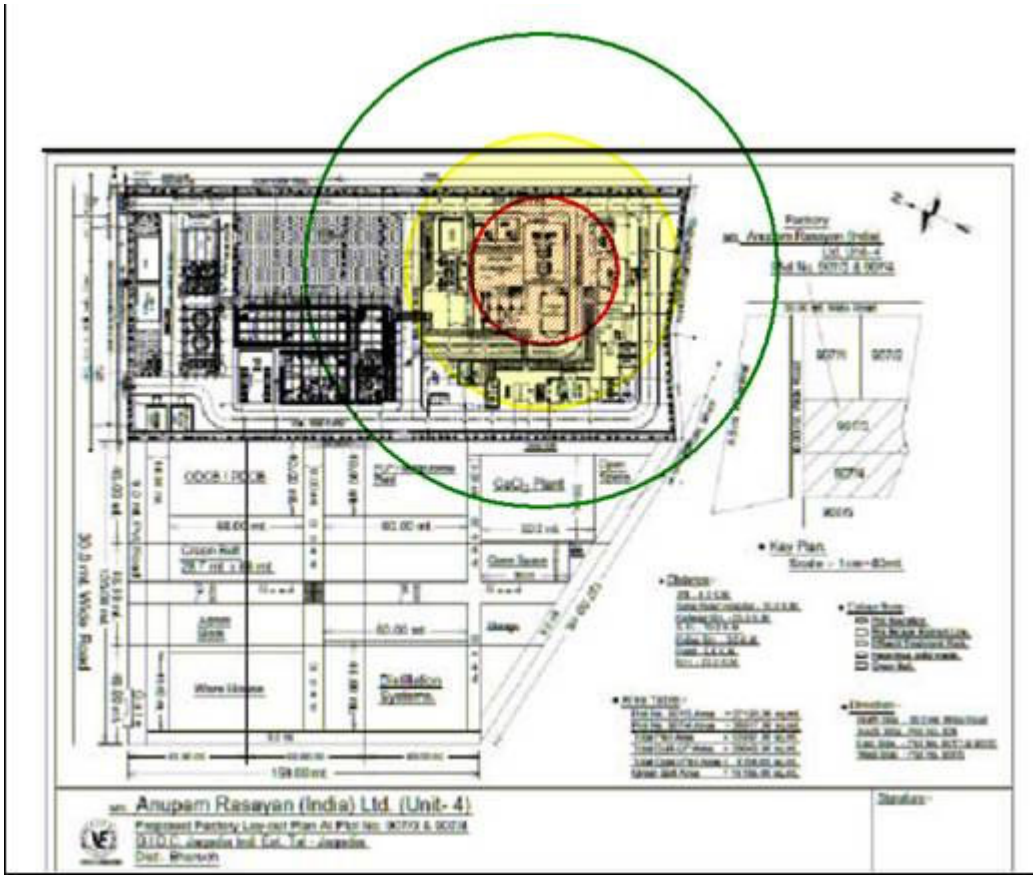
- In the 30 meter radius area is considered as 100 % fatality in 1 min. and first degree burn in 10 sec.
- In the 54 meter radius first degree burn in 10 sec.
- In the 93 meter radius area will give pain after 20 seconds. Blistering unlikely.

In the 148 meter radius area is considered as safe area and no discomfort even on long exposure.

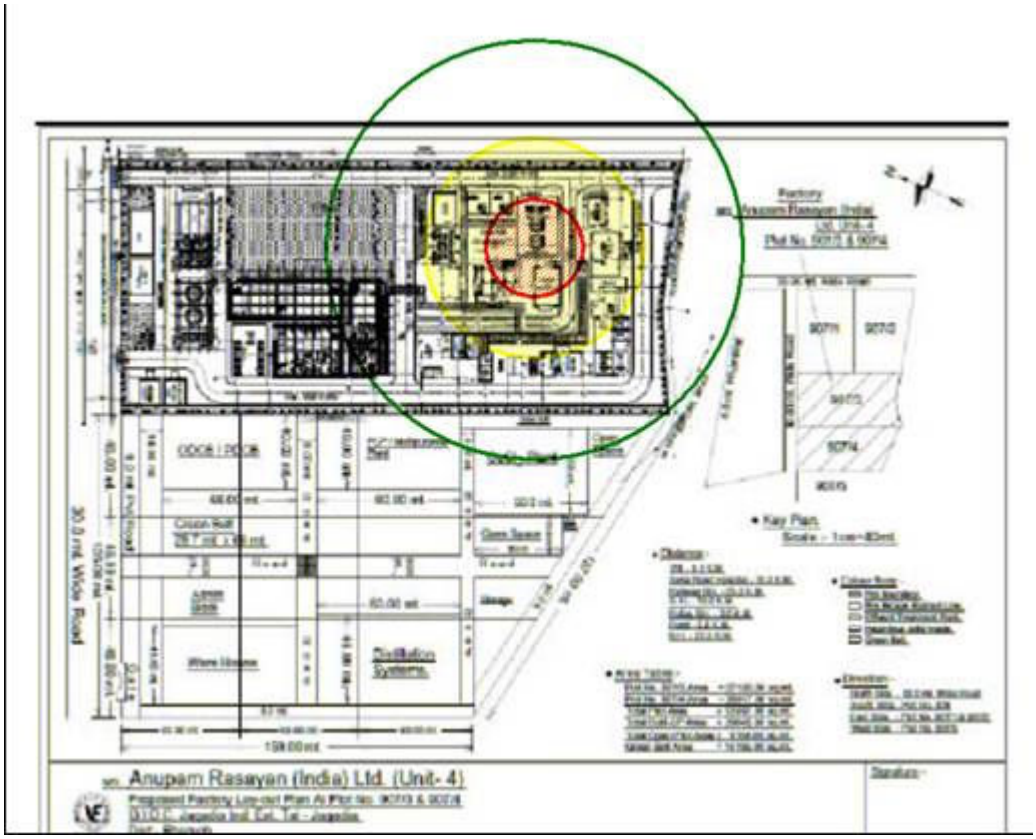
Pool Fire



Fire Ball



Flash Fire



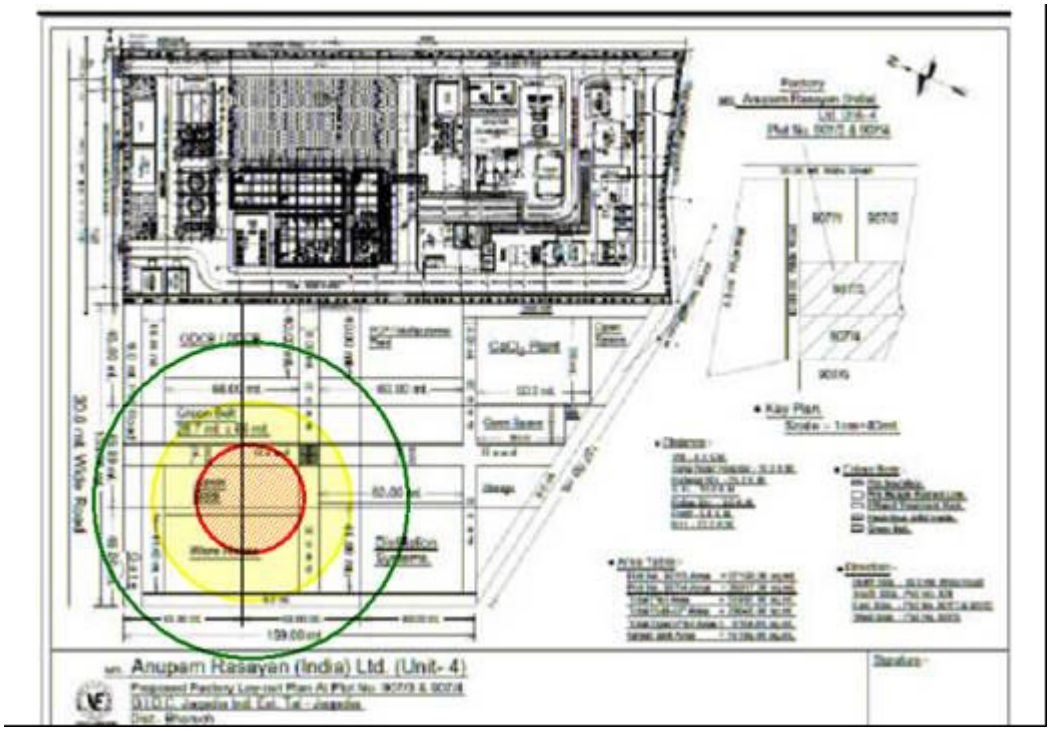
Scenario 7: Release of IPA

This scenario considers release of IPA from Storage Tank:

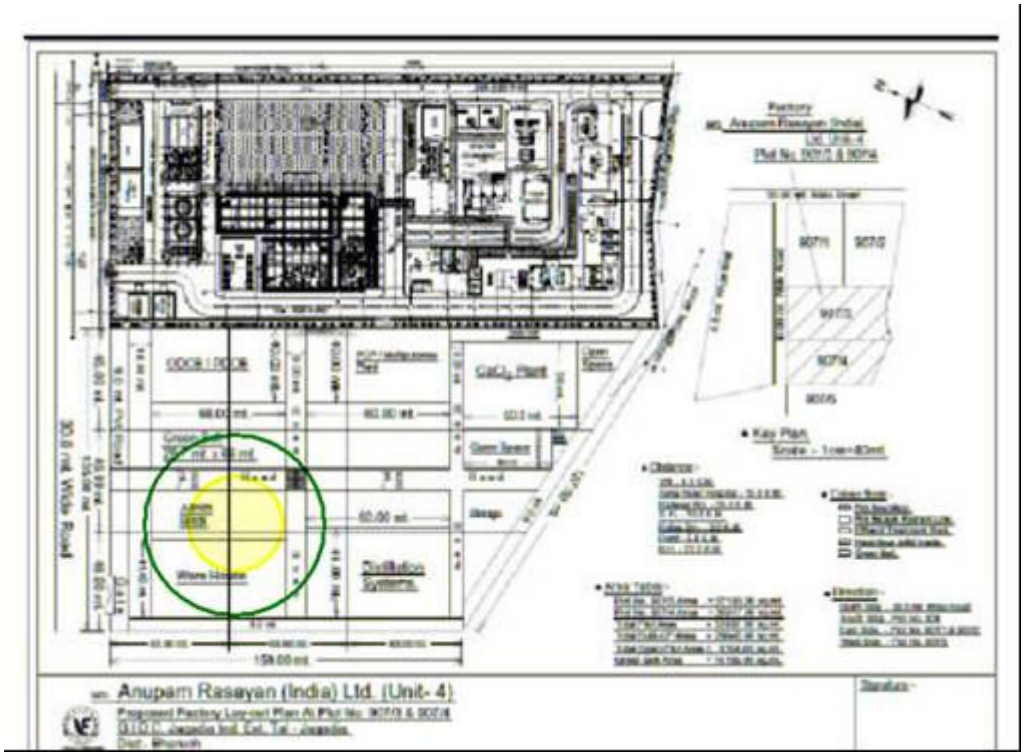
Catastrophic Rupture					
Input Data					
Stored quantity - 20 KL					
Molecular weight - 32.04					
Wind speed - 2.2 m/s					
Density (Air) – 785 kg/m^3					
Results indicate					
Pool Fire Scenario					
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**			
4	62.0	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality			
12.5	40.0	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.			
37.5	22.5	This level of radiation is assumed to give 100% fatality as outlined above.			
Vapor Cloud Explosion					
Radial Distance (m)	**Over Pressure (psi)**	**Fatality lung Rupture (%)**	**Eardrum Rupture (%)**	**Structure Damage (%)**	**Glass Rupture (%)**
6.50	36.7	100.0	100.0	100.0	100.0
6.83	8.4	0.0	73.3	100.0	100.0
10.02	1.9	0.0	2.8	12.8	100.0
In case of Unconfined Vapor Cloud Explosion up to 6.50 meter is considered as 100% fatality and 100% ear drum rupture radius.					
In case of Unconfined Vapor Cloud Explosion up to 6.83 meter is considered as 100% structure damage and up to 10.02 meter 100% glass rupture area.					

Fireball Scenario		
Fireball Radius: 6.36m		
Fireball intensity of Heat Radiation (KW/m^2) – 134.186		
Fireball rate of Energy release (KJ/Sec)- 68393.6		
Fireball total energy released (KJ)- 96888.6		
Fireball duration (Sec) – 1.40		
Radiation Level (KW/m^2)	**Distance in meter**	**Injury Type**
100.20	7.0	100% Fatal
42.09	11.0	100% Fatal
12.5	19.0	1^{st} degree Burn
9.96	23.0	Pain after 20secs.
4.0	35.0	Pain after 20secs.
1.54	59.0	No Injury

Pool Fire



Fire Ball



Scenario 8: Release of Chlorobenzene

This scenario considers release of Chlorobenzene from Storage Tank:

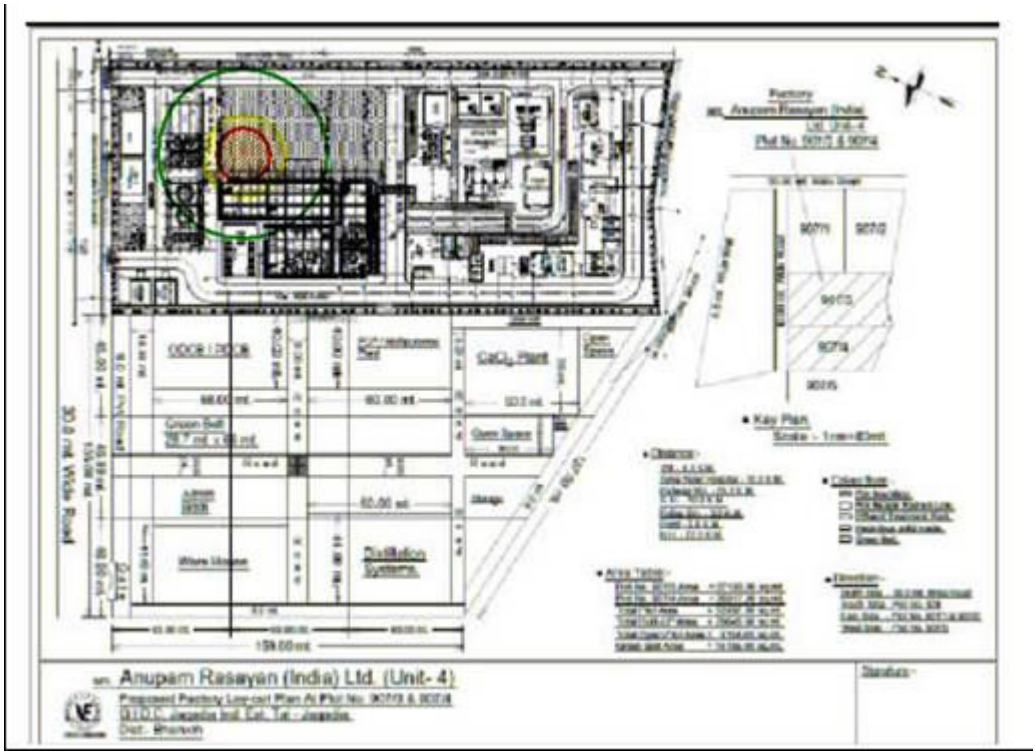
Scenario : Catastrophic Rupture of Unloading arm of Chloro Benzene Tanker and Resultant Pool Fire	
Basic Input Data	
Release quantity	20 KL
Molecular weight	112.56
Vapor Density (Air=1)	3.9
Wind speed	2.2 m/s
Temperature	Room Temperature
Pressure	Atmospheric Pressure
Consequence Results	
Pool Fire Scenario	
Radiation Effects	

Radiation Level (KW/m^2)	**Distance (meter) (Category 1.5/F)**	**Effect if IHR at Height of simulation**
4	34.1	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	16.5	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	9.4	This level of radiation is assumed to give 100% fatality as outlined above.

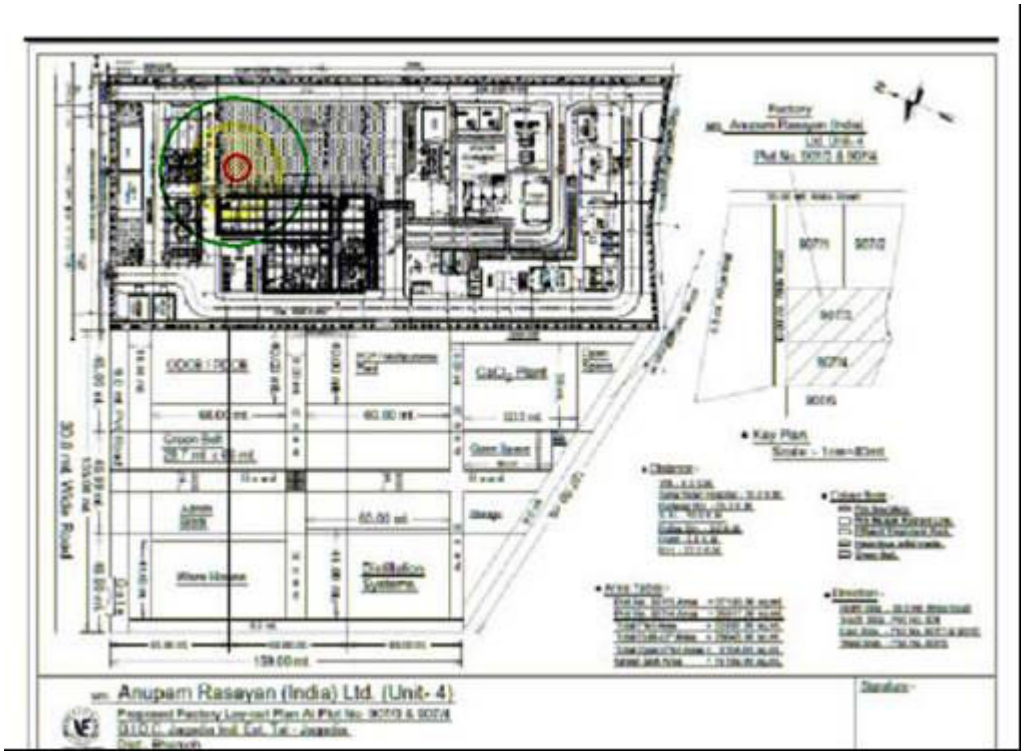
Scenario : VCE form Chloro Benzene Pool after 10 min evaporation					
Radial Distance (m)	**Over Pressure (psi)**	**Fatality lung Rupture (%)**	**Eardrum Rupture (%)**	**Structure Damage (%)**	**Glass Rupture (%)**
1.44	36.3	100.0	100.0	100.0	100.0
2.57	8.1	0.0	70.9	100.0	100.0
5.72	1.9	0.0	2.9	13.3	100.0
In case of Unconfined Vapor Cloud Explosion up to1.44 meter is considered as 100% fatality and 100% ear drum rupture radius.					
In case of Unconfined Vapor Cloud Explosion up to 2.57 meter is considered as 100% structure damage and up to 5.62 meter 100% glass rupture area.					

Scenario : Flash Fire Envelope Results		
Max distance up to which LEL concentration reached	**Max distance up to which LEL concentration reached**	**Effect if IHR at Height of simulation**
4	30	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	18	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	3.5	This level of radiation is assumed to give 100% fatality as outlined above.

Pool Fire



Flash Fire



Scenario 9: Release of Methanol

This scenario considers release of Methanol from Storage Tank:

Results indicate:

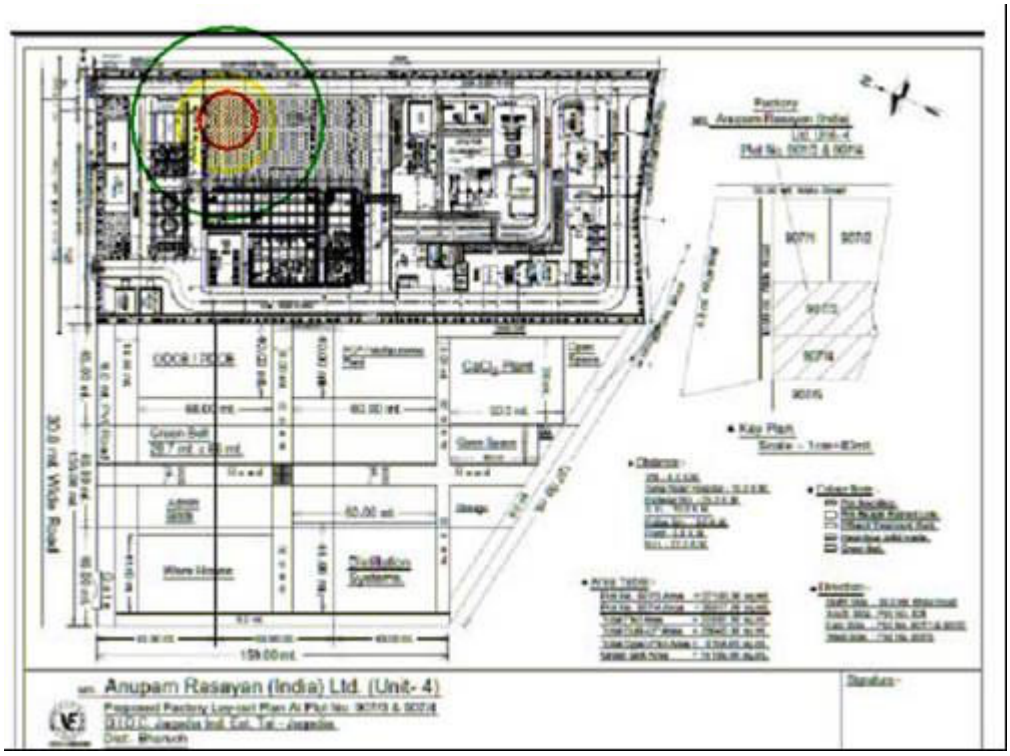
Catastrophic Rupture		
Input Data		
Stored quantity - 20 KL		
Molecular weight -33.05		
Wind speed – 2.2 m/s		
Density (Air) –0. 810 g/cm^3		
Results indicate		
Pool Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	38.60	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	21.19	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	12.81	This level of radiation is assumed to give 100% fatality as outlined above.

Fireball Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Injury Type**
4	49	Pain after 20secs.
12.5	29	1st degree Burn
37.5	16	100% Fatal

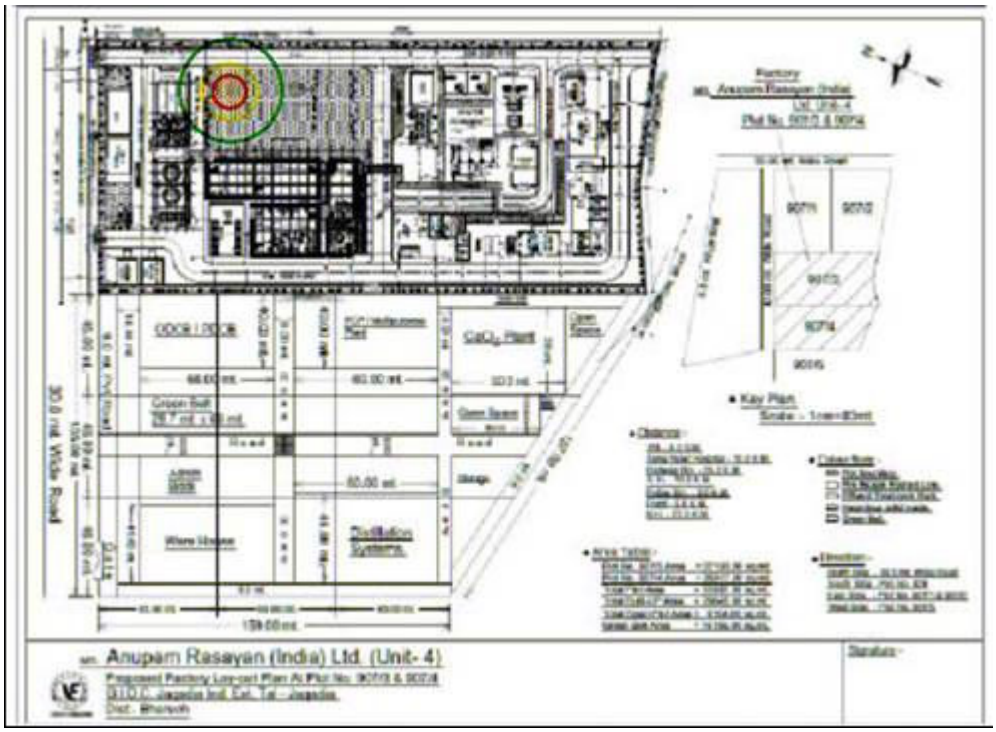
Flash Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	20	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	12	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	6	This level of radiation is assumed to give 100% fatality as outlined above.

Vapor Cloud Explosion					
Radial Distance (m)	**Over Pressure (psi)**	**Fatality lung Rupture (%)**	**Eardrum Rupture (%)**	**Structure Damage (%)**	**Glass Rupture (%)**
1.22	37	100.0	100.0	100.0	100.0
2.13	9.0	0.1	82.4	100.0	100.0
7.62	1.0	0.0	2.3	9.5	100.0
In case of Unconfined Vapor Cloud Explosion up to 1.22meter is considered as 100% fatality and 100% ear drum rupture radius.					
In case of Unconfined Vapor Cloud Explosion up to 2.13 meter is considered as 100% structure damage and up to 7.62 meter 100% glass rupture area.					

Pool Fire



Flash Fire

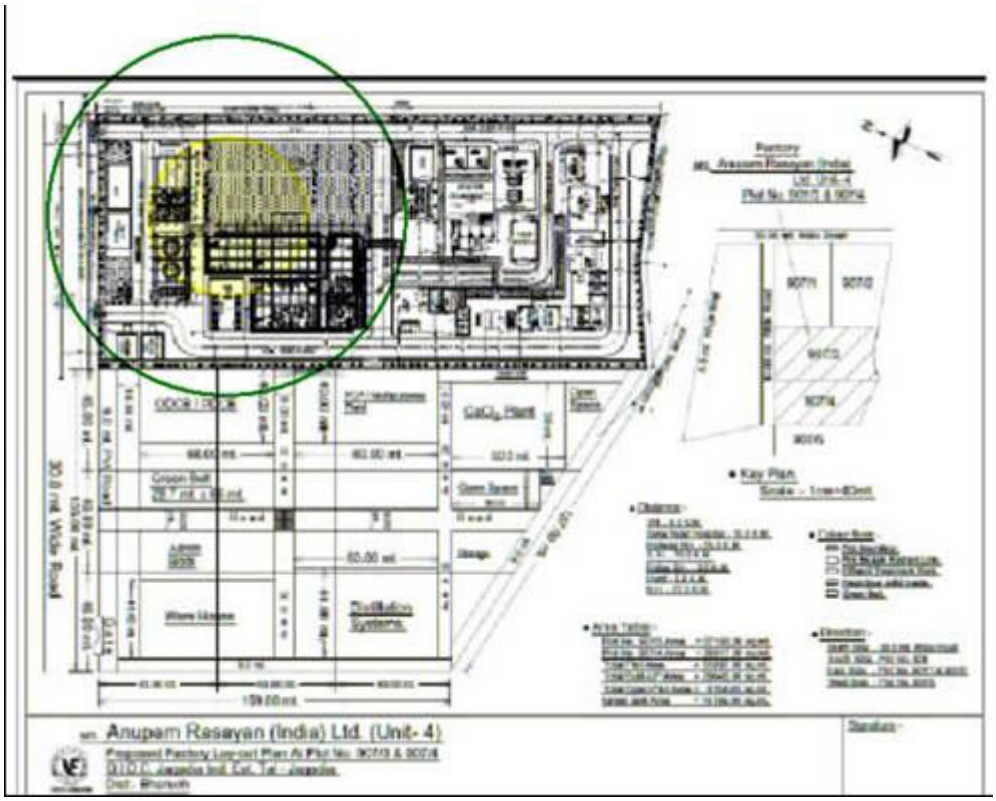


Scenario 10: Release of ODCB

Catastrophic Rupture		
Input Data		
Stored quantity - 20 KL		
Molecular weight - 147		
Wind speed - 2.2 m/s		
Vapor density (air=1) – 5.1		
Boiling Point – 180 °C		
Results indicate		
Pool Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	70.56	Pain after 20 secs. Blistering unlikely.
12.5	32.61	Min. to ignite wood (with flame contact). 1 % fatal in 1 min. 1^{st} deg. burn in 10 sec.
37.5	NR	Damage to process equipment. 100 % Fatal in 1 Min. 1 % fatal in 10 sec.

NR-Not Reached

Pool Fire

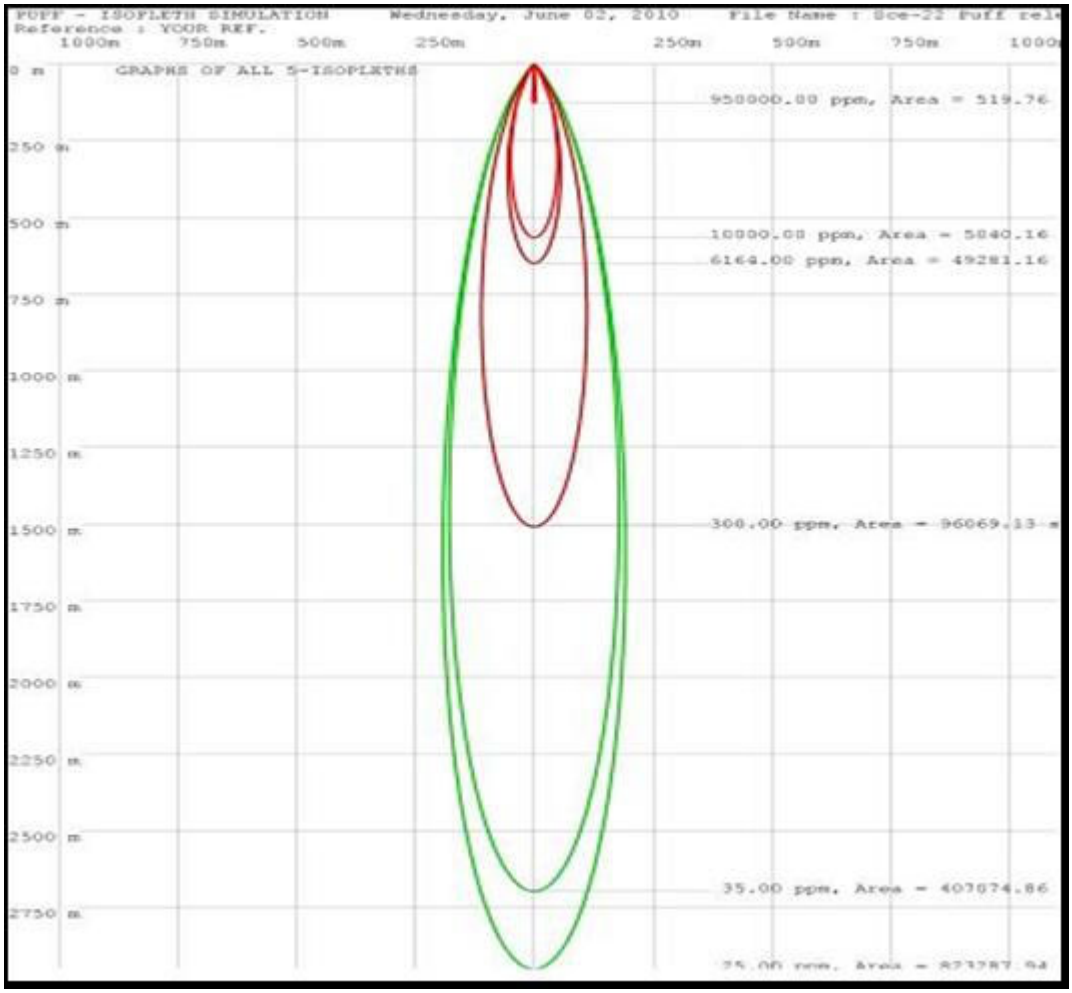

Anupam Rasayan (India) Ltd. (Unit- 4)
30.0 mt. Wide Road
60.00 mt.
Key Plan

Scenario 11: Release of Ammonia

Scenario Puff Release Simulation Module for Ammonia Catastrophic Failure

Puff release simulation module for Ammonia catastrophic failure		
Scenario : PUFF RELEASE		
Input Data		**Results of Computations**
Stored quantity	20 KL	**End point (meter)**
Release Rate	5e + 007 Gms/ Sec.	
LC50 Human	6164 ppm	649.68
IDLH value	300 ppm	1509.17
TLV value	25 ppm	2951.09

Toxic Effect

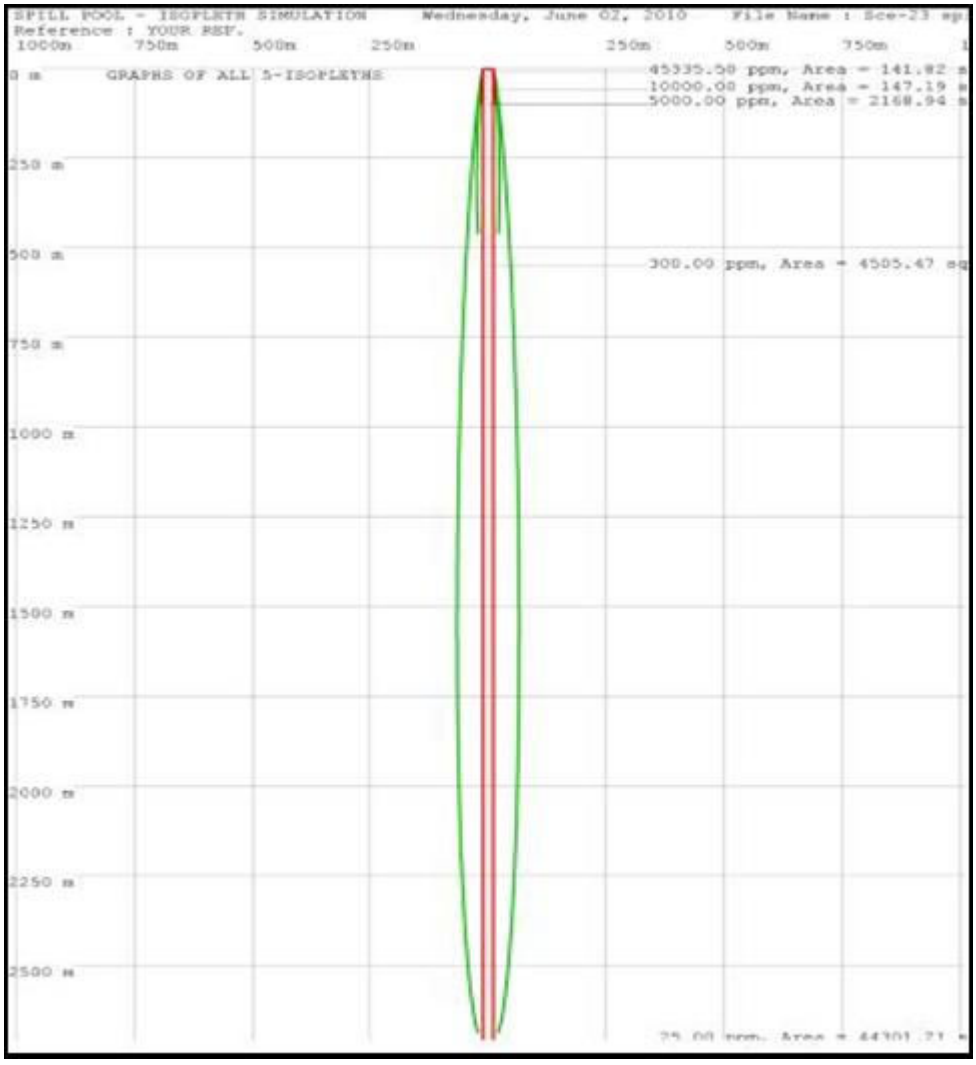


Spill Pool Evaporation

Scenario : SPILL POOL		
Input Data		**Results of Computations**
Stored quantity	50 MT	**End point**
Release Rate	1442 Gms/ Sec.	**(meter)**
LC50 Human	4443ppm	102.31
IDLH value	300 ppm	553.38
TLV value	25 ppm	2709.05

Results

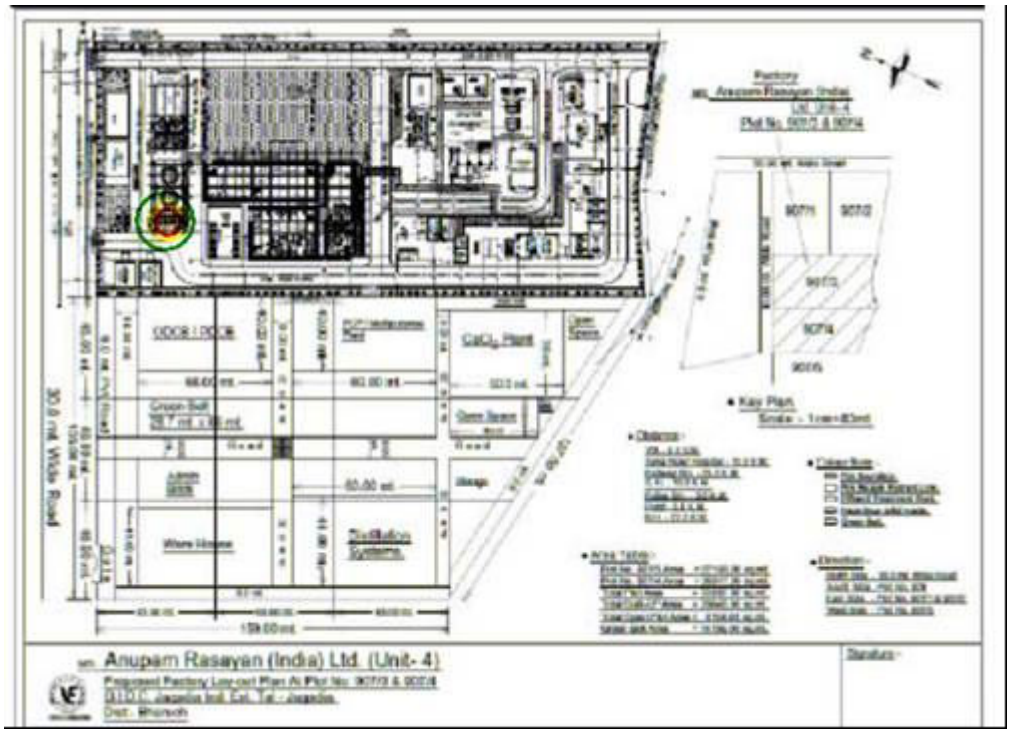
•LC50 HUMAN (4443 ppm) area up to 102.31 meter, IDLH (Immediate danger to life and health) concentration area up to 553.38 meter and TWA (25 PPM) area up to 2709.05 meter. Therefore 553.38 meter area in wind direction is considered as evacuation area.



Scenario 12: Release of Meta Di Nitro Benzene

Catastrophic Rupture		
Input Data		
Stored quantity - 25 KL		
Molecular weight -168.11		
Wind speed - 2.2 m/s		
Density (Air) –1.049 g/cm^3		
Results indicate		
Pool Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	11.19	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	6.98	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	3.60	This level of radiation is assumed to give 100% fatality as outlined above.

Pool Fire

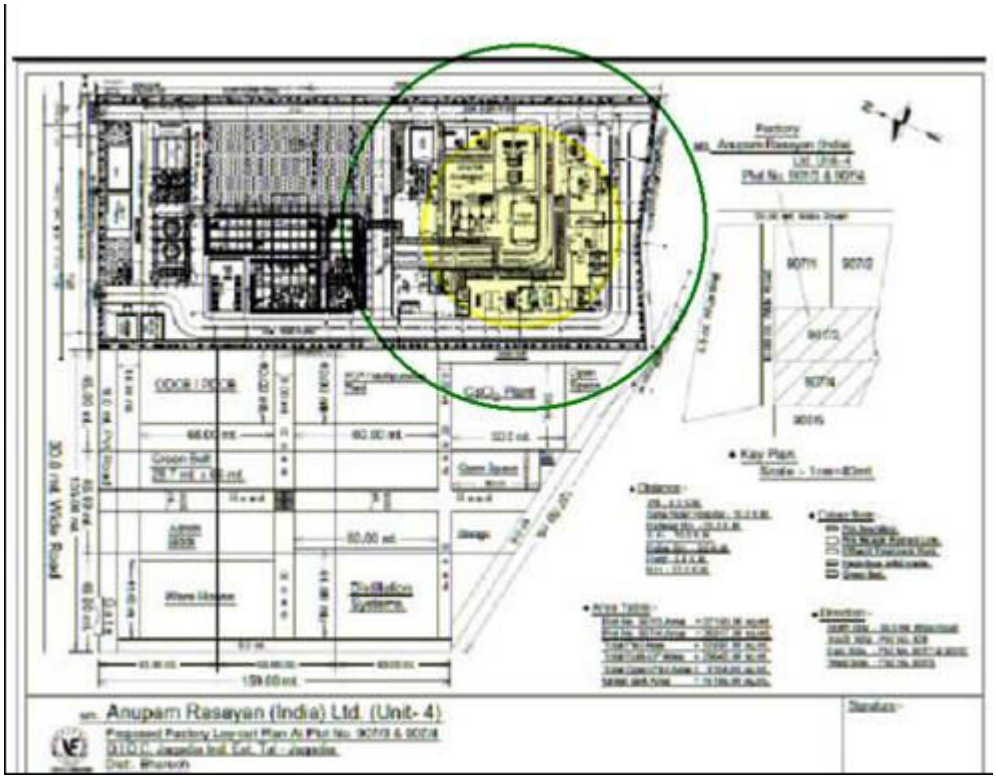


Scenario 13: Release of DEG

Catastrophic Rupture		
Input Data		
Stored quantity - 60 KL		
Molecular weight -106.12		
Wind speed - 2.2 m/s		
Density (Air) –1.049 g/cm^3		
Results indicate		
Pool Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	72.47	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	39.26	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	NR	This level of radiation is assumed to give 100% fatality as outlined above.

NR – Not Reached

Pool Fire

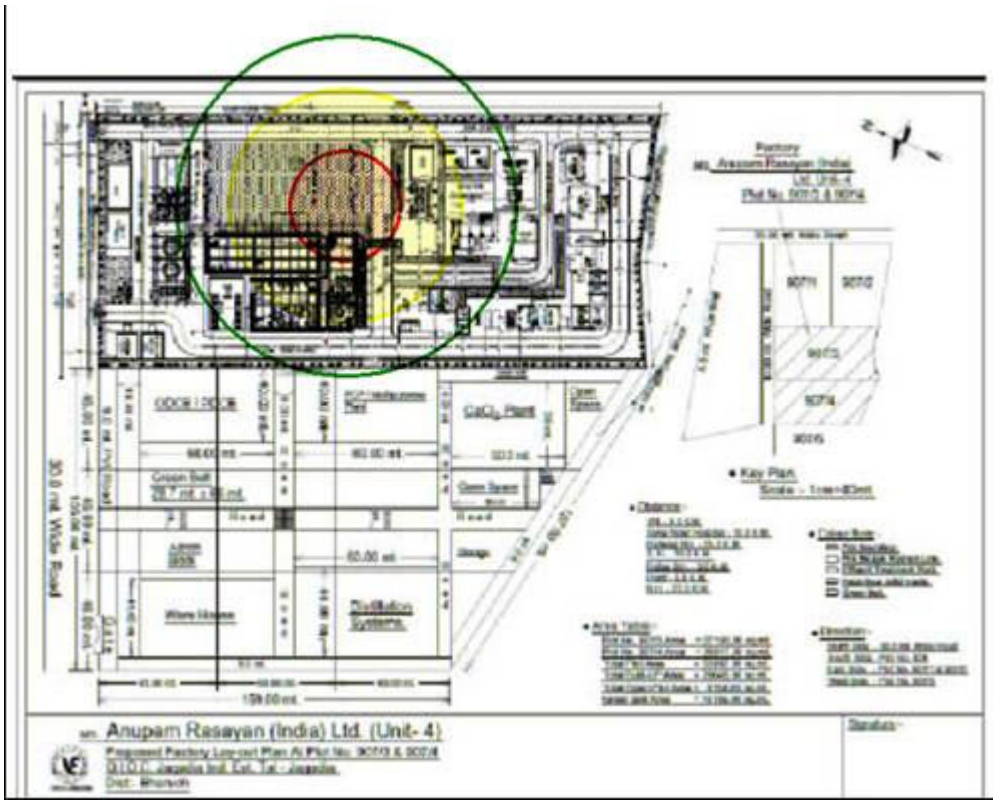


Scenario 14: Unconfined Pool Fire Simulations for Drum Storage Area

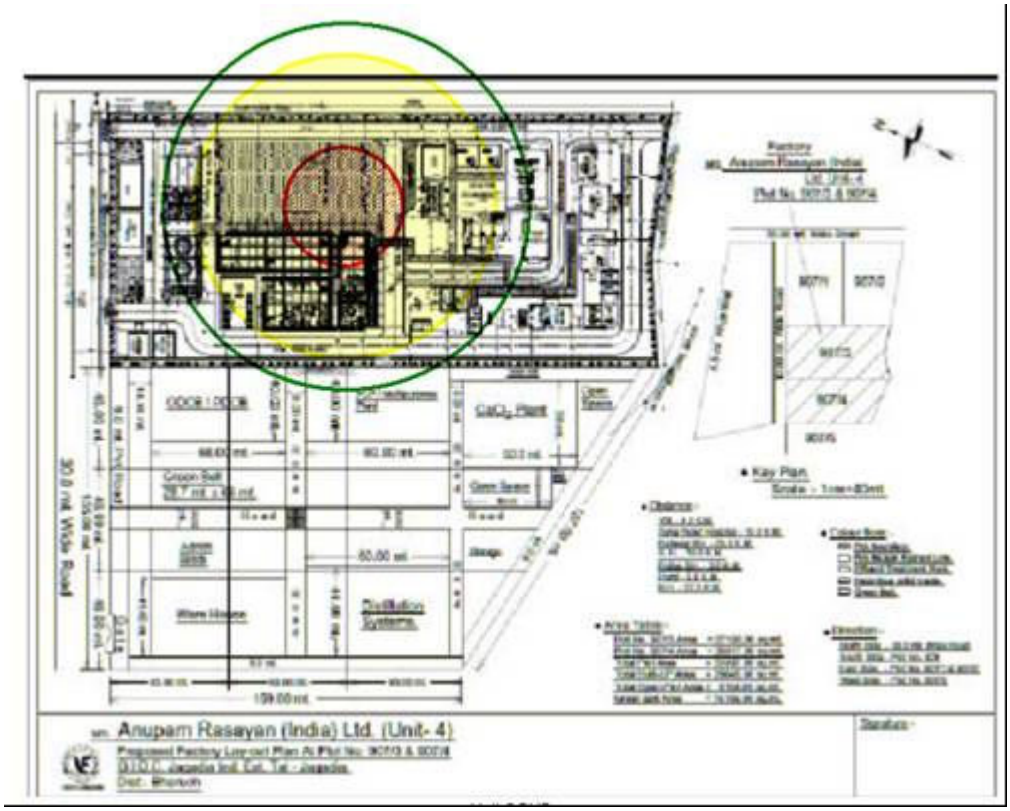
Catastrophic Rupture		
Input Data		
Stored quantity - 10 MT		
Wind speed - 2.2 m/s		
Density (Air) – 0.867 g/cm^3		
Results indicate		
Pool Fire Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Effect if IHR at Height of simulation**
4	68.2	This level is sufficient to cause personnel if unable to reach cover within 20s; however blistering of the skin (second degree burn) is likely; 0: lethality
12.5	45.8	This level will cause extreme pain within 20 seconds and movement to a safer place is instinctive. This level indicates around 6% fatality for 20 seconds exposure.
37.5	22.40	This level of radiation is assumed to give 100% fatality as outlined above.

Fire Ball Scenario		
Radiation Level (KW/m^2)	**Distance in meter**	**Injury Type**
4	72.0	Pain after 20secs.
12.5	59.1	1st degree Burn
37.50	24.2	100% Fatal

Pool Fire



Fire Ball



Measures to be taken to prevent such accident:

- Priority will be given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road.
- Security person will check License, TREM CARD, Fire extinguisher condition, Antidote Kit, required PPEs as per SOP laid down.
- Store officer will take sample as per sampling SOP from sampling point.
- After approval of QC department unloading procedure will be allowed be started.

Following precautions will be adopted during unloading

- Wheel stopper will be provided to TL at unloading platform.
- Static earthing will be provided to road tanker.
- Tanker unloading procedure will be followed according to check list and implemented.
- Flexible SS hose connection will be done at TL outlet line.
- The quantity remaining in the hose pipeline will be drained to a small underground storage tank, which will be subsequently transferred by nitrogen pressure to the main storage tank thus ensuring complete closed conditions for transfer from road tanker.
- All TL valves will be closed in TL.
- Finally earthing connection and wheel stopper will be removed.
- Only day time unloading will be permitted.

Following precautions will be adopted Storage of such chemicals

- Storage tank will be stored away from the process plant.
- Tanker unloading procedure will be prepared and implemented.
- Caution note and emergency handling procedure will be displayed at unloading area and trained all operators.
- NFPA label will be provided.
- Required PPEs like full body protection PVC apron, Hand gloves, gumboot, Respiratory mask etc. will be provided to operator.
- Neutralizing agent will be kept ready for tackle any emergency spillage.
- Safety shower, eye wash with quenching unit will be provided in acid storage area.
- Material will be handled in close condition in pipe line.

- Dyke wall will be provided to all storage tanks, collection pit with valve provision.
- Double drain valve will provided.
- Level gauge will be provided on all storage tanks.
- Safety permit for loading unloading of hazardous material will be prepared and implemented.
- TREM CARD will be provided to all transporters and will be trained for transportation Emergency of Hazardous chemicals.
- Fire hydrant system with jockey pump as per TAC norms will be installed.

For Storage tank farm area:

- Under N2 pressure storage.
- Safety valve provided and storage facility to ensure safe release of HC in case of over pressure.
- Dyke with separate fencing area is provided.
- SOP prepared
- Road tanker unloading procedure prepared
- Work permit followed
- PPEs used
- Safety shower, eye wash provided.
- NFPA labeling system adopted for storage tanks.
- Level indicator at local.
- Alarm for high level & high pressure.
- Automatic fire fighting indication provided for around the storage area
- Sprinkler system will be provided

9.5 EMERGENCY RESPONSE PLAN

The company have prepared and updated on-site / off- site emergency action plan (OEP). Training for OEP is given to all employees on regular basis. Mock drill on regular basis is also conducted. Lacking is observed and will be taken care in the next rehearsal. The company is also a member of Disaster Prevention Management Centre (DPMC), Ankleshwar and actively participated in the mock drills of respected groups.

As per the defined procedure of emergency organizations, as soon as incident comes to knowledge of incident controller, he will sound the emergency siren to activate OEP. Immediately quick actions by all the teams would have been started to control / minimize the affect of emergency and to bring situation back in normalcy.

Emergency response plan for existing facility

1. Sulfuric acid / Nitric acid

1) Activate On Site / Off Site Emergency Action plan.
2) Stop production & evacuate affected area.
3) Attend and rectify the leak to normalcy.
4) Transfer in another available empty tank/ Vessel.
5) Use respiratory protection while handling emergency.

2. 1-4 Dioxane

1) Activate On Site / Off Site Emergency Action plan.
2) Action on site as per the emergency preparedness & response procedure.
3) Collect material at dyke wall and transfer in other tank / receiver.
4) Safe plant shutdown done as per established procedure.
5) Evacuate affected plant/areas.
6) Attend and control the fire by Fire fighting team to normalcy.
7) Start Foam spray.
8) Use respiratory protection while handling emergency.
9) Cover spill with dry sand/ dry earth. Send it for incineration.

3. Di Ethylene Glycol / PEG

1) Activate On Site / Off Site Emergency Action plan.

2) Action on site as per the emergency preparedness & response procedure.

3) Small leakage covers by sand.

4) Collect dike wall and transfer in other tank / receiver.

5) Evacuate affected plant/areas.

6) Attend and control the fire by Fire fighting team to normalcy.

7) Start water spray.

8) Use respiratory protection while handle emergency.

Emergency response plan for proposed facility

1. CHLORINE (CL_2)

1) Activate On Site / Off Site Emergency Action plan.

2) Stop vehicle movement. Safe plant shut down procedures.

3) Training to toxic release controlling team and also to all emergency team.

4) Training for Fit close clamp or use of emergency kit.

5) Scrub in alkali scrubber by using FRP hood & blower assembling.

6) Use respiratory protection while handle emergency.

2. Nitric Acid / NSA,

1) Activate On Site / Off Site Emergency Action plan.

2) Stop production & evacuate affected depts.

3) Attend and rectify the leak to normalcy.

4) Transfer in another available empty Tanks / Vessels.

5) Use respiratory protection while handle emergency.

3. Sulfuric acid / HCL

1) Activate On Site / Off Site Emergency Action plan.

2) Stop production & evacuate affected depts.

3) Attend and rectify the leak to normalcy.

4) Transfer in another available empty Tanks / Vessels.

5) Use respiratory protection while handle emergency.

4. Ethylene Dichloride

1) Activate On Site / Off Site Emergency Action plan.

2) Safe plant shut down procedures.

3) Training to toxic release controlling team and also to all emergency team.

4) Use respiratory protection while handle emergency.

5. Methanol / Benzene.

1) Activate On Site / Off Site Emergency Action plan.

2) Start water sprinkler.

3) Stop vehicle movement

4) Action on site as per the emergency preparedness & response procedure.

5) Safe plant shutdown done as per established procedure.

6) Evacuate affected plant/areas.

7) Attend and control the fire by Firefighting team.

8) Start foam flooding & water Sprinkler on other tank if required.

6. Chloro Benzene / MDNB / MDCB/ODCB/ Iso Propyl Alcohol,

1) Activate On Site / Off Site Emergency Action plan.

2) Action on site as per the emergency preparedness & response procedure.

3) Safe shutdown as per procedure.

4) Cover spill with dry sand/ dry earth. Send it for incineration. Clean area with plenty of water.

5) Attend and control the fire by Fire fighting team to normalcy.

6) Start water spray.

7) Use respiratory protection while handle emergency.

8) Send ambulance to the site with Methylene Blue and vitamin-C injections.

7. Caustic Soda Lye

1) Activate On Site / Off Site Emergency Action plan.

2) Action on site as per the emergency preparedness & response procedure.

3) Collect in dyke wall &/or transfer in other tank.

Small leakage cover by sand or Wash with large quantity of water.

8. AMMONIA (NH_3)

1) Activate On Site / Off Site Emergency Action plan.

2) Safe plant shut down procedures.

3) Training to toxic release controlling team and also to all emergency team.

4) Training for start water sprinkler system on ammonia tank.

5) Use respiratory protection while handle emergency.

9. Nitro Benzene, DEG, and Phenol

1) Activate On Site / Off Site Emergency Action plan.

2) Start water spray.

3) Stop vehicle movement

4) Action on site as per the emergency preparedness & response procedure.

5) Safe plant shutdown done as per established procedure.

6) Evacuate affected plant/areas.

7) Attend and control the fire by Firefighting team.

8) Cover spill with dry sand/ dry earth. Send it for incineration. Clean area with plenty of water.

10. 3- Nitro -4- Methyl Benzoic Acid, Iso Butyl Alcohol, 2- Chloro Ethanol (O - Chloro Ethanol), NITRO BENZENE Storage In Drums & Handling.

1) Activate On Site / Off Site Emergency Action plan.

2) Action on site as per the emergency preparedness & response procedure.

3) Small leakage covers by sand.

4) Transfer in other drum through mobile vacuum pump.

5) Evacuate affected plant/areas.

6) Attend and control the fire by Firefighting team to normalcy.

7) Start water spray.

8) Use respiratory protection while handling emergency.

11. 2- Methyl -5- Nitro Phenol , 2,4 – Dichloro Phenol,Para Chloro Phenol (PCP), Phenol, Benzene Sulphonyl Chloride, Dimethyl Sulfate Storage In Drums & Handling

1) Activate On Site / Off Site Emergency Action plan.

2) Action on site as per the emergency preparedness & response procedure.

3) Small leakage covers by sand.

4) Transfer in other drum through mobile vacuum pump.

5) Evacuate affected plant/areas.

6) Attend and control the fire by Fire fighting team to normalcy.

7) Start water spray.

8) Use respiratory protection while handle emergency.

10.0 OCCUPATIONAL HEALTH & SAFETY

For large industries, where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance; the men, materials and machines are the basic inputs. Along with the boons, industrialization generally brings several problems like occupational health and safety.

The industrial planner, therefore, has to properly plan and take steps to minimize the impacts of industrialization and to ensure appropriate occupational health and safety including fire plans. All these activities again may be classified under construction and erection, and operation and maintenance.

Health of all the employees in plant area will be regularly monitored by outside physician. If any abnormality will found necessary treatment will also being given time to time. Necessary history cards, records will also be maintained which is up-dated time to time.

10.1 OCCUPATIONAL HEALTH

Occupational health needs attention both during construction & erection and operation & maintenance phases. However, the problem varies both in magnitude and variety in the above phases.

10.1.1 CONSTRUCTION AND ERECTION

The occupational health problems envisaged at this stage can mainly be due to constructional accident and noise. To overcome these hazards, in addition to arrangements to reduce it within TLV's, necessary protective equipments shall be supplied to workers.

10.1.2 OPERATION AND MAINTENANCE

The problem of occupational health, in the operation and maintenance phase is primarily due to noise which could affect consultation. The necessary personal protective equipments will be given to all the workers. The working personnel shall be given the following appropriate **personnel protective equipments**.

- Industrial Safety Helmet;
- Face shield
- Zero power plain goggles with cut type filters on both ends;
- Zero power goggles with cut type filters on both sides and blue color glasses;

- Welders equipment for eye and face protection;
- Cylindrical type earplug;
- Ear muffs;
- Canister Gas mask;
- Self contained breathing apparatus;
- Leather apron;
- Aluminized fiber glass fix proximity suit with hood and gloves;
- Boiler suit;
- Safety belt/line man's safety belt;
- Leather hand gloves;
- Asbestos hand gloves;
- Acid/Alkali proof rubberized hand gloves;
- Canvas cum leather hand gloves with leather palm;
- Lead hand glove;
- Electrically tested electrical resistance hand gloves; and
- Industrial safety shoes with steel toe.

10.1.3 HOSPITAL FACILITIES

It is proposed that client will make formal agreements with nearby hospital having facilities to attend fire and toxic effect cases for attending the affected persons in the emergency arising out of accidents, if any.

10.1.4 FACTORY MEDICAL OFFICER

A qualified doctor will be appointed as FMO on retainer ship basis. Apart from him, Paramedical Staff will be employed.

10.1.5 EXISTING FACILITY IS AVAILABLE AT FIRST AID CENTRE

1. Snake Bite Lancet
2. Rub Spirit- Iso Propyl Rubbing Alcohol (LR Grade—I.P.A)
3. Potassium Permanganate (20 gm).
4. Hydrogen Peroxide 100ml
5. Merbromin Solution
6.Torniquet

7.Dettol – 210 ml
8.Parraffin Gauze Dressing B.P. (10 CM ×10 CM)--- 20 nos.
9. Absorbent Cotton Wool – 12 nos.
10. Safety Pin – 2 pkt.
11. Kidney Tray
12. Cutter (scissors)
13. Small Cotton Gauze Swab Sterilise Absorbent (sterilized dressings).(5 cm×5 cm × 12 ply × 04 nos.)
14. Medium Cotton Gauze Swab Sterilise Absorbent (sterilized dressings). -- (7.5 cm×7. 5 cm ×12 ply × 04 nos.)
15. Large Cotton Gauze Swab Sterilise Absorbent (sterilized dressings). -- (10 cm×10 cm ×12 ply ×04 nos.)
16. Sterilised Eye Pad -- 10nos.
17. Triangular Bandage (9 cm×9 cm ×120 cm) –06 nos.
18. 10 nos. of Paracetamol
19. BURNOL
20. SOFRAMYCIN
21. WORKADINE OINTMENT 5 % W/W
22. NETRAPRABHA Eye Drop
23. CIPROXY Eye/Ear Drop
24. RELI SPRAY
25 IODEX
26 MOOV
27 VICKS VAPORUB
28 MILK OF MAGNESIA
29 LIMCEE Tablet
30 METHELEN BLUE INJECTION
31 CASTOR OIL
32 PEG SOLUTION
33. Oxymeter
34. Digital thermometer
35. Medical Oxygen Cylinder

10.1.6 PROPOSED FACILITY TO BE MADE AVAILABLE AT OHC

One Room is proposed to be provided to be operated as OHC. The centre will be equipped with following medical equipments:—

1.	Examination Table	
2	Dressing Tables	For performing Dressing
3.	Glucometer	For measurement of Blood Sugar
4	Vision chart	To evaluate vision acuity
5.	Nebulizer	For relieving coughs & Breathing Difficulty

6.	Infra red light	for relieving muscular pain
7.	Suction machine	For cleaning airway
8.	Autoclave machine	For sterilizing cotton &dressing material
9.	Weighing Machine	For measuring body weight
10.	Sphygmomanometer	To measure blood pressure
12.	Refrigerator	To preserve medicines

10.1.7AMBULANCE VAN

An ambulance van is proposed to be made available 24 hours at Fire Station.

FIRST AID BOX

First Aid Boxes are proposed to be made available at the different location in the plant, Training to be given to employees for First Aid.

10.1.8 PERIODIC MEDICAL EXAMINATION

It is proposed that client will ensure that…

(1) Workers employed shall be medically examined by a qualified medical practitioner/ Factory Medical Officer, in the following manner:

(a) Once in a period of 6 months, to ascertain physical fitness of the person to do the particular job;

(b) Once in a period of 6 months, to ascertain the health status of all the workers in respect of occupational health hazards to which they are exposed and in cases where in the opinion of the Factory Medical Officer it is necessary to do so at a shorter interval in respect of any workers;

© In periodic and pre-medical examinations, various parameters will be checked. Viz., LIVER FUNCRION TESTS, Chest X-rays, Audiometry, Spirometry, Vision testing (Far & Near vision, color vision and any other ocular defect) ECG and other parameters as will be found necessary as per the opinion of Factory Medical officer.

(2) No person shall be employed for the first time without a certificate of granted by the Factory Medical Officer.

10.1.9 EMP for the Occupational Safety & Health hazards so that such exposure can be kept within permissible exposure level (PEL)/Threshold Level value (TLV) so as to protect health of workers.

1. It is proposed to formulate and implement an EMP for Occupational Safety and Health with following aims…

- To keep air-borne concentration of toxic and hazardous chemicals below PEL and TLV.
- Protect general health of workers likely to be exposed to such chemicals
- Providing training, guidelines, resources and facilities to concerned department for occupational health hazards.
- Permanent changes to workplace procedures or work location to be done if it is found necessary on the basis of findings from workplace Monitoring Plan.

2. It is proposed that this EMP be formulated on the guidelines issued by Bureau of Indian Standards on OH&S Management Systems: IS 18001:2000 Occupational Health and Safety Management Systems
3. Proposed EMP will be incorporated in Standard Operating Procedure also.
4. **The proposed EMP will also include measure to keep air-born concentration of toxic and hazardous chemicals below its PEL and TLV, like…**
   a. Leak Surveys
   b. Separate storage for toxic chemicals
   c. Exhaust Ventilation
   d. Proper illumination
   e. On-line detectors toxic chemicals like Chlorine and Bromine
   f. Close processes to avoid spills and exposures
   g. Atomization of process operations to hazards of manual handling of chemicals
   h. Supply of proper PPEs like Air mask, Berating canisters, SCBA sets, On-line breathing apparatus at the places where there is possibility of presence of toxic chemicals
   i. Decontamination procedure for empty drums and carboys.
   j. Regular maintenance program for pumps, equipment, instruments handling toxic and corrosive chemicals
   k. Display of warning boards
   l. Training to persons handling toxic and corrosive chemicals

10.1.9 Workplace Monitoring Plan

- It is proposed that a Workplace Monitoring Plan to be prepared & implemented in consultation with FMO and industrial hygienists.
- Each workplace must be evaluated to identify potential hazards from toxic substances or harmful physical agents. Air-borne concentration of toxic chemicals will be measured and record will be kept.
- The current state-of-the-art exposure measurement model is as follows: For purposes of measuring worker exposure across a single shift it is sufficient t o place a reasonably accurate exposure measuring device on the worker , within t he worker ’s breathing zone, and have it operate for nearly the full shift. Client has been proposed to study the exposure data when the plant is operative.

10.1.10 Health Evaluation of Workers

1. It is proposed that management will device a plan to check and evaluate the exposure specific health status evaluation of workers
2. Workers will be checked for physical fitness with special reference to the possible health hazards likely to be present where he/she is being expected to work before being employed for that purpose. Basic examinations like Liver Function tests, chest x ray, Audiometry, Spirometry Vision testing (Far & Near vision, color vision and any other ocular defect) ECG, etc. will be carried out. However, The parameters and frequency of such examination will be decided in consultation with Factory Medical Officer and Industrial Hygienists.
3. While in work, all the workers will be periodically examined for the health with specific reference to the hazards which they are likely to be exposed to during work. Health evaluation will be carried out considering the bodily functions likely to be affected during work. The parameters and frequency of such examination will be decided in consultation with Factory Medical Officer and Industrial Hygienists. Plan of monthly and yearly report of the health status of workers with special reference to Occupational Health and Safety.

10.1.11 MEDICAL SURVEILLANCE PROGRAM

Pre-employment Medical Check Up

1. Chest X-ray
2. Audiometry
3. Hematological Examination:- CBC, SGOT, SGPT, Cholesterol, Blood Sugar etc
4. Urine Examination
5. Vision test
6. Colour blindness test
7. Lung function test- Spirometry

Periodical Medical Check up

1. Lung Function test
2. Audiometry
3. Hematological Examination
4. Urine examination
5. Vision test
6. Colour blindness test
7. Biomarker in Blood & Urine

10.1.13 Toxicity of Hazardous Chemicals

Sr No	Name of Chemicals	TLV/TWA (ACGIH) TLV-STEL	PEL (OSHA)	NFPA Rating H F R S
1	Methanol	200 ppm	200 ppm	1 2 0 0
2	EDC	10 ppm	10 ppm	2 3 0 0
3	Benzene	1 ppm	1 ppm	4 0 2 0
4	Ortho Di Chloro Benzene (ODCB)	300 ppm	50 ppm	2 3 0 0
5	Meta Di Chloro Benzene (MDCB)	75 ppm	25 ppm	2 1 0 0
6	Di Methyl Sulphate	400 ppm	400 ppm	1 3 0 0
7	Chlorine	0.5 ppm	1 ppm	4 0 0 0
8	Nitro Benzene	0.2 ppm	0.1 ppm	3 0 0 0
9	Phenol	400 ppm	400 ppm	1 3 0 0
10	Chloro Benzene	0.5 ppm	1 ppm	4 0 0 0
11	Di Chloro Phenol	0.2 ppm	0.1 ppm	3 0 0 0

11.0 Chlorine handling facilities and precautions

Storage of Chlorine Cylinder:

- Cylinders may be rolled but never dragged.
- They may be carried in a suitable carrying device.
- They should not strike each other violently.
- While returning empty cylinders and not in use, close the valve and put valve protection.
- Do not store gas cylinders in sun or excess heat.

Handling and Precaution of Chlorine:

1. Designate area for handling Chlorine and clearly label all containers.

2. Prohibit eating, drinking, smoking and mouth pipetting in room where Chlorine is handled.

3. Provide proper instruction and supervision to workers responsible for chlorine equipment.

4. Handle Chlorine compounds that are potentially volatile or in powder form in ventilated enclosures.

5. If enhanced containment is necessary, handle volatile compounds in closed systems vented through suitable traps.

6. Never store combustible or flammable materials near chlorine containers.

7. Never allow any liquid or moisture to enter the chlorine container.Never apply heat directly to a chlorine container.

8. Never attempt to weld an “empty” chlorine pipe line without purging it with air first.

9. Install safety showers and eye wash stations near chlorine equipment.

10. Never spray water on leaking containers; it can make the leak worse.

11. When entering an equipment area, take shallow breaths until you are sure that there is not a chlorine gas leak.

12. Rely upon chlorination equipment for direct disposal of chlorine gas.

13. On completing an operation, secure all Chlorine, remove and dispose of protective clothing and coverings, monitor and decontaminate self and surfaces, wash hands and monitor them again.

Safety Precautions:

The first steps to be taken in providing proper safety precautions at any facility are the selection of safety equipment to be on hand, the proper location of the equipment, and the training of all personnel in proper procedures to avoid unnecessary chlorine releases and to deal with releases that occur.

Proper respiratory equipment is essential for all facilities regardless of size. For maximum safety, it is preferable to use air tank type pressure demand masks that have a self contained air supply and, therefore, are suitable regardless of chlorine concentration.

All respiratory equipment must meet the requirements of the National Institute for Occupational Safety and Health. Following the respiratory equipment manufacturer's recommendation regarding maintenance and periodic testing is essential. This equipment should be stored outside the area containing chlorine or chlorine equipment in a manner protecting it from damage of any kind and so as to be readily available.

All personnel with no assigned responsibility for dealing with a chlorine release should be instructed to leave the area. Those responsible for correcting the situation should don respiratory equipment before doing so.

Protective clothing is recommended for handling even routine operations involving chlorine. In the event of a substantial release, protective clothing is required. Anyone desiring further information on protective clothing should refer to the Chlorine Institute Pamphlet 65, Protective Clothing for Chlorine.

Safety shoes, hard hats, and safety glasses should be used in accordance with standard plant practice.

Most leaks will occur in piping, valves, connections, and the pressurized portions of chlorine equipment. These leaks will usually be eliminated by tightening packing, replacing gaskets, or repairing the equipment.

Emergency kits (meeting Chlorine Institute requirements) are available that can seal off most leaking areas of chlorine containers (i.e., valves, fusible plugs, or container wall).

If these are on hand they must be used only by personnel thoroughly familiar with their use. The chlorine supplier should be contacted immediately for information, assistance and advice on the disposition of the leaking container. The container should always be repositioned, if possible, so the leak is gas rather than liquid.

Emergency Action Plan

- The best emergency plan includes routine practices that are designed to minimize emergencies. Proper maintenance of all equipment associated with the storage, handling, and use of chlorine in accordance with the manufacturer's instructions is essential.
- All equipment and piping containing chlorine under pressure must be tested periodically for leaks. Since it is not unusual for areas used for chlorine storage and chlorine equipment to be relatively unattended, it is important for the air in these areas to be monitored continuously with chlorine detectors, so that warning of leaks is given as early as possible. As with most emergencies, the earliest detection helps to minimize the damage to equipment and personnel. In addition to warning of leaks when the areas are unattended, chlorine detectors should warn of the presence of minor amounts of chlorine that may not be detected by personnel in the area
- Some chlorine leaks are minor but all require immediate attention.
- In the event of a major release of chlorine, there should be no delay in contacting the agency in the community that is responsible for handling hazardous material releases. Appropriate names and telephone numbers must be prominently posted.
- The person responsible for making any of the calls listed above must be sure to give the agency contacted complete details including facility name, address, telephone number, and the names(s) of personnel to contact for further information. The description of the emergency should include size of container, corrective action already taken, local weather.
- Conditions, injuries, proximity to populated areas, and directions for easiest access to the site.
- It is vital that the emergency plan include use of the "buddy system", i.e., no personnel should be allowed to work alone in an area with a chlorine leak even if the second person.
- It is only standing by. As indicated earlier, all personnel not involved in locating and correcting the leak should leave the area travelling in a crosswind direction to an area that is upwind above the leak. Since it may not be possible for all personnel to be equipped with respiratory equipment, they should be instructed to use a wet cloth or handkerchief over the nose and mouth while leaving the area.
- Emergency Control Planning Checklist for Chlorine Facilities may be of assistance in preparing the emergency plan. A Material Safety Data Sheet for Chlorine, available from the Institute or the supplier, should also be consulted.

- No emergency plan should be implemented until it is reviewed by the chlorine supplier and the agency in the community having responsibility for hazardous material handling and disposal.
- If it is apparent that fire will threaten or is present in a chlorine storage area, it is preferable to remove the containers. If this is not possible, the containers must be protected from the heat of the fire by spraying them with water. Do not spray water on any leaking container, however, since water will react with the chlorine, forming acids that will make the leak worse.

12 FIRE FIGHTING SYSTEM

M/s. Anupam Rasayan India Limited management shall take in to consideration fire prevention measures at the project planning and during plant commissioning stage to avoid any outbreak of fire. But looking to the hazardous nature of process and the chemicals that shall be handled and processed, the chance of outbreak of fire cannot be totally ignored. Hence to tackle such a situation a good well laid fire protection system will be provided in the factory. Details of fire fighting are given below.

- **Fire System: Fire Hydrant fully equipped system in Auto mode.**

270 KL Water storage reservoir.

- 01 nos Jockey Pump 10.8 $M^{3/}$hr& 2 HP 70mters Head
- 01 Nos Electrical Main Pump 75 HP & 171 M^3/hr 70 mtrs head
- 15 Nos of Hydrant post & 02 nos of Jet Monitor.

We have fire hydrant system which is cover all area of plant premises for handling fire & explosion hazard in case of emergency.

- **Storage & hazard control:**

Place of its storage:(Dioxane) (DEG)Solvent Tank Farm.& Drum filling room.
State & operating press. & Temp.: Liquid & Ambient temp & pressure
Type of Hazards possible (fire, explosion toxic release, spill, etc.): Fire,Explosion, Toxic Release.
Control Measures provided: All finish goods drums are kept under shade. Proper ventilation is provided.
All Tanks & Reactors are connected with safety valve & breather valve & PRV for ensuring better & safe working atmosphere.
Proper Earthing& Bonding system has been installed for avoid or control of static charge.
Storage tanks of chemicals provided with labels & capacity. Proper material of construction use.
Fire extinguishers are installed in all area of plant & office building for better safety.
Safety signage's and symbol are displayed all necessary location & safety training on specific subject are given on regular basis.
Standard operating procedure for safe working for all operation & processes are developed.
All tanks are covered with Dyke walls to prevent spillage & leakages outside.

List of Fire Extinguisher with Location , Name & Capacity				
Sr No	**Number**	**Type**	**Capacity**	**Location**
1	ADM/CO2/2/01	CO_2 Fire extinguisher	4.5 KG	ADM block
2	CRP/CO2/4.5/02	CO_2 Fire extinguisher	4.5 KG	Control Room Panel
3	QC/CO2/4.5/03	CO_2 Fire extinguisher	4.5 KG	Quality control
4	QC/DCP/06/04	DCP Fire extinguisher	6 KG	Quality control
5	MCCO/DCP/06/05	DCP Fire extinguisher	6 KG	MCC Room Outside
6	MCC/DCP/06/06	DCP Fire extinguisher	6 KG	MCC Room
7	MCC/CO2/22.5/07	CO_2 Fire extinguisher	22.5 KG	MCC Room
8	MCC/CO2/22.5/08	CO_2 Fire extinguisher	22.5 KG	MCC Room
9	MCC/CO2/4.5/09	CO_2 Fire extinguisher	4.5 KG	MCC Room
10	UT/DCP/06/10	DCP Fire extinguisher	6 KG	Utility chiller area
11	BOO/DCP/06/11	DCP Fire extinguisher	6 KG	Boiler Out side
12	BO/CO2/4.5/12	CO_2 Fire extinguisher	4.5 KG	Boiler Room
13	BO/MF/50/13	Mechanical Foam Fire extinguisher	50 Ltrs	Boiler Room
14	STRO/DCP/06/14	DCP Fire extinguisher	6 KG	Store room out side
15	STR/DCP/09/15	DCP Fire extinguisher	9 KG	Stroe room
16	STE/DCP/06/16	DCP Fire extinguisher	6 KG	Store room engg
17	NRMTF/MF/50/17	Mechanical Foam Fire extinguisher	50 Ltrs	New RM Tank farm
18	PGFE/MF/50/18	Mechanical Foam Fire extinguisher	50 Ltrs	Plant Ground floor East side staircase
19	PGFE/DCP/06/19	DCP Fire extinguisher	6 KG	Plant Ground floor East side staircase
20	PFFE/DCP/06/20	DCP Fire extinguisher	6 KG	Plant FIRST floor East side staircase
21	PSFE/DCP/06/21	DCP Fire extinguisher	6 KG	Plant Second floor East side staircase
22	PTFE/DCP/06/22	DCP Fire extinguisher	6 KG	Plant Third floor East side staircase
23	PFFE/DCP/06/23	DCP Fire extinguisher	6 KG	Plant Forth floor East side staircase
24	PF5FN/DCP/06/24	DCP Fire extinguisher	6 KG	Plant Fifht floor North side staircase
25	PFFN/DCP/06/25	DCP Fire extinguisher	6 KG	Plant Forth floor North side staircase
26	PTFN/DCP/06/26	DCP Fire extinguisher	6 KG	Plant Third floor North side staircase
27	PSFN/DCP/06/27	DCP Fire extinguisher	6 KG	Plant Second floor North side staircase

28	PFFN/DCP/06/28	DCP Fire extinguisher	6 KG	Plant First floor North side staircase
29	PL/GLR/MF/50/29	Mechanical Foam Fire extinguisher	50 Ltrs	Plant First floor GLR Platfrom.
30	PGFN/DCP/06/30	DCP Fire extinguisher	6 KG	Plant Ground floor North side staircase
31	PGFN/MF/50/31	Mechanical Foam Fire extinguisher	50 ltrs	Plant Ground floor North side
32	RMTF/MF/50/32	Mechanical Foam Fire extinguisher	50 ltrs	DEG Raw material Tankfarm
33	RMTF/MF/50/33	Mechanical Foam Fire extinguisher	50 ltrs	DEG Raw material Tankfarm
34	RMTF/DCP/06/34	DCP Fire extinguisher	6 KG	DEG Raw material Tankfarm
35	FGTF/MF/50/35	Mechanical Foam Fire extinguisher	50 ltrs	Dioxane Finished good Tank farm
36	DFR/DCP/09/36	DCP Fire extinguisher	9 KG	Drum filling room
37	DFR/MF/50/37	Mechanical Foam Fire extinguisher	50 ltrs	Drum filling room
38	DFR/DCP/06/38	DCP Fire extinguisher	6 KG	Drum filling room
39	DFR/DCP/06/39	DCP Fire extinguisher	6 KG	Drum filling room
40	TF/MF/50/40	Mechanical Foam Fire extinguisher	50 ltrs	Tanker filling area
4	HWZS/DCP/06/41	DCP Fire extinguisher	6 KG	Hazardous waste storage room
142	PCC/22.5/CO2/42	CO_2 Fire extinguisher	22.5 KG	PCC Room
43	PCC/4.5/CO2/43	CO_2 Fire extinguisher	4.5 KG	PCC Room
44	HTY/22.5/CO2/44	CO_2 Fire extinguisher	22.5 KG	Transformer area High-tension yard

We have following Fire Extinguisher in spare at Store		
1	CO_2 Fire extinguisher 4.5 Kg	02 nos
2	DCP Fire extinguisher 09 Kg	07 nos
3	DCP Fire extinguisher 06 Kg	02 nos
4	Mechanical Foam 50 Ltrs	02 nos

13. DISASTER MANAGEMENT PLAN

13.1 DEFINING THE NATURE OF EMERGENCY

LEVEL OF EMERGENCY CAN BE CLASSIFIED IN THREE CATEGORIES.

LEVEL - 1:

The incident or emergency which shall be confinable, controllable within the plant premises, which under normal circumstances does not affect area outside the said plant battery limit and

Controlling does not involve / require external help. This situation is called emergency stand by and affected unit / plant has to handle emergency.

LEVEL - 2:

When the incident or emergency will not controlled within 10 to 15 minutes or does not come under control within 10 to 15 minutes, incident controller, site main controller reviews the situation and decides if situation is worsening.

a) Can affect other section of the same plant and necessitate shutdown of that sections.

b) And or Can affect other nearby plant / sections and necessitate shut down of that area.

c) And / Or affecting whole of premises and not outside the premises.

Then without delay declare On – Site Emergency and activate Siren as per code and give message to affected area for safe shut down.

LEVEL - 3:

After surveying Off – Site implications of level – 2 emergency if there is a likely hood of chlorine gas cloud formation and spreading of cloud in down wind direction affecting neighboring population of industry and villagers and / or in case of following incident IC and SMC are of the opinion that there will be Off – Site implications.

Raise level – 3 sirens and declare Off – Site emergency and activate as per Off – Site emergency plan.

13.2 OBSERVER

DUTIES OF OBSERVER

Any person noticing a fire, leakage of chemicals or an unusual occurrence will contact the security personnel a main gate and Plant Supervisor by:

1. Giving a telephone message
2. Sending message through a messenger
3. Rush personally

While giving the message, he will:

1. Identity himself
2. State briefly type of emergency
3. Location of Incident / accident
4. Severity of emergency

After giving message, he will return to the scene / area of emergency by taking all personnel protection measures, if possible & awaits instructions from Plant Supervisor (Incident Controller).

13.3 CHIEF EMERGENCY CONTROLLER

He will be Chief Manager in his absence; the Plant Supervisor will be the Chief Controller till any one of the designated Managers arrives at Site and assumes overall charge of the situation. His task will be to co-ordinate all internal and external activities from the Emergency Control Center at Main Security Gate from where all operations will be directed. He shall:

- Immediately on being informed of the emergency and its location, will arrive at the scene & handle the situation.
- Relieve the Incident Controller from responsible of the Main Controller.
- Co-ordinate to avail services from external agencies like fire brigade, hospitals etc, if called for, following the declaration of major emergency. If necessary, major installations in the vicinity may also be informed of the situation.
- Exercise direct operational control of the unaffected section of the plant.
- In consultation with the advisory team, expedite the shutting down of loading / unloading operations of tankers and if necessary, instruct the supervisor / security personnel to evacuate tankers.

- Ensure that all employees are evacuated from the affected area and the casualties, if any, are given necessary medical attention. Instruct P & A Assistant / Security for rushing casualties to hospitals if required.
- Liaise with fire and police officials, pollution control board officials and other statutory bodies and advise them of all possible consequence effects outside the premises.
- Arrange for relief of personnel when emergency will prolonged.
- Issue authorized statement or press release to the news – media.
- Ensure preservation of evidence for enquiries to be conducted by statutory authorities.
- Authorize the sounding of "All Clear" and "Evacuation Siren".
- Arrange for obtaining the head – count of all personnel within the premises and crosschecking with the data from records available for no. of persons within the premises.
- Nominate a person from advisory team, to maintain chronological log of event during the entire period of emergency.

13.4 LIST SAFETY APPLIANCES:

- **INTERNAL SAFETY SURVEY:**

It will be conducted by a task force specially formed to identify various hazards in plant areas. Checking of Personnel Protective Equipment's shall be done for its workability. Checking of various Safety installation/facilities available at site shall be done for its workability.

- **PERSONAL PROTECTIVE EQUIPMENT:**

Adequate numbers of Personal Protective Equipments will be available and spare stocks are also kept. Workers shall be trained to use above PPE'S.

Helmets	- Will be Issued to all
Safety shoes	- Will be Issued to all
Safety goggles	- Will be Issued to all
Face shield	- Nos.
Hand gloves	- pair
Apron, PVC suit	- Nos.
Safety belts	- Nos.
Ear plug/ear muff	- Nos.

Required emergency safety appliances and PPEs shall be provided in emergency boxes in plants and ECC as per list.

14 STRUCTURE OF EMERGENCY MANAGEMENT SYSTEM

M/s. Anupam Rasayan India Ltd. (Unit-IV) shall develop an emergency management team. The management structure includes the following personnel's;

- Chief Emergency Controller
- Incident Controllers and Deputy Incident Controllers
- Site Main Controllers
- Key Personnel's
- Essential Workers
- Assembly points
- Emergency control center
- Fire control arrangements
- Medical arrangements
- Other arrangements

14.1 CHIEF EMERGENCY CONTROLLER

He will be Chief Manager in his absence, the Plant Supervisor will be the Chief Controller till any one of the designated Manager arrives at Site and assumes overall charge of the situation. His task will be to co-ordinate all internal and external activities from the Emergency Control Centre at Main Security Gate from where all operations will be directed. He shall:

1. Immediately on being informed of the emergency and its location, will arrive at the scene & handle the situation.
2. Relieve the Incident Controller from responsible of the Main Controller.
3. Co-ordinate to avail services from external agencies like fire brigade, hospitals etc, if called for, following the declaration of major emergency. If necessary, major installations in the vicinity may also be informed of the situation.
4. Exercise direct operational control of the unaffected section of the plant.
5. In consultation with the advisory team, expedite the shutting down of loading / unloading operations of tankers and if necessary, instruct the supervisor / security personnel to evacuate tankers.

6. Ensure that all employees are evacuated from the affected area and the casualties, if any, are given necessary medical attention. Instruct P & A Assistant / Security for rushing casualties to hospitals if required.
7. Liaise with fire and police officials, pollution control board officials and other statutory bodies and advise them of all possible consequence effects outside the premises.
8. Arrange for relief of personnel when emergency is prolonged.
9. Issue authorized statement or press release to the news – media.
10. Ensure preservation of evidence for enquiries to be conducted by statutory authorities.
11. Authorize the sounding of "All Clear" and "Evacuation Siren".
12. Arrange for obtaining the head – count of all personnel within the premises and cross-checking with the data from records available for no. of persons within the premises.
13. Nominate a person from advisory team, to maintain chronological log of event during the entire period of emergency.

14.2INCIDENT CONTROLLER AND DEPUTY INCIDENT CONTROLLER

His primary duties are to take charge at the scene of the incident. In the initial stage he may be required to take decisions involving the operation of the other plants or to stop or continue any process and to take technical decisions to control the incident. The deputy incident controller should take the charge of incident controller, if he is not available due to any reason. As our factory is running 24 hrs, so each plants shift in charge are being nominated as I.C (after 'G' Shift) and they will be always available in the shift and can take charge till the arrival of IC.

Responsibilities/Duties of Incident Controller and Deputy Incident Controller:

- He shall take charge at the scene of incident.
- He may be required to take decisions whether to stop or continue any Process and take a control the incident or to isolate affected area of the plant and simultaneously inform / consult senior officers as per requirement.
- He shall immediately assess the gravity of risk and alert panel and field operators to start controlling their respective section.

- After assessing the level of emergency likely to exist, he shall ad emergency. As per the assessment of risk, if necessary inform concerned Senior Officer to declare major emergency and active on-site/off site emergency plan accordingly. As Per the situation ensure that Site Main Controller (SMC) will be informed.
- He will work under the direction of the SMC, but till his arrival he may have to execute following responsibilities.
- Ensure that all the Key Personnel are called.
- Direct for evacuation of plant and areas likely to be affected by the emergency.
- He shall communicate to the SMC the type of outside help needed.
- He shall direct all emergency operations within the affected area with the following priorities.
- Personnel safety, including of surrounding community.
- **Minimum damage to Plant, Property and Environment.**
- Appropriate actions to minimize loss of Production and Material.
- Give information to the head of fire fighting and rescue team and other emergency services.
- Depending on the incident, instruct partial or total shut down, isolations, depressurization, Nitrogen purging, fire fighting, rescue operations.
- Instruct upstream/downstream units to take emergency shutdown /cutting off supply and other appropriate actions and emergency evacuation help etc.
- Direct for search of casualties.
- Evacuate non-essential workers/visitors/contractors to safe assembly points.
- Brief site main controller and keep him informed about the developments.
- Pressure evidences. This will be necessary for investigation for cause and concluding preventive measures.
- Send runners, if telephones are out of order.

14.3 SITE MAIN CONTROLLER

He will have an overall responsibility for directing operations & calling outside help from Emergency Control Centers. He is required to take decisions after consultation with the Senior Manager available at site.

The Shift Engineer of non-affected Plant will act as SMC till arrival of the designated SMC at Emergency Control Centre (ECC). Until the arrival of SMC, he may have to execute following responsibilities.

- As soon as he received the information or comes to know about the incident, he shall proceed to Emergency Control Room (Control Room) and shall take charge of the incident. If Control Room gets affected due to unfavorable wind direction, Fire Control Room shall be used as alternate Emergency Control Room.
- He has overall responsibility for directing emergency action, operation and calling outside help.
- He shall ensure that all the Key Personnel are called.
- He shall assess the gravity of situation with the help of Incident Controller (IC), Plant Manager and Key Personnel and after quickly assess the situation, shall find out the of emergency from Incident Controller (l C), and declare the emergency**.**
- Level-l: Emergency - may be handled within the plant premises.
- Level-2: Emergency - On Site Emergency plant shag be activated.
- Level-3: Emergency - Action to be taken to operate Off-Site Emergency Plan.
- He shed direct all emergency operations within the affected area with the following priorities.
- Personnel safety, including of surrounding community.
- Minimum damage to Plant, Property and Environment.
- Appropriate actions to minimize loss of Production and Material.
- He shall direct for evacuation of plant and areas likely to be affected by the emergency.
- He shall continuously review and assess possible developments to determine most probable course of events and actions.
- He shall assess the situation and ensure that whatever resources needed is made available and utilized in a co-ordinate manner.
- He shall direct the safe shut down of plants in construction with incident controller and Key Personnel, if necessary.
- He shall check that all non-essential workers, visitors, contractors are evacuated to safe assembly point sand head count is completed.
- He shall give instructions to the Incident controllers, Fire fighting and Rescue teams.

- He shall, if necessary arrange for evacuation of neighboring population.
- He shall ensure that search for casualties, within the affected area has been carried out and arrange for hospitalization of victims and additional medical help, if required.
- He shall ensure that liaison will be made with outside agencies such as Police Services, Fire Services, Expert on Health and Safety, Meteorological Office, District Emergency Authorities, Collector and Senior Inspector of Factories. Provide advice on possible effects to areas outside the factory.
- He shall arrange for up to date records of emergencies.
- He shall advice not to re-start the plants unless it is declared safe to start by competent authorities.

14.4 KEY PERSONNELS

Key Personnel are required to provide and to implement the decisions made by the SMC in the light of information received on the developing situation at the time of emergency. As necessary, they will decide the actions needed to shutdown plants, evacuate personnel, carryout emergency engineering work, arrange for supplies of equipments, utilities, carryout environment monitoring, provide catering facilities, liaise with police, fire brigade and other local authorities, relative of casualties, hospital, press & neighboring industries. Action at assembly points, outside shelters and mutual aid center under the direction of the SMC. All the key personnel and other called in so to assist shall report to the ECC. They shall be available at any time on duty or on call or on oil duty or holiday.

14.5 ESSENTIAL WORKERS

A task force of essential trained workers (expert's team) is available to get the work done by the Incident Controller and the Site Main Controller. Such work will include:

1) Fire fighting and spill control till a Fire Brigade takes the charge.
2) To help the Fire Brigade and mutual aid teams, if it is so required.
3) Shutting down plant and making it safe.
4) Emergency engineering work e.g. isolating equipment, material process, providing temporary by-pass lines, safe transfer of materials, urgent repairing or replacement, electrical work, etc.
5) Provision of emergency power, water, lighting, instruments, equipments, materials, etc.

6) Movement of equipment, special vehicle and transport to or from the scene of the accident.
7) Search, evacuation, rescue and welfare.
8) The injured is given First Aid.
9) Moving tankers or other vehicles from area of risk.
10) Carrying out atmospheric test and pollution control.
11) Manning of assembly points to record the arrival of evacuated personnel. Manning for outside shelters and welfare of evacuated persons there.
12) Assistance at causalities reception areas to record details of causalities.
13) Assistance at communication centers to handle out going and incoming calls and to act as messengers if necessary.
14) Manning of works entrances in liaison with the police to direct emergency vehicles entering the work, to control traffic leaving the works and to turn away or make alternative safe arrangements for visitors, contractors and other traffic arriving at the works.
15) Informing surrounding factories and the public as well as directed by the Site Main Controller.
16) Any special help required.

14.6 ASSEMABLY POINT

In affected& vulnerable plants, all nonessential workers (who are not assigned any emergency duty) are evacuating the area & report to a specified Assembly Points. Each assembly Point will be clearly marked by a Conspicuous notices & provided with an identification numbers e.g. Assembly Point No. 1, 2 and so on. Assembly Points are located at a safe place, well away from area of risk and least affected by the down wind direction. To ensure that workers do not have to approach the affected area to reach the Assembly Point proper location and numbers have been marked at Assembly Points. Each Assembly Point in manned by a nominated person to record the names and dept. Further telephone to communicated SMC has been provided at each assembly Points. At each Assembly Point duties of Assembly Point In-charge has been also displayed in brief Before reaching an Assembly Point or subsequently, if it is required to pass through an affected area or due to presence of toxic substances. Suitable PPE's including respirators, helmet etc., are issued & made available with workers.

14.7 EMERGENCY CONTROL CENTER

The Emergency Control Center (ECC) is the place or room from where the operations to handle the emergency are directed and coordinated. Main Control Room will be earmarked/identified as the Emergency Control Room. Fire Control Room shall be earmarked/identified as the alternative Emergency Control Room to be operated in case of unfavorable wind direction. Adequate Telecommunication System will be available in the Emergency Control Room i.e. Hot Lines, Intercom & External Phones.

The ECC center shall be equipped with the following facilities.

1. Internal and external telephone including STD facility
2. Telephone directory
3. Telephone nos. of mutual aid centers
4. Factory layout plan
5. Map of the area
6. Employee blood group and their address
7. Messengers / Runners for sending messages
8. Adequate numbers of PPE'S

14.8 FIRE CONTROL ARRANGEMENTS

14.8.1 FIRE FIGHTING, GAS LEAK CONTROL AND RESCUE OPERATION

A) Role of Manager (Fire and Safety) / Shift In-Charge (Fire & Safety)

1. Incident Controller will be the only person to direct the fire fighting and Emergency operation.
2. Keep the constant touch with the SMC / In charge - EHS.
3. Direct the crew members to the scene of emergency and arrange replenishment of Manpower / equipment / extinguishing media etc.

B) Role of EHS Representative:

1) On being notified about the location of fire/ gas leakage immediately proceed to the help.
2. Decide his line of action in consultation with Incident controller and take appropriate measures to handle the emergency.
3. Assessing the severity of the incident immediately report to emergency controller about the gravity of the situation.
4. He will assess the extra requirement required if any from the neighboring industry.

C) Fire crew members

1. On hearing fire alarm, emergency siren they shall immediately report to control room and proceed to the scene of emergency and work under the direction of IC/ Dy IC.
2. The personal availability at the scene of incident to be made optimize.

14.9 MEDICAL SERVICES

The roles of Medical officers are as follows;

(a) He will contact immediately to the SMC/IC.

(b) He will render necessary treatment, at Occupational Health Center.

(c) He will arrange for Hospitalization and Treatment at outside hospitals, if required.

(d) He will mobilize in getting the services of External medical agencies, other Para –medical services etc. and transportation services etc.

(e) He will arrange for extra medical assistance/antidotes, from out, if required.

(f) He will arrange for first-aid trained volunteers for necessary help.

(g) He will rise with the Government Health Authorities for treatment of the affected persons nearby.

14.10 OTHER ARRANGEMENTS

Other arrangements include external transport, cranes, generator sets to supply emergency power, environment monitoring equipment, rescue items etc. when available resources do not meet the requirement.

STANDARD OPERATING PROCEDURE (EMERGENCY)

- As soon as emergency alarm is heard, all essential workers shall report to IC or SMC.
- They shall carefully listen to the instructions given by IC or SMC
- According to the type of emergency/accident, they shall get equipped with PPE/Fire fighting equipment and devices.
- The runner among the workers shall inform SMC/IC and key personnel if they are not at site.
- The messenger amongst the workers shall deliver messages to nearby units as per the instructions of SMC/IC.

- The in-charge of medical arrangements shall prepare first-aid and other required facilities for the injured.
- The other essential workers shall try to control the emergency as per the instructions given to IC.
- IC would keep SMC informed about the status of control measures being taken at the site and ask for other requirements e.g. Mutual aid, equipment etc., if he find necessary.
- SMC would co-ordinate with outside agencies regarding control measures being taken, need for external help, evacuation, medical treatment etc.

14.11COMMMUNICATION SYSTEM

After the assessment of risk & their possible environmental impact and after making an organization for the preparedness to control the emergency, the next most essential step is to make us ready for Communication at the time of emergency. Communication System is a Crucial Factor while handling emergency.

Company will have quick & effective Communication System through which, any situation, which can lead to emergency, can be informed or known to.

i. All working inside the plant.
ii. Key Personnel outside during normal working hours & during off-duty hours.
iii. Outside emergency services, Statutory and Local Authorities and
iv. Neighboring facilities and public leaving in vicinity.

Each and every section, Plant & Department of the Factory shall be connected by internal telephones. External Phone at Office and Residence and Mobile shall be also available with Key Personnel and top executive of the factory. Hot lines shall be provided with mutual aid Partner through the Emergency Control Center. The Communication System begins with raising the alarm declaring the emergency, Telephone messages and Procedure to communicate the emergency to other persons & General Public.

14.11.1 RAISING THE ALARM

As soon as incident takes place inside the factory and is noticed by someone, the first step is to raise the nearest manual emergency bell to alert the nearby people. Next, he/she informs the security persons to raise the emergency siren located at the factory gate. The security personnel sound the siren, raising and lowering the sound three times in a 10 second “ON”, 5 second “OFF” sequence. All

the security employees shall be trained for operating the siren to announcing the emergency. In case of power failure, manual bell shall be also provided.

The alarm sound informs the I.C and the S.M.C that an emergency has been created and emergency organization is to be activated. The I.C. rushes to the site and takes charge of the scene.

14.11.2DECLARING THE MAJOR EMERGENCY

Major emergency has to be declared after sufficient and through check because the declaration of major emergency puts many agencies on action and it may disturb the running system, which may be Costly at, time or its Consequence may be Serious. Therefore major emergency must not be decided on whims or immature judgment or without proper thought. Looking to all the above, we will have taken care to nominate the persons who can declare the emergency; we will have selected them on the basis of their knowledge & experience. These persons will be technically qualified and experienced. They shall advice the Incident Controller or Site Main Controller regarding the type of emergency. On being convinced, the Site Main Controller or Incident Controller shall declare an ON-SITE emergency. The decision about major emergency shall be taken as early as possible and without wasting time so that control action can be started immediately.

14.11.3TELEPHONE MESSAGES

After hearing the emergency alarm and during emergency or even while just receiving the emergency message on phone, Telephone operator should be precise, sharp, attentive and quick in receiving and noting the message and subsequently effective in further Communication A form to record emergency telephone calls shall be available with telephone operator or Person available in Emergency Control Center, who has to record such calls during emergency. Telephonic messages shall be given out by the telephone operator to Site main Controller and key personnel as per the instructions of the Incident Controller. Telephonic messages shall also be given to authorities and external agencies to describe the type of emergency. All details of emergency shall be collected/delivered according to this format shall available with the telephone operator.

14.11.4 COMMUNICATION OF EMERGENCY & STATUTORY INFORMATION

14.11.4.1 COMMUNICATION OF EMERGENCY

An effective system to communicate emergency shall be available.

- Inside the factory i.e. workers including key personnel and essential workers, on duty & inside during normal working hours.
- To key personnel and essential workers not on duty and outside during normal working hours.
- To the outside emergency services and the Government authorities.
- To the neighboring factory & the General Public in the vicinity.

a) Information to Workers

All personnel inside the factory shall be informed by the sounding of the siren or in case of electricity by ringing the bell.

b) To key personnel outside during normal working hours

The key personnel outside the factory premises shall be informed as per the need by external telephones or runners.

c) To the outside Emergency Services and the Authorities

Once the emergency is declared, it is essential that the outside emergency services should be informed in the shortest possible time. Responsibilities shall be fixed as per the Incident/Emergency Command structure/plan to contact outside agencies for help and to communicate to the all the Government and other Authorities such as Fire Brigade, Police, District Emergency Authorities, Factory Inspectorate & Hospital etc.In case of major emergency, outside agencies like mutual aid, hospitals, policies, Factory Inspector, Collector, Fire-brigade etc. shall be informed by telephone or by sending special messenger from emergency control center.

d) To neighboring factories and the General Public

A major emergency will affect areas outside the works and it is essential that neighboring factory and General Public, should be informed to enable them to take prompt action to protect their own workers and to take whatever measures may be possible to prevent further escalation of the

emergency due to effects on their own installations, at the same time, they may be able to provide assistance as part of a prearranged mutual aid plan. Further responsibilities shall be fixed to inform the neighboring factories and the General Public leaving in the vicinity.The neighboring units shall be informed about an emergency through external telephones or runners. The general public shall be informed about an emergency using loudspeaker on scooter or rickshaw or car. Help from police shall be sought if required.

14.11.4.2 STATUTORY INFORMATION

a) Information to Workers

Set of Statutory information regarding types of hazards and their prevention and control as directed in the Factories Act shall be prepared by the unit. This information shall be printed in the local language and given in the form of booklet to all workers including contract workers.

b) To the outside emergency services and authorities

Statutory information in the form of booklet shall be given to outside emergency services and authorities.

c)To neighboring firms and the general public

Statutory information in the form of booklet will be given toneighboring units and the general public of the villages in the vicinity of the unit.

14.12 ACTION ON SITE

The activities related to emergency time activities shall be divided into two parts. These are

- Pre-emergency activities
- Post-emergency Activities

14.12.1 PRE-EMERGENCY ACTIVITIES

14.12.1.1 INTERNAL SAFETY SURVEY

A safety committee shall be constituted as per Factories Act. The nominated members of the committee shall be assigned the responsibility to conduct safety survey once in a month before safety meeting. The internal safety survey includes –

- Identify various hazards in the factory
- Check whether protective equipments are in sound working condition

- Check various safety installations located at various plants for proper working
- Check sprinklers, showers, etc. in all plants
- Suggest extra modifications/ requirements to make systems more reliable
- Check presence of toxic gases by the help of dragger tube

Frequency of Internal Safety Survey: Once in a month

14.12.1.2 THIRD PARTY SURVEY

A safety survey shall be carried out once in a year by an external agency. It shall include –

- Inspection of building, structures for strength and stability
- Identify and study the hazards inside individual plants and within the factorypremises.
- Check safety system for its adequacy.
- Suggest modifications or additions in the operating practices and safety system, ifnecessary.

Frequency of Third Party Safety Survey: Once in a year

14.12.1.3PRESSURE VESSEL TESTING/ EXAMINATION

- To prepare list of pressure vessels in the plant with details of operating conditionsand manufacturing details.
- To carry out preventive maintenance of valves & fittings on all pressure vessels(valves, pipelines, pressure gauge, temperature recorders and emergency vent lines)
- To arrange for testing and examination of all pressure vessels as per the rules ofFactories Act by govt. certified competent person on due date.
- To maintain record of testing and certificates issued by competent person andmake them available to Factory Inspector at the time of inspection.

Frequency of Pressure Vessel Testing / Examination: Twice in a year

14.12.1.4 NON-DESTRUCTIVE TESTING (NDT)

- To prepare list of equipment and pipelines in the plant which require NDT as perthe rules of Factories Act.
- To arrange for Non-Destructive Testing (NDT) as per the rules under FactoriesAct by govt. certified competent person on due dates.

- To maintain record of testing and certificates issued by competent person andmake them available to Factory Inspector at the time of inspection.

Frequency of Non-Destructive Testing : Once in a year

14.12.1.5 SAFETY RELIEF VALVES TESTING

- To prepare list of Safety Relief Valves installed on various equipment and pipelines in the unit alongwith detailed specifications.
- To prepare schedule for testing and calibration as per the rules under Factories Act by govt. certified agencies on due dates.
- To maintain record of testing and certificates and mark dates of testing and calibration on the valves.
- To carry out repairs/replacement as suggesting by the testing authority.

Frequency : Twice in a year

14.12.1.6 FIRE SYSTEM TESTING

- To prepare list of various fire-fighting equipment (Fire Extinguishers, etc.)installed at various locations in the unit along with detailed specifications.
- To prepare schedule for testing of all these equipment and check operability
- To maintain record of testing and mark dates of testing on the equipment.
- To carry out repairs/replacement of defective equipment

Frequency: Once in a month

14.12.1.7 MUTUAL AID SCHEME

- To prepare Mutual Aid Scheme and enter into agreement with the neighboringunits for getting or extending help during emergency
- To appoint coordinator for follow-up under mutual Aid Scheme
- To review the scheme once in a year with coordinators of neighboring unitsw.r.t. scope of help, type of aid, contact persons, etc.
- To include the scheme in mock drills

14.12.1.8 MOCK-DRILLS

- To conduct minor mock drills to train employees about their role / duties duringemergency
- To refresh training to the employees for fire fighting, spill control, use of personal protective equipments etc.
- To check whether various members of emergency control committee remember their role / duties properly and to find out the faults and points of improvement in their performance.
- To check whether the various equipment for emergency control are operatingsatisfactorily and find and rectify the draw-backs if any.
- To conduct major mock-drills with permission from the authorities

Mock drills shall be regularly conducted in our unit by our Emergency Control Organization and the findings are compiled to analyze whether employees are familiarized with the emergency control procedures and what sort of training is required to be given.

14.12.1.9 SAFETY TRAINING

To organize regular training for the employees for handling of safety equipment, use of personal protective equipment, first-aid, etc. by internal/external faculty, as well as by sending persons outside to attend safety programs etc. The topics covered in safety training will be –

- Training on fire fighting
- Training on spill control
- Training on toxic release control
- Training on good housekeeping
- Training on use of PPE

The records of the training programs shall be maintained by the Safety Committee. New topics will be included in the safety training programs year by year to upgrade safety knowledge among the workers.

Frequency: Once in a year

14.12.1.10 PERSONAL PROTECTIVE EQUIPMENT

- To procure adequate number of personal protective equipment (aprons, handgloves, safety goggles, helmets, nose masks, safety belts, gas cartridges, self-breathing apparatus, safety shoes etc.) suitable for plant operations and maintain records of use.
- To have proper system for issuing the PPE and disposal of used PPE
- To train the workers about proper use of PPE.
- To check the fresh air blowers provided at confined spaces for fresh air to workers.

14.12.1.11 COMMUNICATION

- To maintain internal/external telephones in working order
- To check alarms / siren / loudspeakers for workability
- To provide manual emergency bells at various location for use during power failure
- To periodically check wind cock for wind direction
- To check lightning arrestors installed at different locations for physical condition and proper earthling connection.

14.12.1.12 EMERGENCY LIGHTS

- To keep sufficient number of emergency torch/ batteries in ECC as well as at theproduction site
- To maintain the three DG sets available in the factory as stand-by for power failure. The D.G. sets are set to start functioning within two minutes of failure of electricity.

14.12.1.13 EMERGENCY CONTROL ROOM

It is necessary to maintain the Emergency Control Room and keep it equipped with all necessary items, documents, telecommunication systems, PPE etc. required in case of an emergency.

14.12.1.14 ASSEMBLY POINTS

- To fix assembly points in the factory for non-essential workers
- To fix assembly points for plant emergency staff and coordinators
- To maintain record of no. of workers gathered at the assembly points at the timeof emergency. The Safety Committee shall nominate a person for this duty.

14.12.1.15 LIAISON WITH STATE AUTHORITIES

- To liaison with civil authorities, local hospitals, Fire-Brigade, Collector, factories Inspector, Police, etc regarding emergency activities and need for external aid.
- To keep the details regarding name, address & telephone numbers of various govt. authorities and neighboring units available and update the details from time to time.
- To inform about Mock-drill in advance and if required conduct mock-drill in presence of any of these authorities.
- To submit report of Mock-drill conducted and the out comings with photograph to Factories Inspector.

14.12.1.16 HOSPITAL FACILITIES

- To equip Occupational Health Centre with First-Aid and medicines
- To keep Health records (esp. blood-group records) of all employees
- To liaison with hospitals in the area of the unit
- To keep list of blood donors ready for reference
- To update arrangements with neighboring units for emergency first aid.

14.12.1.17 OUTSIDE SHELTER

- To reserve space in nearby schools/hospitals/buildings for temporary shelter during emergency
- To arrange for clothing, food, medicine in temporary shelter

14.12.1.18 STATUTORY INFORMATION

Statutory Information about chemicals handled in the unit, manufacturing process, the hazards in the unit, methods of prevention and control, first aid measures etc. shall be given to

- Workers
- Public and Neighboring units
- Government authorities & outside emergency services

14.12.1.19 PROTECTIVE DEVICES & ENGINEERING MAINTENANCE

- Installation of safety valve and pressure gauges on vessels used for high pressure operations.
- Installation of temperature indicators on reactors, temperature switch or alarm at critical reactors
- Maintenance of cooling water systems and pumps. To keep standby pump at cooling tower.
- Installation of overhead water tank for emergency. To keep it filled and regular cleaning of the same
- Periodic cleaning of heat transfer surfaces (jacket, reactors, shell& tube heat exchangers, boilers)
- To keep minimum inventory of hazardous materials with records
- To maintain good housekeeping and ensure safety compliance

14.12.1.20 LIST OF SUPPLIERS OF SAFETY EQUIPMENT

- To prepare and preserve list of suppliers of safety equipment e.g. first aid box, medicines, fire extinguishers, PPE, communication, self breathing apparatus, chlorine kit, etc.
- To check all supplies every three months
- To update the list and keep it ready-to-refer location in the plant as well as at ECC

14.12.1.21 FIRE PREVENTION PLAN

- List of major work-place fire hazards
- Potential ignition sources

  Sparks from electrical fitting / motors

  Sparks from welding operations

  Ignition system of boiler house

  Sparks from static electricity
- Fire prevention & control measures
- Use of flameproof electrical fittings and electric motors wherever necessary
- No welding shall be done anywhere in the plant without prior permission from safety officer and necessary precautions from in charge of the area.
- Ignition system of boiler should be provided with guard

- All vessels and pipeline should be properly earthed to prevent static electricity
- The vent lines of all vessels and tanks holding flammable materials should beprovided with flame arrestors
- Fire extinguishers shall be provided at all critical locations in the unit

14.13POST EMERGENCY ACTIVITIES

These activities are to be carried out after an emergency is over so as to establish the cause of the emergency and decide the measures to be taken to prevent its re-occurrence. These activities are –

1. Collection of records of accident, injury, damage to property, buildings, equipment, material and loss of production
2. Conducting enquiries and concluding preventive measures
3. Making insurance claim for the materialistic loss / damage
4. Implementation of enquiry report's recommendations
5. Rehabilitation of affected persons within and outside the plant
6. Restarting the plant and normalizing the operations.

14.14 EMERGENCY TIME ACTIVITIES

The probable emergency situation that can arise in the unit and the corresponding control actions are describes below.

14.14.1 FLAMMABLE RELEASES

Source / Incident – Fire involving spilled combustible material near or in flammable storage areas

Control action –

1. Any one who notices fire shall sound emergency alarm.
2. SMC/IC who is at site, shall immediately rush to the scene and assess the situation. For fire due to spillage of combustible material, he activates the on-site plan as -
    - He cuts off electric supply to that area and evacuates all the persons to safe assembly points.
    - He calls in DIC (if DIC is not present there) and asks essential workers to fight fire with dry chemical / CO_2 fire extinguisher or sand.
    - He inform fire brigade telling them in briefly about kind of fire and type of extinguishers required

- He informs mutual aid teams and asks for necessary help.
- He arranges first-aid / hospitalization for the affected persons.
- Fire officer on reaching the site, takes charge of the fire-fighting operations
- Mutual aid teams shall be asked for help in the form of first-aid, transport etc.
- If fire is growing, fire officer informs IC who alerts neighboring units and through SMC gets more fire-fighting help.
- Fire fighting shall be continued till fire is fully overcome
- After extinguishing fire, fire officer cools the entire area with water spray and checks that no re-ignition shall be likely. After that, he declares the area safe.
- IC tells essential workers to sound all clear
- The incident shall be recorded
- SMC arranges to inform families / relatives of injured / dead.
- SMC issues authorized statement to press / media.
- SMC informs Factories Inspector about the incident and related information

14.14.2 TOXIC RELEASES

Source / Incident – Pressure release due to failure of

- Stuffing box gland packing
- Pressure release valve
- Vessel / pipeline failure

Control action –

1. Any one who notices the release shall sound emergency alarm.
2. SMC/IC who is at site, shall immediately rush to the scene and assess the situation. For toxic release from a reactor, he activates the on-site plan as -
   - He evacuates all the persons to safe assembly point.
   - He calls in DIC (if DIC is not present there) and asks essential workers to wear self-breathing apparatus and if the reaction is exothermic, start cooling water flow in the reactor jacket and cool the reactor as soon as possible.
   - The essential workers stop all the charging pumps of that reactor and the nearby reactors.
   - He informs mutual aid teams and asks for necessary help.

- He arranges first-aid / hospitalization for the affected persons.
- Mutual aid teams shall be asked for help in the form of first-aid, transport etc.
- When the leak stops and the air shall clear of toxic release, IC tells essential workers to sound all clear.
- The vessel / rupture disc/gland packing will be attended by maintenance department.
- The incident shall be recorded
- SMC arranges to inform families / relatives of injured / dead.
- SMC issues authorized statement to press / media.
- SMC informs Factories Inspector about the incident and related information

14.14.3 CHEMICAL SPILL

Most of the storage tanks shall be located in Storage Tank Yards. Dyke walls of sufficient size will be connected around the tank yard. Neutralizing material shall be kept nearby. For dilution, water connection will be provided on all sides of tank farms. Sand buckets shall be provided for covering spillage of flammable / corrosive materials.

14.14.4 EVACUATION & TRANSPORTATION

All non-essential workers shall be evacuated from incident area and adjacent areas to safe assembly points. Assembly points shallbe clearly marked and assembly point in-charge will also bedesignated. The assembly point in-charge will be a well-trained supervisor who shall keep record of persons arriving at the assembly point and direct them for proper gathering. He shall also inform the ECC about the persons gathered at the assembly point. Those in need of medical treatment shall be transported to first-aid center / hospital as the case may be. In case of major emergency all non-essential workers shall be transported to temporary shelter.

14.14.5 SAFE CLOSE-DOWN

As per the instructions from IC or SMC, some parts or full of the plant shall be closed down by the essential workers. The procedure for safe shut-down and start-up will be given in safety manual given to all workers.

14.14.6 USE OF MUTUAL AID

Mutual aid from neighboring units shall be called up as and when required. The aid shall be taken under the supervision of SMC.

14.14.7HELP OF EXTERNAL AUTHORIES

Outside authorities such as Police, District Emergency Authority (DEA), Factory Inspector, Disaster Management Centre, GIDC officer, Industries Association, Regional Pollution Control Board, nearby hospitals etc. shall be informed of the on-site and off-site emergency plans and called in as per need.

14.14.8 MEDICAL TREATMENT

Injured workers shall be located and given prompt first-aid by essential workers and key personnel. Those requiring medical treatment shall be taken to the hospital / outside medical center.

14.14.9 ACCOUNTING FOR PERSONNEL

Through daily muster rolls and with the help of shift-in-charge the head count shall be undertaken to find out whether persons are missing and if so immediate search shall be carried out to locate them. The list shall include company employees, contract workers as well as visitors. Help from local authority or fire-brigade shall be taken if required. This list shall be kept with time keeper / security officer at any time and shall be used to account for personnel. Injured shall be taken to hospitals and their families/relatives shall be informed Casualties would be identified, their families and local authority shall be informed.

14.14.10 ACCESS TO RECORDS

In order to inform families/relatives of injured/dead, a up-to-date list of names and addresses of all the workers is maintained in addition to the muster roll where shift-wise attendance is marked. Such list includes health records. This list will be available at the ECC and one such copy shall be available at our head office.

14.14.11 PUBLIC RELATIONS

Our General Manager shall be the only nominated person to issue administrative statement about the accident or emergency to news/media. No other person shall divulge any information to any news / media person.

14.15 REHABILITATION

In case of Toxic release or chemical spillage, Senior Fire Brigade Officer would ensure that the incident area shall be safe and cleaned up of all mess. Then only, he would allow people to re-enter the location.

In case of fire, the Senior Fire-Brigade Officer shall ensure that the area is cooled down and there are no chances of re-ignition. IC shall arrange for clean-up of the area and then only people shall be allowed to re-enter the area for work.

Even when all clear has been given, great care shall be taken when re-entering affected areas and no work in connection with the salvage, collection of evidence or start up shall be taken up until a thorough examination of the area has been carried out. The statutory powers of the Factory Inspector shall be kept in mind before any evidence is disturbed. Particular care shall be taken to avoid the introduction of possible sources of ignition, such as diesel engines, hand or power operated tools, flame cutting equipment, etc. until it has been established that no flammable materials are present where they could be ignited.

15.0OFF – SITE EMERGENCY PLAN

15.1 NEED OF THE OFF – SITE EMERGENCY PLAN

An off-site emergency plan is prepared to deal with those incidents which have the potential to harm persons or the environment outside the boundary of the factory premises. A major accident, major emergency and disaster may affect areas outside the plant. An explosion can scatter debris over wide areas and its effects of blasts can cover considerable distances. Wind can spread burning fumes of toxic gases. Thus the events like these described above can affect outside areas and combating them needs an Off-site Emergency plan.

Envisaging such a rare incident, an off-site emergency plan should be drawn up for the following purpose.

1. To provide basic information about the risk and environmental impact assessment related to the unit to local / district authorities, police, fire-brigade, surrounding units, and the general public. To appraise them of consequences and the protection / prevention measures and control actions and to seek their help to communicate with public in case of a major emergency. The information from all industries shall enable district authorities to educate public about what could go wrong, and to train them of measures to be taken as an individual.
2. To enable district authorities to prepare the off-site emergency plan (contingency) for the district or particular area and to organize rehearsals and initiate actions learnt from these incidents.

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

15.2 STRUCTURE OF THE OFF-SITE EMERGENCY PLAN

IC → SMC Essential Workers (Implementing Action plan, Informing nearby Public)	District Authorities (Collector, Factory Inspector, Police) Information, Evacuation	Mutual Aid teams, outside services, voluntary organizations (Fire-fighting, Gas leak control, First-aid, Shelter, Hospitalization, Transportation)

15.3 ROLE OF FACTORY MANAGEMENT

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

15.4 ROLE OF EMERGENCY CO-ORDINATION OFFICER (ECO)

The various emergency services will be co-ordinated by the Emergency Co-ordination officer (ECO), who will likely to be a Collector. The ECO will liaise closely with the Site Main Controller. The Emergency Control Centre of the factory can be utilized by the ECO to keep liaison with the Site Main Controller.

15.5 ROLE OF THE FIRE AUTHORITIES

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

- The senior fire brigade officer may also have similar responsibility for other events such as explosion and toxic releases. Fire authority having major hazard units in the area shall-

Familiarize themselves with the location and site of all stages of flammable materials, water and foam supply points, firefighting equipment.

- Act as observer of an on-site exercise involving only site personnel

15.6 ROLE OF THE HEALTH AUTHORITIES

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

15.7 ROLE OFTELEPHONE DEPARTMENT

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

15.8 ROLE OF POLICE AND EVACUATION AUTHORITIES

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

For evacuation, the following criteria are useful:

a) In case of major fire, only houses close to fire and in the direction of smoke need evacuation

b) If fire is escalating and in turn threatening a store of hazardous material, it is necessary to evacuate people nearby if time is available; otherwise they should be informed to keep themselves indoor and shield from the fire.

c) For release of toxic gases, limited evacuation may be appropriate in downwind direction with windows closed and provides good protection. Toxic gases which are hazardous down to much lower concentration cover a long distance. This factor must be considered while deciding upon the need and extent of evacuation.

15.9 ROLE OF THE MUTUAL-AID AGENCIES

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

16. Do's & Don't of preventive maintenance, strengthening of HSE, manufacturing utility staff for safety related measures

DO's and DON'Ts for Safer Operation

Do's:

- Use lubricating oil carefully to avoid spillage on ground.
- Use lubricating oil as per requirement.
- Use minimum amount of water wherever it is required as per plant guidelines.
- Waste disposal system for all plants should be separate.
- Use cleaning equipment carefully. (i.e. cotton waste, oil & chemicals)
- Place all the equipments (i.e. Fire Hose, Rubber Pipe and Chisel) at proper place.
- Handling of chemicals should be as per plant guidelines to avoid undesired chemical reaction.
- Safety training and correct use of PPE's must for all the employees.
- Follow shift in charge's instructions during loading or unloading of chemicals.
- In case of fire or any accident, immediately inform responsible person,
- In case of emergency, inform operator as well as control room.
- Area of work during excavation, radiography, sand blasting shall be cordoned with warning tags of "work in progress", "no entry", "radiography" in progress' etc.
- Switch off lights and computers when not in use.
- Shut the water cock properly when not in use.
- Always follow safety rule during the plant operation.

Do's during shut down:

- All equipment, vessels, lines where hot work is envisaged shall be purged, flushed thoroughly and positively isolated. Similar precautions should be taken for vessel entry also.
- Back flow of materials from sewers, drains should be avoided by proper isolations.

- In case of confined space entry and other cleaning, catalyst removal, sludge removal jobs etc. which are to be carried out by the process department, vessel entry permit should be issued to immediate supervising officer/operator by shift in charge. This permit should be renewed by incoming shift in charge during every shift.
- Hoist, Platform, cages used for lifting persons or to send persons inside vessels by such means must be of sound construction with wire ropes slings, etc. to avoid failure.
- All steam, condensate, hot water connections should be made tight with clamps.
- All underground sewers shall be flushed, protected from sparks.
- Full PPEs like PVC suits, gum boots, face shield & other required shall be used while draining, flushing and other reclaiming activities to avoid burn, poisoning etc.
- Wet asbestos cloth/metallic plate should be used to collect flying sparks.
- Water, steam flushing, nitrogen blanketing shall be continued where spontaneous combustion takes place. Precautions should be taken for pyrophoric nature of material.
- Temporary electrical connections, cords, boards and other electrical fixtures should be of sound material to prevent electrical shock.
- Proper approach like aluminum ladder should be provided to reach to the platforms of scaffolding and ladder must be tied.
- All clumps of scaffolding should be tightened properly and planks should be tied at both ends and supported at proper distances along span to avoid sagging and failure.
- Always use safety belt while working at height of more than 2 meters and ensure tieing the life line of safety belt with firm support.
- Ensure area cordoning for hot work, X-ray, excavation, hazard material temporary storage.
- Ensure proper tagging of valves, switches etc to prevent its use.
- Ensure proper guidance to workman and make him aware about local area hazards before start of the job.
- All welding machines should be provided with power isolation switch of suitable rating.
- Portable electrical appliances/tools earthing should be in good working condition. Insulation portion should be free from damages.
- All electrical cables should be joints free and connection taken by using three pin plugs.
- While inserting fuse all care should be taken so that no one touches conductor to avoid the shock to the persons.
- During hydro jetting work workers should wear hand gloves, safety helmet goggles and PVC suit.

Don’ts:

- Do not use fire hydrant water for washing/bath purpose.
- Do not use water for cleaning purpose, use broomstick if possible.
- Do not wash or clean trolley, tractor or trucks which are used for chemical/fertilizer’s transportation. Wash them at proper place.
- Smoking & carrying matchbox, cigarettes, lighter, bidis etc. are prohibited.
- Photography & carrying cameras/Mobile phones are strictly prohibited in all areas.

- Do not spill liquid or chemicals in open atmosphere.
- The use of Radio Active Source within the plant shall not be allowed without obtaining valid permission/work permit and intimation in the form of a circular to all plant persons shall be given in advance.
- Unauthorized entry into any battery limit of plant is strictly prohibited.
- Sitting or walking on rail tracks, crossing between wagons, taking rest under stabled wagons, crossing the rail through the openings underneath the stationary wagons are strictly prohibited.

Don’ts during shut down:

- Do not use gasket or other blinds as it can fail during job. All blinds should be metallic.
- No toxic/corrosive/irritating materials should remain plants or sections where hot work is to be carried out.
- No hot work should be permitted in battery limits near sewers till areas have been cleaned flushed properly.
- No hot work irrespective of place of area shall be done without valid permit.
- No combustible material shall be there in flare line for taking up of flare line job. Isolations shall be ensured.