6. RISK ASSESSMENT& DISASTER MANAGEMENT PLAN

6.1. Introduction

Industrial plants deal with materials, which are generally hazardous in nature by virtue of their intrinsic chemical properties or their operating temperatures or pressures or a combination of these. Fire, explosion, toxic release or combinations of these are the hazards associated with industrial plants using hazardous chemicals. More comprehensive, systematic and sophisticated methods of Safety Engineering, such as, Hazard Analysis and Quantitative Risk Assessment have now been developed to improve upon the integrity, reliability and safety of industrial plants.

The primary emphasis in safety engineering is to reduce risk to human life, property and environment. Some of the more important methods used to achieve this are:

- **Quantitative Risk Analysis:** Provides a relative measure of the likelihood and severity of various possible hazardous events by critically examining the plant process and design.
- **Work Safety Analysis:** The technique discerns whether the plant layout and operating procedures in practice have any inherent infirmities.
- **Safety Audit:** Takes a careful look at plant operating conditions, work practices and work environments to detect unsafe conditions.

Together, these three broad tools attempt to minimize the chances of accidents occurring. Yet, there always exists, no matter how remote, probability of occurrence of a major accident. If the accident involves highly hazardous chemicals in sufficiently large quantities, the consequences may be serious to the plant, to surrounding areas and the populations residing therein.

6.2. Risk Assessment

A three 'levels' risk assessment approach has been adopted for the M/s Swarup Chemicals Pvt. Ltd (henceforth SCPL) proposed project to be set up at Plot No. B 15-22, UPSIDC Industrial Area, Village Mahfona Tehsil Sandila, Hardoi, Uttar Pradesh. The risk assessment levels are generally consistent with the practices encountered through various assignments for medium and large chemical complexes. The brief outline of the three-tier approach is given below:

- **Level 1 – Risk Screening**

This is top-down review of worst- case potential hazards/risks, aimed primarily at identifying plant sites or areas within plant, which pose the highest risk. Various screening factors considered include:

- Inventory of hazardous materials;
- Hazardous Materials properties;
- Storage conditions (e.g. temperature and pressure);
- Location sensitivity (distance to residential areas / populace).

The data / information are obtained from plant. The results provide a relative indication of the extent of hazards and potential for risk exposure.

- **Level 2 – Major Risk Survey** (Semi - Quantitative)

The survey approach combines the site inspection with established risk assessment techniques applied both qualitative as well quantitative mode. The primary objective is to identify and select major risks at a specific location in the plant considering possible soft spots / weak links during operation / maintenance. Aspects covered in the risk usually include:

- Process Hazards;
- Process Safety Management Systems;
- Fire Protection and Emergency response equipment and programs.
- Security Vulnerability;
- Impact of hazards consequences (equipment damage, business interruption, injury, fatalities);
- Qualitative risk identification of scenarios involving hazardous materials;
- Risk reduction measures.

Selection of critical scenarios and their potential of damage provide means of prioritising mitigative measures and allocate the resources to the areas with highest risks.

- **Level 3 – Quantitative Risk Assessment** (Deterministic)

This is the stage of assessment of risks associated with all credible hazards (scenarios) with potential to cause an undesirable outcome such as human injury, fatality or destruction of property. The four basic elements include:

i. Hazards identification utilising formal approach (Level 2, HAZOP etc.);

ii. Frequency Analysis. Based on past safety data (incidents / accidents); Identifying likely pathway of failures and quantifying the toxic / inflammable material release;

iii. Hazards analysis to quantify the consequences of various hazards scenarios (fire, explosion, BLEVE, toxic vapour release etc.).Establish minimum value for damage (e.g. IDLH, over pressure, radiation flux) to assess the impact on environment.

iv. Risk Quantification: Quantitative techniques are used considering effect / impact due to weather data, population data, and frequency of occurrences and likely hood of ignition / toxic release. Data are analysed considering likely damage (in terms of injury / fatality, property damage) each scenarios is likely to cause.

QRA provides a means to determine the relative significance of a number of undesired events, allowing analyst and the team to focus their risk reduction efforts where they will be beneficial most.

SCPL shall manufacture some pesticides chemicals and some intermediates at the proposed plant site. Table 2.4 in Chapter 2 gives the list of raw materials. Solid raw materials are stored in ware house while liquid and gaseous raw materials are stored in tank farms and covered area. The list of bulk liquid storages of raw materials are as given below:

Table 6.1 Liquid/Gaseous Bulk Storages

Raw Materials	Capacity (KL)	Storage Mode	Remarks
Hydrochloric Acid	30	Tank	
Carbon disulphide	30	Tank	
Dimethyl Amine	20	Tank	
Ethylene dichloride	30	Tank	
Diethyl Amine	30	Tank	
Chlorine	30 (Tonners)	Tonners	
Ammonia	--	Cylinders	

6.3. Risk Screening Approach

Proposed Plant: Risk screening of SCPL proposed project was undertaken through data / information provided by SCPL. Data of major / bulk storages of raw materials, intermediates and other chemicals were collected. MSDS of hazardous chemicals were studied vis a vis their inventories and mode of storage. SCPL plant will be using number of hazardous chemicals and also producing pesticides chemicals – all hazardous in nature. The chemicals stored in bulk (liquid or gaseous) and defined under MSHIC Rule will be considered for detailed analysis.

Hazardous materials have been defined under MSIHC Rules (1989) - 2 (e) which means.

(i) Any chemical which satisfies any of the criteria laid down in Part I of Schedule I and is listed in Column 2 of Part II of this Schedule;

Toxic Chemicals: Chemicals having the following values of acute toxicity and which owing to their physical and chemical properties, are capable of producing major accident hazards:

S. No	Toxicity	Oral Toxicity LD_{50} (mg/kg)	Dermal Toxicity LD_{50}	Inhalation Toxicity LC_{50}	Remarks

			(mg/kg)	(mg/l)	
1	Extremely Toxic	>5	< 40	< 0.5	
2	Highly Toxic	>5 – 50	> 20 – 200	< 0.5 – 2.0	
3	Toxic	>50 - 200	> 200 - 1000	> 2 – 10	

Flammable chemicals:

(i) **Flammable gases**; 20 ^{0}C and at standard pressure of 101.3 KPa are:

- Ignitable when in a mixture of 13% or less by volume with air, or;
- Have a flammable range with air of at least 12% points regardless of the lower flammable limits.

(ii) **Extremely flammable liquids**: chemicals which have a flash point lower than or equal to 23 ^{0}C and the boiling point less than 35 ^{0}C;

(iii) **Very Highly flammable liquids**: chemicals which have a flash point lower than or equal to 23 ^{0}C and the boiling point higher than 35 ^{0}C;

(iv) **Highly Flammable Liquid**: Chemicals, which have a flash point lower than or equal to 60 ^{0}C but higher than 23 ^{0}C.

(v) **Flammable liquids**: chemicals, which have a flash point higher than 60 ^{0}C but lower than 90 ^{0}C.

Explosives: Explosive means a solid or liquid or pyrotechnics substance (or a mixture of substances) or an article.

Which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to surroundings;

Which is designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reaction.

I. any chemical listed in Column 2 of Schedule 2;
II. any chemical listed in Column 2 of Schedule 3;

Table 6.2 Hazardous Analysis of Products

S. No	Material	S. No & Threshold Quantity (TQ in MT) as per MSHIC Rules			Hazards Potential		Remarks
		Schedule- 1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic DT->---mg/Kg; OT----mg/Kg; IT----mg/l; (Rats)	
A	**Products**						
1.	Kresoxim -methyl: C18H19NO4 AG-95% CAS No: 1443390-89-0 UN NO: 3077 Brown powder with sweet odour; Nonflammable;	---	---	---	Harmful if swallowed , inhaled , or absorbed through skin. Cause eye irritation. Do not get on skin , in eyes , or on clothing. Avoid breathing vapor or spray mist	DT->2000; OT->5000 (rat); IT-5.6; [T] (Rats)	
2.	Dinotefuron Technical 0.25%+99.75% Diatomaceous earth CAS No.: 166252-70-0 Form: White powder with earthy odour	---	---	---	Relatively nontoxic after single ingestion. Relatively nontoxic after short-term skin contact. Relatively nontoxic after short-term inhalation. May cause moderate but temporary irritation to the eyes. May cause slight irritation to the skin	DT->5000 (rat); OT->5000 (rat); IT- 2.08 [T] (Rats)	
3.	Difenthiuron Form: White odourless powder CAS No.: 80060-09-9	---	---	---	May cause sensitization by skin contact. Harmful: Danger of serious damage to health by	DT->4000; OT->1950; IT---------- (Rats)	This product is moderately hazardous (WHO Hazard Class II)

S. No	Material	S. No & Threshold Quantity (TQ in MT) as per MSHIC Rules			Hazards Potential		Remarks
		Schedule- 1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic DT->---mg/Kg; OT----mg/Kg; IT----mg/l; (Rats)	
					prolonged exposure in contact with skin and if swallowed		
4.	Pyriproxyfen C20H19NO3 Form: White to off white crustal powder CAS No.: 95737-68-1	---	---	---	No data available	No data available	
5.	ZDC (Zinc Diethyldithiocarbamate) C10H22N2S4Zn CAS No:136-94-7 Solid Powder	---	---	---	Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.	DT->----; OT-700 (rat); IT—------	
6.	.Ziram $C_6H_{12}N_2S_4Zn$ CAS No: 137-30-4 White odourless powder	---	---	---	Ziram can cause skin and mucous membrane irritation. Humans with prolonged inhalation exposure to ziram have developed nerve and visual disturbances. Ziram is corrosive to eyes and may cause irreversible eye damage	DT->6000 (rat); OT-1400 (rat); IT—-----	
7.	Thiram AG-98%; $C_6H_{12}N_2S_4$.	---	---	---	May be irritating to respiratory	DT->2400; OT-	

S. No	Material	S. No & Threshold Quantity (TQ in MT) as per MSHIC Rules			Hazards Potential		Remarks
		Schedule- 1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic DT->---mg/Kg; OT----mg/Kg; IT----mg/l; (Rats)	
	CAS No:137-26-8 UN No: 3077 Granular solid ColorLight brown Odor Caramel-like				system, skin and eyes. May cause skin sensitization. May be harmful if inhaled, swallowed, or absorbed through skin.	1080; IT-4.42;[T] (Rats	
8.	Captan C9H8Cl3NO2S CAS NO:133-06-2 UN No:3082 Solid – off-white amorphous wettable powder. Odour: Faint odour	105			WHO Table; EPA – III A low toxicity fungicide. Likely routes of exposure: Skin and eye contact, inhalation and ingestion.	DT->2000 (rats); OT->5000 (rats); IT-2.6 [T] (in rats 4 hrs)	
9.	Folpet C9H4Cl3NO2S. AG-96% CAS NO:133-07-3 UN No: 3077 Off White granules Characteristic odour Sensitive to light; open flame and humidity	---	---	---	Harmful if inhaled. Avoid inhaling or breathing dust. Causes eye irritation. May irritate skin	DT-2000; OT->5000; IT-NA; (Rats) NFPA-H-2;F-0;I-0	
10	Metam sodium (Wt % 27 --42) CAS NO:137-42-8 UN No:3267 Light yellow liquid	---	---	---	Harmful if Swallowed, inhaled and causes severe skin burns and eye damage	DT-2000 (rat); OT->896 (rat); IT-2.54	

S. No	Material	S. No & Threshold Quantity (TQ in MT) as per MSHIC Rules			Hazards Potential		Remarks
		Schedule- 1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic DT->---mg/Kg; OT----mg/Kg; IT----mg/l; (Rats)	
						[T] (rat 4 hrs); (Rats)	
11	Zineb C4H6N2S4Zn Form: Solid Color: slight yellow Odor: N/A CAS No.: 12122-67-7	---	---	---	Eyes: Irritation and inflammation. Skin: Irritation and inflammation. Ingestion: N/K (FPN/ORNL). Inhalation: Irritation and inflammation of nose and throat.	No Data	

- Hazard analysis of raw materials stored in bulk are as below:

Table 6.3 Hazardous Analysis Raw materials stored in Bulk

S. No	Material	S. No & Threshold Quantity (TQ in Kg) as per MSHIC Rules			Chemicals Hazards Potential		Remarks
		Schedule-1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic	
.	Hydrochloric acid (Gas) CAS No: 7647-01-0	313			Not Flammable; Inhalation of fumes results in coughing	ERPG-1: 3.0 ppm ERPG-2: 20 ppm ERPG-3: 150	Plant uses liquid and emits HCl gas

	UN No: 1789				and choking sensation, and irritation of nose and lungs. Liquid causes burns	ppm IDLH: ---- ppm	
.	Caustic Soda (Sodium Hydroxide) CAS No: 1310-730-2 UN No: 1823	571	---	---	Not flammable; Corrosive to metals and tissue. Hazardous.	ERPG-1: 0.5 ppm ERPG-2: 5.0 ppm ERPG-3: 50 ppm IDLH: ---- ppm	
.	Carbon di sulphide CAS No:75-15-0 UN No:1131 A clear colorless to light yellow volatile liquid with a strong disagreeable odor	110	--	107 TQ-1: 20 MT TQ-2: 200 MT		LD50 (oral):3188 mg/kg (rat) LC50 (rat): 12500 ppm	Flammable
.	Dimethyl Amine CAS No:124-40-3 (Pure DMA) Liquid with strong odour	215	--	--	Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant).	Acute toxicity Oral-(LD50): Mouse) Vapor (LC50): 11350 ppm 4 hour(s) (Rat) (Calculated value for the mixture).	Flammable. NFPA: Health: 3 Flammability: 4 Reactivity: 0
	Ethylene	271	--	--	BP-84^{0}C	Oral: LD50	Harmful if

.	Dichloride CAS No:107-06-2 Colorless Liquid. chloroform-like. (Odour)				FP-13 ^{0}C Inhalation of vapours or mists may cause irritation to the respiratory system	>200 - 2000 mg/kg , Rat Dermal-LD50 >200 - 2000 mg/kg , RabbitInhalation-LC50>5mg/l /10hrs Rat [T]	swallowed . Irritating to eyes, respiratory system and skin. Irritating to eyes, respiratory system and skin.
.	Diethyl Amine (CH3CH2)2 NH CAS No: 109-89-7 UN No: Clear Flammable Lquid with ammonical odour	196			Extremely hazardous in case of ingestion. Very hazardous in case of eye contact (irritant). Hazardous in case of skin contact	ORAL (LD50): Acute: 540 mg/kg [Rat]. DERMAL (LD50): Acute: 820 mg/kg [Rabbit]. VAPOR (LC50): Acute: 4000 ppm 4 hour(s) [Mouse].	Slightly hazardous in case of inhalation
.	Chlorine CAS No:7782-50-5	119	5 TQ-1: 10MT	108 TQ-1: 10MT	Non Combustible; May ignite other combustible materials (wood, paper, oil, etc.). Mixture with fuels may cause explosion. Container	ERPG-1: 1.0 ppm ERPG-2: 3.0 ppm	

					may explode in heat of fire. Chlorine reacts explosively with or supports the burning of numerous common materials. Ignites steel at 100°C in the presence of soot, rust, carbon, or other catalysts. Ignites dry steel wool at 50°C. Hydrogen and chlorine mixtures (5-95%) are exploded by almost any form of energy (heat, sunlight, sparks, etc.). Health Hazards: Poisonous; may be fatal if inhaled. Contact may cause burns to skin and eyes. Bronchitis or chronic lung conditions		
	UN No:1017 A greenish yellow gas with a pungent suffocating odor. Toxic by		TQ-2: 25 MT	TQ-2: 25 MT		ERPG-3: 20 ppm IDLH: 10 ppm	

	inhalation.						
.	Ammonia CAS No:7664-41-7 UN No:1005	31	2 TQ-1: 60 MT TQ-2: 600 MT	105 TQ-1: 50 MT TQ-2: 500 MT	Fire Hazards: Mixing of ammonia with several chemicals can cause severe fire hazards and/or explosions. Ammonia in container may explode in heat of fire. Health Hazards: Vapors cause irritation of eyes and respiratory tract. Liquid will burn skin and eyes. Poisonous; may be fatal if inhaled. Contact may cause burns to skin and eyes. Contact with liquid may cause frostbite.	ERPG-1: 25 ppm ERPG-2: 150 ppm ERPG-3: 750 ppm IDLH: 300 ppm	

TQ-I: Threshold quantity (for application of rules 4,5,7 to 9 and 13 to 15)TQ-II: Threshold quantity (for application of rules 10 to 12)

Note:

1. Oral Toxicity (OT) in LD_{50} (mg/kg)
2. Dermal Toxicity (DT) in LD_{50} (mg/kg)
3. Inhalation Toxicity in LC50 (mg/l) [4 hrs.]

Though SCPL will be using a number of raw materials however it will be storing nearly 6 liquid and two gaseous raw materials (in bulk). All of the raw materials stored in bulk are listed under "List of hazardous and Toxic Chemicals" category under MSIHC Rules, 1989.The raw materials coming under hazardous category as specified by MSIHC Rules, 1989 (including subsequent amendments) is given in Table 6.3 above

All pesticides products are hazardous in nature and many of them are new compounds with little data available. None of the product are listed in MSIHC Rules. The products are produced as per market demand and packed and stored in saleable packing.

6.4. Hazardous Materials Storage

The solid raw materials will be received in bags or drums and will be stored in chemicals go-downs. The products (liquid or solid) will be packed in drums and stored in product go-downs as per market demand. The bulk storages of liquid and gaseous hazardous materials are given in the Table 6.3.

The solid materials powder or granules spillage can results in polluting small area only. The damage to personnel can be through ingress- dermal (if individual come in contact), oral (if individual food gets infected through fugitive dust) or inhalation (fugitive dust). The main route is fugitive dust which in covered area will move to short distance only. Some of the raw materials are though stored in bulk (quantity) but in drums only.

The pesticide product will be both as liquid and solid. The product storage for liquid will be in drums and ISO containers and for solid in bags depending upon client requirement

The risk is through liquid and gaseous materials which are volatile/gaseous material (toxic) and inflammable/explosive materials. The toxic vapours due to spillage of such material can travel to some distance (as they are stored in covered go-downs) and cause damage. The liquid products will be packed in drums (50 litres drums).

6.5. QRA Approach

Identification of hazards and likely scenarios (based on Level-1 and Level-2 activities) calls for detailed analysis of each scenario for potential of damage, impact area (may vary with weather conditions / wind direction) and safety system in place. Subsequently each incident is classified according to relative risk classifications provided in Table below as Table 6.4:

Table 6.4 Risk Classification

Stage	Description

Stage	Description
High (> 10^{-2}/yr.)	A failure which could reasonably be expected to occur within the expected life time of the plant. Examples of high failure likelihood are process leaks or single instrument or valve failures or a human error which could result in releases of hazardous materials.
Moderate (10^{-2} --10^{-4}/yr.)	A failure or sequence of failures which has a low probability of occurrence within the expected lifetime of the plant. Examples of moderate likelihood are dual instrument or valve failures, combination of instrument failures and human errors, or single failures of small process lines or fittings.
Low (<10^{-4})	A failure or series of failures which have a very low probability of occurrence within the expected lifetime of plant. Examples of 'low' likelihood are multiple instruments or valve failures or multiple human errors, or single spontaneous failures of tanks or process vessels.
Minor Incidents	Impact limited to the local area of the event with potent for 'knock – on-events'
Serious Incident	One that could cause: ❖ Any serious injury or fatality on/off site; ❖ Property damage of $ 1 million offsite or $ 5 million onsite.
Extensive Incident	One that is five or more times worse than a serious incident.

Assigning a relative risk to each scenario provides a means of prioritising associated risk mitigation measures and planned actions.

6.6. Thermal Hazards

In order to understand the damages produced by various scenarios, it is appropriate to understand the physiological/physical effects of thermal radiation intensities. The thermal radiation due to tank fire usually results in burn on the human body. Furthermore, inanimate objects like equipment, piping, cables, etc. may also be affected and also need to be evaluated for damages. Table 6.5, Table 6.6 and Table 6.7 (below), respectively give tolerable intensities of various objects and desirable escape time for thermal radiation.

Thermal hazards could be from fires or explosion. Fire releases energy slowly while explosion release energy very rapidly (typically in micro seconds). Explosion is rapid expansion of gases resulting in rapidly moving shock wave. Explosion can be confined (within a vessel or building) or unconfined (due to release of flammable gases).

BLEVE (boiling liquid expanding vapour explosion) occurs if a vessel containing a liquid at a temperature above its atmospheric boiling point ruptures. The subsequent BLEVE is the explosive vaporisation of large fraction of its vapour

contents; possibly followed by combustion or explosion of the vaporised cloud if it is combustible range.

Thermal hazards have been considered for various scenarios including:

- Fire in inflammable chemicals storage tanks.

Table 6.5 Effects due to Incident Radiation Intensity

Incident Radiation kW/m^2	Damage Type
0.7	Equivalent to Solar Radiation
1.6	No discomfort on long duration
4.0	Sufficient to cause pain within 20 sec. Blistering of skin (first degree burn are likely).
9.5	Pain threshold reached after 8 sec. Second degree burn after 20 sec.
12.5	Minimum energy required for piloted ignition of wood, melting of plastic tubing etc.
25	Minimum Energy required for piloted ignition of wood, melting, plastic tubing etc.
37.5	Sufficient to cause damage to process equipment.
62.0	Spontaneous ignition of wood.

Table 6.6 Thermal Radiation Impact to Human

Exposure Duration	Radiation Energy {1% lethality; kW/m^2}	Radiation Energy for 2nd degree burns; kW/m^2	Radiation Energy for 1st degree burns; kW/m^2
10 sec	21.2	16	12.5
30	9.3	7.0	4.0

Table 6.7 Tolerable Intensities for Various Objects

Sl. No	Objects	Tolerable Intensities (kw/m^2)
1	Drenched Tank	38
2	Special Buildings (No window, fire proof doors)	25

3	Normal Buildings	14
4	Vegetation	10-12
5	Escape Route	6 (up to 30 sec.)
6	Personnel in Emergencies	3 (up to 30 sec.)
7	Plastic Cables	2
8	Stationary Personnel	1.5

6.7. Damage due to Explosion

The explosion of a dust or gas (either as a deflagration or detonation) results in a reaction front moving outwards from the ignition source preceded by a shock wave or pressure front. After the combustible material is consumed the reaction front terminates but the pressure wave continues its outward movement. Blast damage is based on the determination of the peak overpressure resulting from the pressure wave impacting on the object or structure.

As a safety measure SCPL is storing highly hazardous raw materials in isolated places with full safety measures. Damage estimates based on overpressure are given in Table 6.8 below:

Table 6.8 Damage due to Overpressure

Sl. No	Overpressure (psig / bar)	Damage
1.	0.04	Loud Noise / sonic boom glass failure
2.	0.15	Typical pressure for glass failure
3.	0.5 - 1	Large and small windows usually shattered
4.	0.7	Minor damage to house structure
5.	1	Partial demolition of houses, made uninhabitable.
6.	2.3	Lower limit of serious structure damage
7.	5 – 7	Nearly complete destruction of houses
8.	9	Loaded train box wagons completely demolished
9.	10	Probable total destruction of houses
10.	200	Limits of crater lip

- In SCPL case explosion not likely.

6.8. Toxic Release

Hazardous materials handled and stored in bulk in SCPL complex are toxic gas i.e. Chlorine and liquids (as detailed in Table 6.1) and other raw materials as defined in MSHIC rules and indicated in Table 6.3. Some of these chemicals are stored in bulk (in tank farm).

Damage criteria: For toxic release the damage criteria considered is IDLH concentration (if data are available). In the absence of non-availability of IDLH, 'Inhalation Toxicity (IT) data for rats' are considered. 'IT' data are used for the products as IDLH are not available for these chemicals.

6.9. Data Limitations

It is also observed that very little data or information (regarding physical properties required for modelling) is available about the products.

6.10. Likely Failure Scenarios

Few likely failure scenarios have been selected after critical appraisal of raw materials and storage inventories. Failure scenarios selected are as given in Table 6.9 below:

Table 6.9 Different Failure Scenarios

S. No.	Scenario	Bulk Storage	Remark
Raw materials			
1.	Carbon Disulfide Spillage	30 KL	Toxic Impact
2.	Dimethyl Amine Spillage	20 KL	Toxic/Thermal Impact
3.	Ethylene Dichloride Tank Leakage	30 KL	Toxic Impact
4.	Diethyl Amine Spillage	30 KL	Thermal Impact
5.	Chlorine Cylinder leakage	30 Tonners	Toxic Impact

6.11. Weather Effect

The effect of ambient conditions on the impact of fire / heat radiation and GLC of hazardous / toxic material can be beneficial as well as harmful. A high wind (turbulence) can dilute the toxic material while stable environment can extend the reach of IDLH or IT (inhalation LC50 rats for products) concentration to long distance. Any inflammable gas / vapour release in turbulent weather will soon dilute the hazardous gases below LEL and thus save the disaster.

6.12. Incidents Impacts

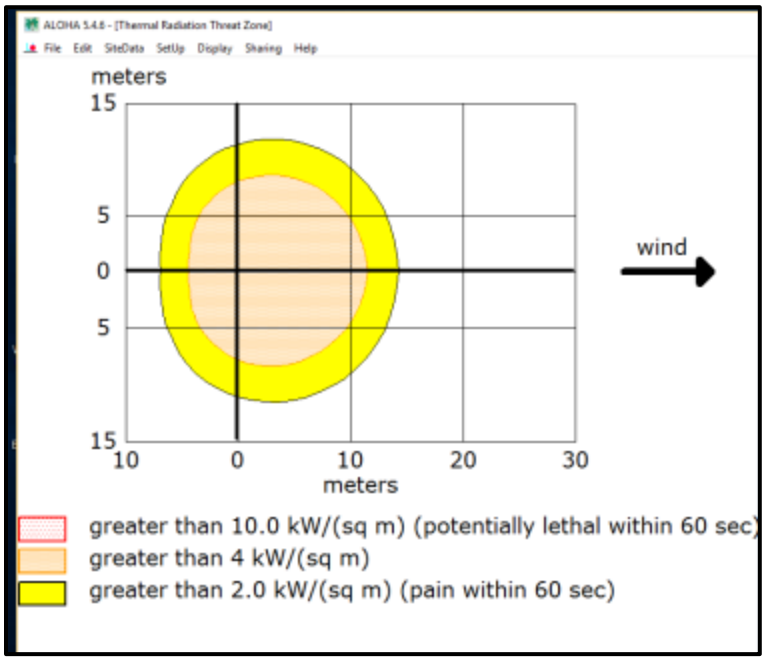
The identified failure scenarios (Table 6.9) have been analysed (Using ALOHA and EFFECT Modules) for the impact zones considering damage due to thermal and toxic impacts. Similar impacts are considered for expansion units. Each incident will have Impact on the surrounding environment which in extreme case

may cross plant boundary. The impact zones for various scenarios are given in Table 6.10.

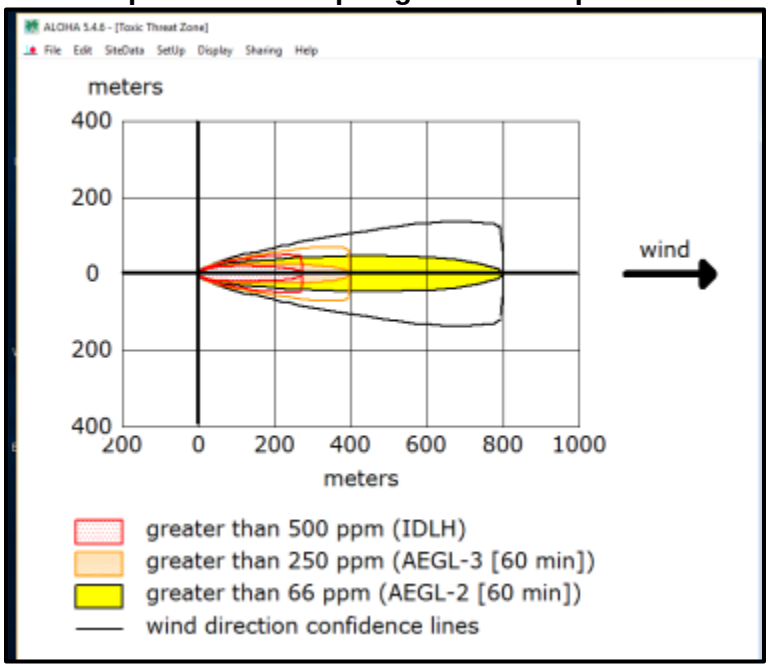
Table 6.10 : Hazards Scenario Impact

Scenario No.	Scenario	Impact Zone (m)	Remarks
Scenario Raw Material			
Case 1.	Carbon Disulfide Spillage	❖ <25	IDLH; Stability Class D;Template-1
Case 2.	Dimethyl Amine	❖ 275 ❖ 21 ❖ 31	IDLH; Stability Class D;Template-2 Thermal Impact; 1st degree burn Template 3 Flammable Area of Vapor Cloud 60% LEL = Flame Pockets Template 4
Case 3.	Ethylene Dichloride Tank Leakage	❖ < 108	ERPG-1 (50 ppm); Stability Class D;Template-5
Case 4.	Diethyl Amine	❖ 25	Thermal Impact; 1st degree burn
Case 5.	Chlorine Cylinder leakage	❖ <1000 ❖ <1200	IDLH; Stability Class D;Template-6 IDLH; Stability Class F;Template-7

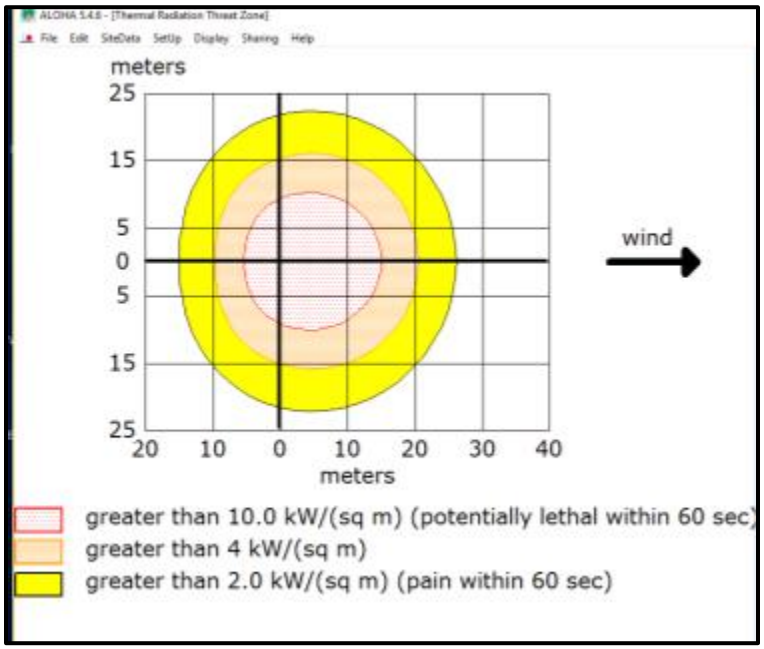
- Templates of Scenario



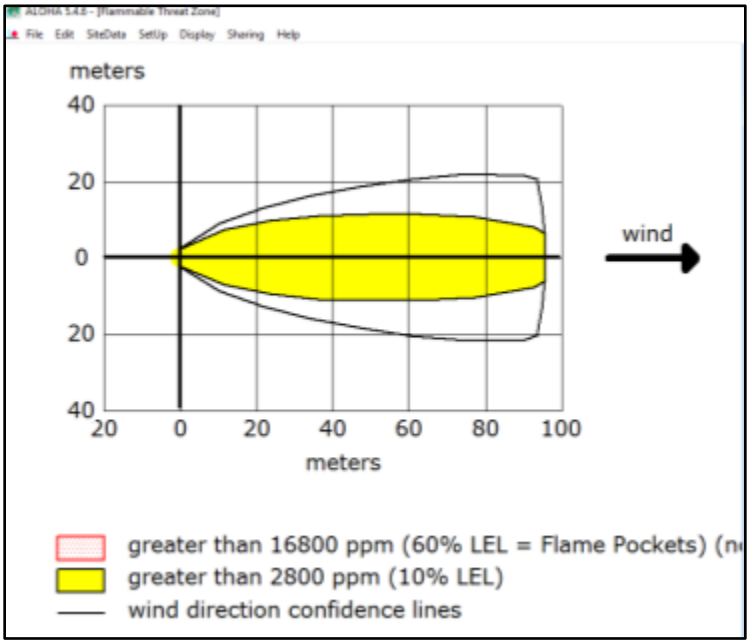
Template 1. CS2 Spillage-- Toxic Impact Zone



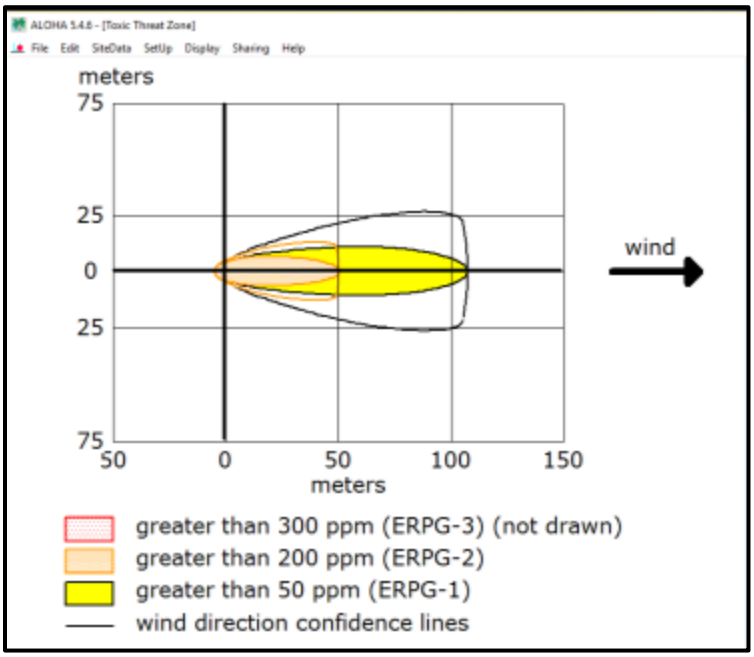
Template 2. Dimethyl Amine Spillage- Toxic Impact Zone



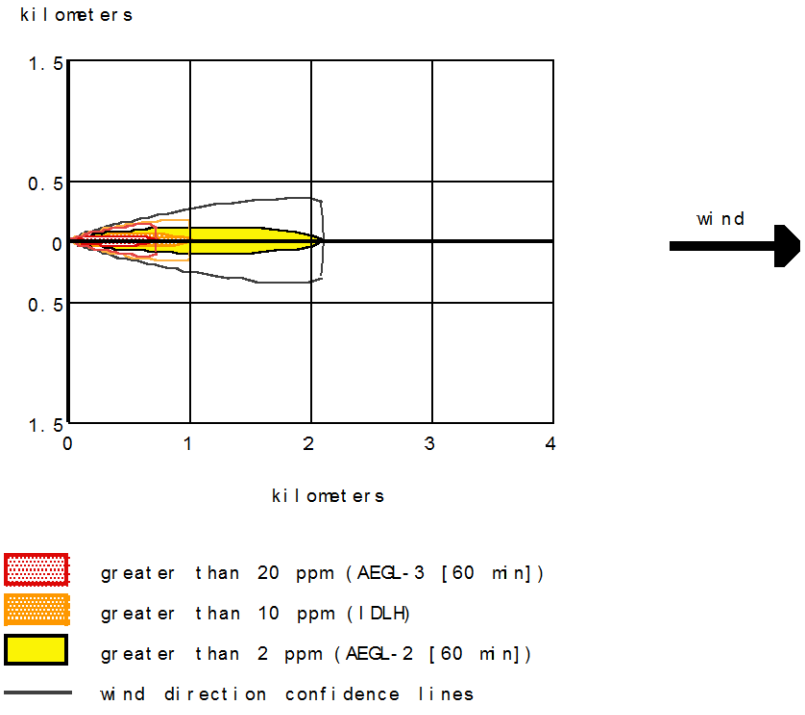
Template 3. Dimethyl Amine Spillage burning puddle—Thermal Impact Zone



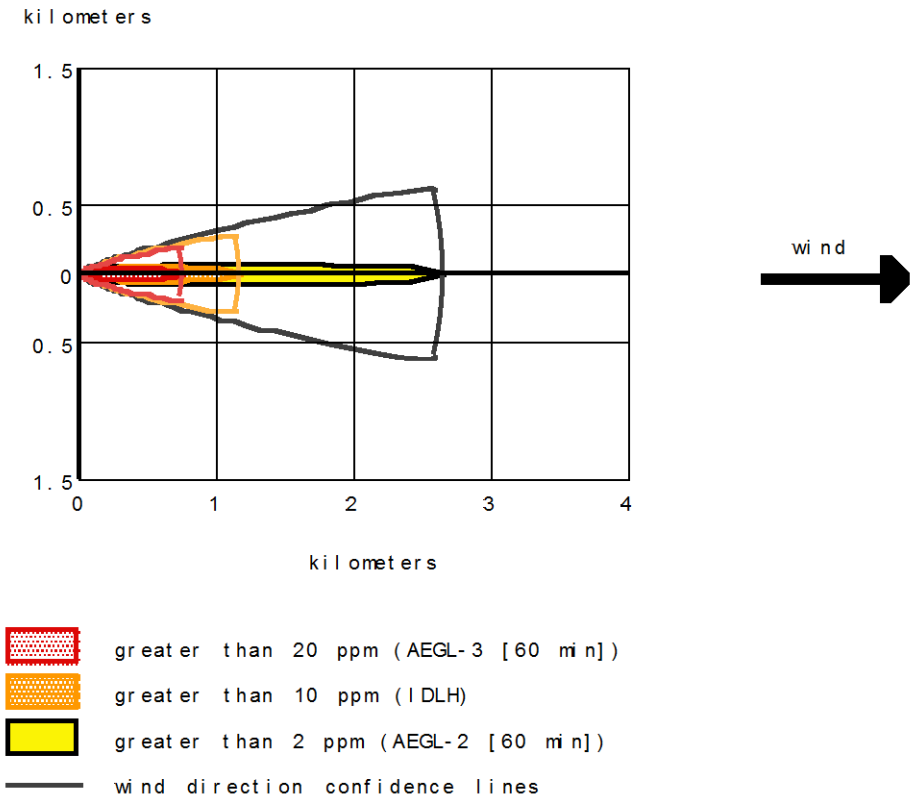
Template 4. Dimethyl Amine Spillage Flammable Area of Vapor Cloud



Template 5. Ethylene Dichloride Spillage- Toxic Impact



Template 6. Toxic Impact Zone Tonner Chlorine Leakage; Stability Class D



Template 7. Toxic Impact Zone Chlorine Tonner Leakage; Stability Class F

6.13. Consequential Impacts

The consequential impacts from each incident scenario can be though thermal, over pressure wave and toxic route. The damage can be on plant personnel (and neighbouring residents in case incident crosses boundary), property and also loss in production.

6.14. Thermal and Explosion Hazards

Incidents involving thermal hazards are mainly due to raw material fire (mainly amines large spillage & fire). The impact (1st degree burn) is limited to <25 m only (i.e. within plant boundary). However the consequences can go to worse if the incidents lead to domino effect to other tanks.

6.15. Toxic Hazards

Toxic hazards are mainly due to Chlorine and other toxic chemicals leakage and its impact can cross the plant boundary (if not controlled in time). The impact due to Chlorine, Dimethyl amine and Ethylene Dichloride can go up to 1200 /275/108

m i.e. it may cross the plant boundary limit and affect larger area / nearby populace depending upon wind direction.

SCPL is using Chlorine and other chemicals as basic raw material and shall provide following emergency safety measures:

- Caustic drum shall be provided adjoining to Chlorine storage for any emergency.
- Alternatively hood shall be provided that covers the Chlorine/ bromine vessels

Other hazardous chemicals including products their impact will be limited to spillage area. The acid spillage if comes in contact with metal parts will produce hydrogen which is highly flammable gas. Any person moving in area and getting splash will get the injury. In addition the spillage will cause pollution problem. The spillage is to be collected and neutralized for toxic contents before disposal.

6.16. General Control Measures

Since some of the substances in use at SCPL are hazardous with fire potential and also toxic in nature, it is necessary to use appropriate control measures recommended for such substances:

6.17. Flammable Gas Fires

Fire control generally consists of directing, diluting and dispersing the inflammable gas/ vapor to prevent contact with persons, to prevent it from infiltrating structures if the leak is out door, and to avoid its contact with ignition sources while, if possible, simultaneously stopping the flow of gas. Water in the form of spray, applied from hoses or monitor nozzles or by fixed water spray system cools the burning vapours / gas.

6.18. Process Safety System

- Process & Plant Safety:

  Conducting Preliminary Safety Analysis (A1), Basic Safety Review (A2), Detailed Safety Review (A3), Pre Start-Up Safety Review (A4) & Pre Start-Up Safety audit according to PPS directive as below:

  - Every change in the process, procedure, equipment, etc. will be done through robust management of change (MOC) procedure
  - Pre-Start up Safety Reviews for all modification
  - Pressure testing of pipelines and replacement of fragile pipelines and tanks by prevention project

- Hazardous area classification
- Internal safety rounds for P&PS
- Control P&IDs, and Lock opened (LO)/ Lock closed (LC) procedures are in place
- TOPPS (Top Performance in Process & Plant Safety) training to all employees
- Root Cause Analysis of all incidents
- Pre-Start up Safety Reviews for all modification

Occupational Safety:

- Permit to Work procedure and Monthly monitoring of all filled permit for continual improvement
- Mobilized Near- Miss Reporting and award scheme
- HSE rounds: PMT (Plant Management Team) of one plant takes HSE round of another plant. Exchange of best practices among plants
- MSDS Management
- Tool Box talk with contractors
- Central Safety Committee
- Departmental Safety Committees
- HSE Coordinator and Monitor program: Shop floor employees' participation in Safety activities
- Celebration of theme based Safety days/ weeks at site
- Safety Induction program for new joiners (both company & contract employees)

Emergency Preparedness:

- On-Site Emergency Plan for the site
- Training on On-Site Emergency Action Plan
- Regular Site level Mock drills and Plant specific Fire Drills and Leak, spill drills
- Availability of First aiders, Fire Fighters and Rescue members in each shift
- Maintenance of Fire hydrant system, sprinkler system and portable fire extinguishers
- Periodic testing of fire hydrant and sprinkler systems
- Fire Tenders and Ambulances kept ready

Occupational Health:

- Pre-employment & Annual Medical Examination
- Quarterly/Periodical Physical Examinations
- Canteen Employees Examination
- Fork lift operators Examination
- Recall services & Follow-Up
- Return to work assessment

- Exit Examination
- Training on Counselling, Hearing Conservation Program, Hazardous Chemical Awareness Program, Shop floor training, First-aid (Adequate numbers of Certified First Aiders/employees), etc.
- Legal records: All medical records of employees to be maintained.
- Emergency Medical services: Ambulance services, First-aid boxes, Decontamination facility etc.

Health Promotional Activities: Awareness on Medical issues, Ergonomics awareness programs, Stress management, De-addiction program, etc.

- ❖ Decontamination facility is provided
- ❖ Breathing air provision is provided at toxic chemical handling area.

Safety System for Toxic Material Handling

Following precaution Taken while handling Toxic materials

- ❖ Highly Toxic chemical is stored in storage room with lock and key.
- ❖ Inventory records are maintained.
- ❖ Toxic material is stored in well ventilation and out of sunlight
- ❖ It is stored away from incompatible chemicals.
- ❖ Keeping containers tightly & securely closed when not in use
- ❖ Toxic chemical charging is done inside the closed room in presence of shift in-charge.
- ❖ Local Ventilation system is provided to avoid exposure at work place.
- ❖ Vent gas is passing through scrubber system for absorption & reduction of pollution.

Standby pump provision is available for scrubber system. Training to employees is providing for manual handling of toxic chemicals.

- ❖ First aid training also provided to concern employees.
- ❖ Antitoxic kit is maintaining inside OHS.
- ❖
- ❖ Safety PPE's is providing during charging.
- ❖ First aid kit provision is available at work place area.

Eye wash/Safety shower stations are readily available nearby and are tested regularly

To avoid fire and explosion nitrogen blanketing, earthing & bonding, electrical flame proof equipment's, pressure rated equipment' are provided.

Suitable fire extinguisher and spill cleanup equipment are maintained.

Dyke provision is available where liquid toxic chemicals are stored.

- Appropriate spill control equipment and procedures is available.

MSDS is maintained inside the concern plant / department.

- Precautionary placard is displayed nearby the work place.
- Toxic chemicals sign board is displayed on container.
- Avoiding any welding, cutting, soldering or other hot work on an empty container of toxic chemicals.
- Good housekeeping is maintaining.
- Toxic gas detector also provided at workplace.
- Toxic chemical waste is collecting in separate pit and transferring to ETP for its treatment.
- Always ensuring that the waste container used is compatible with the waste material
- Ensuring that the waste container is properly and accurately labelled.
- Unauthorized person entry is restricted.
- Restricted for eating, drinking & smoking at work place.
- Employees are trained for emergency of toxic chemicals.
- Toxic chemical spill, leak drills are conducting for awareness, preparedness & response during an emergency.
- Work place area monitoring is to be carried out for ensuring exposure at workplace.
- Process is performed in closed conditions.
- Regular pressure testing for pipelines and equipment to ensure tightness

WORK PLACE MONITORING PLAN

Work zone monitoring is carried out by HSE department every month for gaseous pollutants and dusts. Records are to be kept in standard Form as per Factories Rules. Location for samplings shall be identified. Samples are analyzed for Air borne concentration of hazardous chemicals in ppm.

The analyzed results are compared with the threshold limit values (TLV) of international organizations. The monitoring program is based on the Action level Concentration (ALC) which is 50% of the TLV. If the analyzed concentration is < ALC, no regular monitoring is required, only occasional checks (once in a year) to ensure the acceptability of the system.

If the analyzed concentration is > ALC < TLV then the monitoring is carried out at regular interval (once in two months). Incase analyzed concentration is > TLV

then corrective actions are decided by Plant Manager, General Manager - works and Engineering Manager and they are implemented. After implementation again monitoring is carried out.

The sampling for gaseous pollutants and air pollutants are done by Air sampling pump.

Arrangement for ensuring health and safety of workers engaged in handling of toxic materials

All persons working in manufacturing units are surveyed by regular medical examinations.

Pre-employment Medical examination To be carried out for all employees prior to employment at well-known multispecialty hospital.

Checkups & tests carried out as per Factory rules / SPCB guidelines.

6.19. Safety Recommendations

6.20. Commonly Recommended Control Measures

A number of preventive control measures for hazardous occurrences have been analysed and discussed above. Some more salient points are enumerated below:

- All storage tanks in the tank farm should be dyked. Other operation and maintenance features shall be based on established best safety practices.
- Concentration detectors for hazardous chemical vapours (e.g. Chlorine/ bromine/ other toxic chemicals etc.) fire Smoke / heat detectors and fire alarm should be installed at all strategic locations in the plant.
- A schedule for preventive maintenance including health survey of all plant equipment should be adhered to as far as possible.
- Ensure the absence of ignition sources in storage area.
- Ensure placement of firefighting facilities, such as, carbon dioxide, dry chemical powder and foam type fire extinguishers in addition to fire hydrant system, at strategic locations. Spill control measures, such as, removal of all ignition sources from the spill area and ventilating the area as well as soaking the spilled material with paper, towel or mud and letting the volatile substance evaporate slowly in a safe area.
- Compulsory use of protective clothing, non-sparking tools and warning signs during critical operations and maintenance.
- Training / refresher courses on safety information's / norms.
- Eyewash and showers should be put up at strategic places for use during emergencies.
- A group of plant personnel should be trained in first aid, rescue, firefighting and emergency control measures. These personnel will form core

group/emergency squad who will fight the emergency and also act as rescue and first aid team.

- In order to ensure communication from isolated places/locations Walkie-Talkie be made available to persons working in these areas. This will considerably improve the effectiveness of emergency management.
- There is no substitute for training-mock drills and these must be held at regular interval keeping the following objectives in mind:
- Real time mock-drill should be carried out for probable/likely hazardous situation (after the plant is successfully commissioned).
- Target to be set up for various tasks and events during an emergency.
- Weak links should be marked and corrective action taken to improve effectiveness during emergency.
- SCPL team already understand the implication and hazards in pesticide industry and has implemented most of the measures in the sister organisation existing plants.

6.21. Occupational Health and Safety

Occupational Health and Safety (OHS) are of prime importance more so in hazardous industries. Industries have various types of hazards and QRA is carried out to understand the hazards potential from various incidents. Pre-emptive steps can be planned to safeguards from likely causes. Some of the

- Frequent causes of accidents
  - Fire and explosion: explosives, flammable material
  - Hazards from Toxic Materials
  - Mechanical Hazards such as:
    Being struck by falling objects

    Caught in between machine parts

    Snapping of cables, ropes, chains, slings

    Handling heavy objects

  - Electricity Hazards
    - Electrocution
    - Short circuits and consequential fire.
    - Poor illumination etc.
  - Other Hazards:
    Falls from height inside industrial units or on the ground

    Struck by moving objects; Slipping on wet surfaces

    Sharp objects

Oxygen deficiency in confined spaces; Lack of personal protective equipment (PPE), housekeeping practices, safety signs

- Consequential hazards due to extreme Temperatures;
- Consequential hazards due to vibration
- Consequential hazards due to radiation;
- Many more hazards.

- Hazardous substances and wastes
  - Heavy and toxic metals
  - Lack of hazard communication (storage, labeling, material safety data sheets)
  - Batteries, fire-fighting liquids
  - Welding fumes
  - Volatile organic compounds (solvents)
  - Inhalation in confined and enclosed spaces
  - Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload

Ergonomic and psychosocial hazards

- Many of the hazards are as result of working environment.
-
- Long working hours, shift work, night work, temporary employment (Long working hours, shift work, night work, temporary employment, Mental stress, human relations) which results in less attention at work place and consequential incidents and accidents.
- Lack of education and training / awareness is another prime cause of accidents.

Considering above, QRA analysis and also the nature of activities at SCPL the following steps for OHS activities have been suggested:

- Employee's health check-up: pre-employment and periodic check-up during employment. The health check-up observations should be informed to employees.
- The health should include any impact due to hazards at work place including (but not limited to) due to noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc.
- Training and refresher courses on safety to all employees.
- Employees should be made aware of the hazards in the plant and the preventive actions to be safe from such hazards.

Response to Injuries: Based on a survey of possible injuries, a procedure for response to injuries or exposure to hazardous substances should be established. All staff should have minimum training to such response and the procedure ought to include the following:

- Immediate first aid, such as eye splashing, cleansing of wounds and skin, and Bandage etc.
- Immediate reporting to a responsible designated person
- If possible, retention of the item and details of its source for identification of possible hazards.
- Medical surveillance
- Recording of the incident
- Investigation, determination and implementation of remedial action

6.22. Ergonomic and psychosocial hazards

- **Many of the hazards are as result of working environment**

Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload

Long working hours, shift work, night work, temporary employment (Long working hours, shift work, night work, temporary employment, Mental stress, human relations) which results in less attention at work place and consequential incidents and accidents.

Lack of education and training / awareness is another prime cause of accidents.

Considering above, QRA analysis and also the nature of activities at SWAROOP the following steps for OHS activities have been suggested:

Employee's health check-up: pre-employment and periodic check-up during employment. The health check-up observations should be informed to employees.

The health should include any impact due to hazards at work place including (but not limited to) due to noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc.

Training and refresher courses on safety to all employees.

Employees should be made aware of the hazards in the plant and the preventive actions to be safe from such hazards.

Response to injuries: Based on a survey of possible injuries, a procedure for response to injuries or exposure to hazardous substances should be established. All staff should have minimum training to such response and the procedure ought to include the following:

- Immediate first aid, such as eye splashing, cleansing of wounds and skin, and Bandage etc.
- Immediate reporting to a responsible designated person
- If possible, retention of the item and details of its source for identification of possible hazards.
- Medical surveillance
- Recording of the incident
- Investigation, determination and implementation of remedial action

6.22.1. Key Process Safety Measures

- Flameproof equipment's and fittings are provided for handling of hazardous chemicals.
- Tanks and all pump motors are earthed.
- Road tanker earthing lines have been provided near the unloading pumps.
- Dykes have been provided for hazardous chemicals storage to contain leakages. Floors of the dyke area have impervious finish.
- Housekeeping of the plant is as per prescribed norms. Floors, platforms, staircases, passages are kept free of any obstruction.
- All hazardous operations are explained to the workers. They are periodically trained on the hazardous processes.
- Dedicated supply of firewater is available in the plant.
- Only authorized persons are allowed inside the plant.
- All instrument and safety devices are checked and calibrated during installation. They are also calibrated, checked at a frequent interval. Calibration records are maintained.
- All electrical equipment's are installed as per prescribed standards.
- All the equipment's of the plant are periodically tested as per standard and results are documented. All equipment's undergo preventive maintenance schedule.
- Hydrant system is pressured with a Jockey Pump.
- Flame arrestor is provided on each tank.
- Pressure gauge is provided on each tank.

In addition to fire hydrant system, nos. of fire extinguishers is also installed at different locations within premises.

Retention basin is provided to collect the contaminated water used during firefighting.

6.23. Transportation:

- Many hazardous chemicals / raw materials will be received through road tanker and stored in storage tank as per norms and safety regulations.
- Road tanker unloading procedure will be in place and will be implemented for safe unloading of road tanker.
- Static earthing provision will be made for tanker unloading.
- Earthed Flexible Steel hose will be used for solvent unloading from the road tanker.
- Fixed pipelines with pumps will be provided for solvent transfer up to Day tanks/reactors.
- Double mechanical seal type pumps will be installed.
- NRV provision will be made on all pump discharge line.
-

Table 6.11 Transportation, Unloading and Handling safety Measures

SR.NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	MITIGATION MEASURES
1	Transportation of Chemicals like Chlorine, Bromine and acids & Solvents by road tanker	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 • 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	Acids, Bromine and & Solvents Road tanker unloading at project site.	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 • 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. • Only day time unloading will be permitted.
3	Chlorine,	Leakage& Spillage,	• Check the source of leakage point.

	Bromine, fuels and acid & Solvents Storage tank safety	Fire, Explosion Toxic release.	• 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	Bromine and acid & 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	Transportation of Chemicals transfer from	Leakage, Spillage due to Line rupture, Flange Gasket	• Gravity transfer. • Total quantity of day tank material will be charged in to reactor at a

	Day tank to reactor.	failure, Fire, Explosion, Toxic release.	time. • Static earthing will be provided to storage tank. • Double Jumpers will be provided to pipeline flanges.

6.24. Emergency facilities

Emergency Management Planning (EMP) should be developed considering the likely hazards in the plant and sincerely implemented. Mock drills for various scenarios should be carried out and results of the drills should be recorded. Weal links in the mock drills should be strengthened.

Objectives

The Emergency Management Plan (EMP) is developed to make the best possible use of the resources available at SWAROOP and the nearby agencies to provide help/assistance in case of an emergency in the plant. The activities will include:

- Rescue the victims and give them the necessary medical attention in the shortest possible time.
- Safeguard other person (evacuate them to a safer place).
- Contain the incident and control it with minimum damage to human and life and property.
- Provide necessary information to families/relatives of affected persons, outside agencies including media and statutory bodies.

6.25. Emergency Management Plan [EMP]

SCPL is storing Chlorine ~ 30 tonners which is more than threshold limit as in Schedule 3 Part 1. As per these regulations occupier should prepare Emergency Management Plan and Safety report. The EMP and Safety reports should be regularly updated. SCPL should develop an Emergency Management Plan (EMP) and regularly carry out Mock drills to check the effectiveness of the EMP.

6.26. Disaster Management Plan

Disaster/ Emergency Management Plan is essential for a chemical plant as the processes adopted for manufacturing are classified under Factory Act as Hazardous due to handling and storage of toxic, flammable and explosive hazardous materials. Over the years, the chemical process plant has created adequate infrastructure and adopted risk mitigation measures to tackle any emergency that may arise during the manufacturing process. The important aspect in emergency planning is to control an emergency by technical and organizational means, minimize accidents and consequent losses. Emergency

planning also brings to light deficiencies, such as, lack of resources necessary for effective emergency response. It also demonstrates the organization's commitment to safety of employees and physical property as well as increases the awareness among management and employees.

Disaster Management Plan for the plant is necessarily a combination of various actions which are to be taken in a very short time but in a pre-set sequence to deal effectively and efficiently with any disaster, emergency or major accident with an aim to keep the loss of men, material, plant/machinery etc. to the minimum.

A major emergency in a hazardous chemical plant is one, which has the potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption of both inside and outside the plant. Sometimes, it would require the assistance of outside emergency services to handle it effectively. Although the emergency at the plant may be caused by a number of different factors, *e.g.* leakage of toxic and flammable materials from piping/tanks, total/partial power failure, earthquake or sabotage, it will normally manifest itself in fire/toxic release.

Primarily, DMP is prepared to furnish details which may require at the time of the emergency, to delegate responsibility, to estimate the consequences in advance and to prepare ourselves to control any type of emergency. The plan explains basic requirements as follows:

- Definition,
- Objectives,
- Organization set up,
- Communication System,
- Action on site,
- Link with Off-site Emergency Plan,
- Training rehearsal and record aspect.

6.26.1. Definitions

- Various definitions on different analogy used on On-site & Off-site Emergency Plan are as follows:
- **Accident:** An accident may be defined as “an undesirable and unplanned event with or without or major damage consequence of life and /or property.
- **Major Accident:** It is a sudden, unexpected, unplanned event resulting from uncontrolled developments during an industrial activity, which causes or has the potential to cause, death or hospitalization to a number of people, damage to environment, evacuation of local population or any combination of above effects.

- **Emergency:** This can be defined as any situation, which presents a threat to safety of person's or/and property. It may require outside help also.
- **Major Emergency:** Occurring at a work is one that may affect several departments within and/or may cause serious injuries, loss of life, extensive damage to properly or serious disruption outside the works. It will require the use of outside resources to handle it effectively.
- **Disaster:** Disaster is a sudden calamitous event, bringing great damage, loss or destruction.
- **Hazards:** Hazard may be defined as "the potential of an accident". Hazard exists in man and the system of materials and machines.
- **Chemical Hazards:** It is a hazard due to chemical(s) (including its storage, process, handling, etc.) and it is realized by fire, explosion, toxicity, corrosively, radiation, etc.
- **Risk*:*** Risk may be defined as the combination of consequence and probability or likelihood of an accident being caused in a given man-material – machine system.
- **On-Site Emergency plan:** It deals with measures to prevent and control emergencies within the factory and not affecting outside public or environment.
- **Off-Site Emergency plan:** It deals with measures to prevent and control emergencies affecting public and the environment outside the premises.

6.26.2. Objective of the Disaster Management Plan

The primary purpose of this Disaster Management Plan is to equip the Plant with required resources and information for prompt implementation of the set of actions to be undertaken in the event of an accident posing hazards to the people and community after commissioning of the plant.

The objective of Disaster Management Plan (DMP), for the plant is to be in a state of perceptual readiness through training, development and mock drills, to immediately control and arrest any emergency situation so as to avert a full fledge disaster and the consequence of human and property damage and in the event of a disaster still occurring, to manage the same to that the risk of the damage consequences to life and property are minimized and thereafter, proper rehabilitation, review and revisions of the DMP to overcome the shortcomings noticed are undertaken.

The DMP document is prepared keeping in view and to conform the requirements of the provisions of The Factories Act 1948 under section 41 B (4), Guidelines issued by the Ministry of Environment and Forests, Govt. of India and

Manufacture, Import and Storage of Hazardous Chemicals Rules, 1989 amended in 2000, Schedule 11 under Environmental Protection Act 1986.

- Following are the main objectives of the plan to:
  - Defined and assess emergencies, including hazards and risk
  - Control and contain incidents.
  - Safeguard employees and people in vicinity.
  - Minimize damage to property and/or the environment.
  - Minimization of risk and impact of event accident.
  - Preparation of action plan to handle disasters and to contain damage.
  - Inform employees, the general public and the authority about the hazards/risk assessed and to provide safeguard, and the role to be played by them in the event of emergency.
  - Be ready for 'mutual aid' if need arises to help neighbouring unit.
  - Inform authorities and mutual aid centres to come for help.
  - Effect rescue and treatment of casualties.
  - Effective rehabilitation of the affected persons and prevention of damage to the property.
  - Identify and list any fatalities.
  - Inform and help relatives.
  - Secure the safe rehabilitation of affected areas and to restore normalcy.
  - Provide authoritative information to the news media.

6.27. Emergency Organization

6.27.1. Incident Controller

Incident Controller's role will be to control the emergency at the incident site

6.1.1.2 Duties of Incident Controller

Incident Controller will proceed to the place of emergency after hearing siren/announcement. He will:

- Assess the scale of emergency and decide if a major emergency exists or is likely, accordingly activate emergency procedure.
- Immediately give his feedback to Emergency Control Centre (ECC) regarding emergency.
- Direct all operations within the area with following priorities.
  - Secure the safety of personnel
  - Minimize damage to plant property and environment.
  - Minimize loss of material.
- Direct rescue and firefighting operations till the arrival of the outside Fire Brigade, he will relinquish control to Sr. Officer of Fire Brigade.

- Ensure that the affected area is searched for causalities.
- Ensure that all non-essential workers in the affected area evacuate to the appropriate assembly point.
- Set up communication point to establish Radio/Telephone/Messenger contact as with emergency control centre.
- Pending arrival of works site controller, assume the duties of the post in particular to:
  - Direct the shutting down and evacuation of plant and areas likely to be threatened by emergency.
  - Ensure that the outside emergency services have been called in.
- Ensure that the key personnel have been called in.
- Report all significant development to the Site Main Controller.
- Provide advice and information, as required to the Senior Officer of the Fire Brigade.
- Preserve evidence that would facilitate any subsequent inquiry into the cause and circumstances of emergency.

- ***Dy. Incident Controller*** will carry out above said duties in absence of Incident Controller.

6.27.2. Site Main Controller

Site Main Controller will be overall in-charge of emergency organization:

6.1.1.3 Duties of Site Main Controller:

- Relieve the Incident Controller of responsibility of overall main control.
- Co-ordinate ECC or if required, security for raising evacuation siren and also all clear siren, in case emergency is over.
- Declaration of major emergency ensures that outside emergency services will be called and when required nearby firms will be informed.
- Ensure that key personnel will be called in.
- Exercise direct operational control on parts of the works outside the affected area.
- Maintain a speculative continuous review of possible development and assess these to determine most possible cause of events.
- Direct the shutting down and evacuation of plants in consultation with key personnel.
- Ensure causalities are receiving adequate attention; arrange for additional help if required. Ensure relatives are advised.
- Liaison with Chief Officers of the Fire and Police services for providing assistance in tackling the emergency.
- Ensure the accounting of personnel.
- Control traffic movement within the work.
- Arrange for a chronological record of the emergency to be maintained.

- During prolonged emergency, arrange for the relief of the personnel and provision of catering facilities.
- Contact the local office to receive early notification of impending changes in weather conditions, in case of prolonged emergency.
- Issue authorized statements to the news media and informs H.O.
- Ensure that proper consideration is given to the preservation of evidence.
- Control rehabilitation of affected areas after control of the emergency.

6.27.3. Other Key Personnel

The key personnel required for taking decision about further action for shutting down the plant, evacuate the personnel, and carry out emergency engineering works in consultation with Site Main Controller in light of the information received.

HOD's /Senior Managers/ Section Heads will be responsible for safety, security, fire, gas and pollution control, spillage control, communication system including telephone, wireless etc. Also medical services, transport, engineering, production, technical services, will form part of advising team.

Emergency Response Team

- The role of Emergency Response Team members is to actually combat the emergency at the site and control the emergency situation and carry out rescue operations.
- All team members will be thoroughly trained to deal with fires, explosions, chemical spills and atmospheric releases, first aid. As per priority list during emergency, the activities will be carried out as per emergency control plan.

Emergency Personnel's responsibilities Outside Normal Working Hours of the Factory.

- The duties of Shift In-charge & **team members** have been brought out in emergency control plan. **All team members** after evacuating the area shall report to ECC/ Incident Place. The non-essential workers shall be evacuated from the plants if need arises and this will be determined with the forcible rate with which incident may escalate. Non-essential workers shall assemble at the earmarked/specified point of assembly.

Assembly Points

At the proposed plan, at least 2 assembly points will be identified and marked properly.

6.27.4. Emergency Control Centre

It will be headed by Site Main Controller, HOD – PD, HOD- P&A and it is sited in **Office of Site Main Controller in Admin Building** & **New security office** (after office hours), which is readily accessible & with minimum risk, equipped with

telephone facilities and other announcements extra communications facilities needed. It has enough means to receive and transmit information and directions from site main controller to incident controller and other areas. In emergency control center due to its safer location and advantage of easier accessibility, all necessary personnel protective equipment's firefighting extinguishers will be stocked in sufficient quantity.

Role of Emergency Control Centre

- In case of mishap or accident like fire, toxic gas leakage, explosion in the factory, The Emergency Control Center will be Office of Head- Operations
- The plot plan indicating all the activities in the factory premises including that of storage's utility services, production area, administration, will be kept for ready reference, showing the location of fire hydrant and firefighting aids.
- Normal roll of employees, work permits, gate entries and documents for head count, employees blood group, other information and addresses will be available and the person, who will handle this operation will HOD P & A.
- Stationery required is available in the Control Centre (ECC) and HOD (P & A) looks after it
- The requirement of personnel protective equipment and other material, like torches, have been worked out and the quantity required during emergency will be kept in the Control Room (ECC). The responsible person for maintaining the said requirement/inventory will be HOD- HSE.

6.27.5. Fire & Toxicity Control Arrangements

- The plant will be well equipped with suitable numbers of firefighting and personnel protective equipment. The staff will be trained regularly to handle the various emergency situations.

6.27.6. Medical Arrangements

Availability of first aid facilities in sufficient quantity will be always ensured. In case of emergency arrangements will be made to avail outside medical help immediately. Emergency transport facility will be available.

6.27.7. Transport & Evacuation, Mutual Aid Arrangements:

- Transport & Evacuation and Mutual Aid arrangements will be available in the factory.

6.28. Communication System

6.28.1. Declaring the Emergency

In case of any emergency in the plant, speedy and effective communication of the same to all concerned in least possible time is the most important aspect of any emergency-handling plan. An early communication increases the chances of

control of emergency in the bud stage. Blowing siren will be adopted as method of communication of emergency, to all employees in the plant.

Types of Sirens

- Three different types of sirens have been identified for communication of emergency.
- **Alert Siren: *Single Continuous Siren for One Minute***. This indicates that there is some accidental happening in the plant. All have to become alert. Incident controller will be rush to the site of emergency. Plant area people have to start safe shut down. Rescue team and other emergency control teams have to reach at the site of emergency.
- **Siren for evacuation: *wailing & waning siren for three minutes***. This siren indicates that emergency is of serious proportion and everybody has to leave his work place. All people having their role in emergency control have to assume their assigned role. All non-essential workers have to proceed immediately to assembly area and wait for further instruction.
- **All clear siren: *Long continuous siren for two minutes***. This is a sign of return of normalcy. On hearing this siren everybody should go back to his or her respective workplace.

Location of Siren

- Siren will be located in center of the pant for wide coverage of the whole campus. Switch for siren will be provided at security gate. The switch at Security gate should be operated only as a general rule.
- Emergency manual call bell will be installed which will be used in case of total failure of electricity. It is responsibility of HOD (HSE) to maintain the upkeep of electric call bell and HOD- Security and administration to maintain manual and Hand operated siren.

Raising Alarm

- Any person noticing any emergency situation in the plant should immediately call security gate with following information:
  - Identify oneself
  - State briefly the type of emergency i.e. whether fire, explosion, toxic gas release etc.
  - Give the location of the incident
  - Estimated severity of the incident.
- Security personnel after ensuring genuineness of the call shall raise the ALERT SIREN. At the same time he will also contact the incident controller and ECC in order and inform about the incident. He will keep the gate open and rush his two security personnel at the site of emergency.

- ECC will be located at the office of Head- Operations on normal working hours and at Security gate after normal working hours (during night). ECC shall be immediately manned on hearing alert siren. If the authorized people to handle ECC are not available, any senior most people out of the available person nearby shall occupy ECC till authorized person comes.
- Incident controller, on hearing alert siren or by any other way of information of the emergency, will immediately reach at the site of incident and assess the situation. He will immediately give his feed back to ECC. ECC shall direct security gate to raise evacuation siren, if the need arise.
- SIREN FOR EVACUATION shall be raised on instruction from Site Main Controller or any Manager of the plant in the ECC.
- Security gate person will be authorized to raise ALL CLEAR SIREN on instruction from Site Main Controller or ECC, after the emergency is over.
- Incident controller shall assume the responsibility of site main controller in his absence

6.1.2. Internal Communication

- It shall be responsibility of ECC to communicate to all employees in the plant. They may take help of telephone operator for such communication. However, telephone operator can directly communicate information about emergency to all internal departments, if such message comes from incident controller or site main controller. Telephone operator will continue to operate the switchboard advising the callers that staffs are not available and pass all calls connected with the incident to ECC.

Availability of Key Personnel outside Normal Working Hours

- The details of key personnel availability after working hours will be made available at Security Gate, ECC, telephone operator as well as production units. Security personnel shall call required key personnel from their residence in case emergency occurs outside normal working hours. Availability of emergency vehicle / Ambulance will be ensured to fetch the key personnel residing outside. It will be the responsibility of HOD (P & A) to maintain it.

To the Outside Emergency Services

- Decision to call outside help to deal with emergency like fire brigade, ambulance, police, etc., shall be taken by Site Main Controller. However, in absence of Site Main Controller, if the incident controller realizes the situation going out of control, he may ask for immediate help from outside. ECC will be responsible for calling help from outside. A list of emergency services available in the area with their telephone numbers will be provided at ECC, at Security gate and with telephone operator. Facilities such as phones, emergency vehicle, and security personnel will be available to help calling outside emergency services and authorities.

6.1.3. Communication to the Authorities

- The emergency will be immediately communicated to the government officers and other authorities such as SPCB, police, district emergency authority, Factory Inspectorate, hospital etc. by Emergency Control Centre.

To Neighbouring Firms & the General Public

- In case of emergency having its outside impact, public will be cautioned regarding the same. Co-ordination of police will be sought for speedy action. This is to be ensured by ECC.

6.29. Pre-emergency activities

Internal Safety survey with regard to identification of hazards, availability of protective equipment's, checking for proper installation of safety devices will be carried out periodically.

- Periodic pressure testing of equipment
- Periodic pressure testing of lines.
- Periodic safety/relief valve testing
- Periodic fire hydrant system testing.
- Mock drill to check up level of confidence, extent of preparedness of personnel to face emergency is being contemplated.
- Regular training is being imparted to all personnel to create awareness.
- Adequate safety equipment will be made available.
- Periodic check-up of emergency lights.
- Safer assembly points will be identified.
- Storage of adequate first aid treatment facilities.
- Statutory information is imparted to workers.
- Post emergency activities:

Following post emergency actions will be carried out to study in detail and preventive measures to be taken.

- Collection of records.
- Inquiries
- Insurance claims
- Preparation of reports comprising suggestion and modification.
- Rehabilitation of affected personnel.
- Normalization of plant.

6.29.1. Evacuation and Transportation

- In case of emergency, evacuation and transportation of non-essential workers will be carried out immediately. The affected personnel will be transported for medical aid.

6.29.2. Safe Close Down

- During emergency plant shut down will be carried out if situation warrants. This will be as per the instruction of site main controller under guidance of incident controller.

6.29.3. Use of Mutual Aid

- Mutual aid agreement with nearby industries will be ensures to provide help to each other in the emergency,

6.29.4. Use of External Authorities

- As and when necessary, statutory authorities, police, pollution control personnel, medical aid/ center, ambulance etc. will be contacted.

6.29.5. Medical Treatment

- The affected personnel will be brought to safer place immediately to give them first aid. Immediate medical attention will be sought.

6.29.6. Accounting for Personnel

- Proper accounting for personnel will be laid down in all the shifts. The number of persons present inside the plant premises, their duty etc. will be available with the P & A. This record will be regularly updated and will be made available.

6.29.7. Access to Records

- The relatives of affected personnel will be informed. The details regarding all employees will be made available to Administration building.

6.29.8. Public Relations

- In case of emergency, Manager P & A will be available for official release of information pertaining to the incident.

6.29.9. Rehabilitation

- The affected area will be cleared from emergency activities only after positive ascertaining of the system in all respects. The entry to affected area will have to be restricted until statutory authorities visit and inspect the spot of incident. Nothing should be disturbed from the area till their clearance. The site main controller will be in charge of the activities to be undertaken.
- The plan will cover emergencies, which can be brought under control by the works with the help of emergency team/fire services. The DISASTER CONTROL PLAN for gas leak and fire will be prepared for entire factory.

6.30. Causes of Emergency:

6.1.4. Risk

Nature

- In the plant, the nature of dangerous events could be of the following:
  - FIRE : Chemical/Electrical
  - TOXIC RELEASE gas. : From chemicals & Chlorine

- LEAKAGES : Equipment, pipe lines, valves, etc.

- Release of vapors like chlorine / bromine gas or hexane can result in highly toxic environment or in fire or explosion.

- Improper handling of products (raw materials/finished products)
- Large spillage to ground floors resulting in pollution & fire.
- Failures of Equipment / Instruments.
- Release of safety valves or ruptures of vessels due to excessive pressures.

Various Emergency Actions

a. Onsite

- Safe shut down of the plant and utilities.
- Emergency control measures.
- To attempt with the help of trained crew in firefighting to contain the fire spread up/gas emission and limit within limited space.
- To cut off source of oxygen by use of firefighting appliances/to cut off source of gas emission.
- Cut off fall sources of ignition like electrical gadgets.
- To protect fire prone area from the fire.
- To remove material which can catch fire to the extent possible from fire prone area.
- Evacuation of non-essential persons.

b. Medical Facilities/Treatment

- The Plant will have a Health centre which is manned with trained male nurse on continuous basis who can render medical first aid. Doctor will visit two times a week for two hour each time. The Plant is searching for a full time medical officer and will appoint as and when available.
- Depending on seriousness the injured person shall be shifted to any other hospital.
- Vehicle will be available round the clock for transportation. Ambulance will be also made available in the campus on regular basis.

c. In the event of Fatal Accidents

- The information shall be given to following authorities:

- Inspector of Police
- Inspector of Factories
- Mamlatdar
- Corporate Office

- Regd. Office
- Insurance the plant
- Regional Officer, SPCB

d. Emergency Siren

- Emergency siren shall be blown for announcing the emergency which shall have different sound for identification/differentiation than the normally used for commencement of factory working etc.

• Location of Siren	Above Plant.
• Type of Siren	Industrial Siren
• Position of siren switch	Located at Main Gate

e. Seeking Help From Neighbouring Industries / Sources For Fire Engine

f. Advise for vacation of other areas

- Since the effect of fire/gas emission shall be contained within the area of the plant advice of vacation of other areas is not necessary.

Response Time-Minutes

Hazard	Fire Fighting	Police	Medical Services
Fire & Explosion	Immediate with whatever facilities available with the plant	10 minutes	10 minutes
	External Help within 15 minutes		

6.31. Off-Site Emergency Plan

6.1.5. Need of the Site Emergency Plan

- Depending upon the wind direction and velocity of the effects of accident in factory may spread to outside its premises. To avert major disaster it is essential to seek guidance/assistance of statutory authorities, police and health department. The movement of traffic may have to be restricted.
- Required information will be given to the authority and consultation will be sought for remedial measures.
- A purpose of the off-site emergency plan is:
- To provide the local/district authorities, police, fire, brigade, doctors, surrounding industries and public the basic information of risk and environmental impact assessment and appraise them of the consequences and the protection/prevention measures and to seek their help to communicate with public in case of major emergency.
- To assist district authorities for preparing the off-site emergency plan for district or particular area and to organize rehearsals from time to time and initiate corrective actions on experience.

6.31.1. Structure of the Off-Site Emergency Plan

- Available with concerned authorities.

6.31.2. Role of the Factory Management

- The site main controller will provide a copy of action plan to the statutory authorities in order to facilitate preparedness of district/area off-site emergency plan.

6.31.3. Role of Emergency Co-ordination Office (ECO):

- He will be a senior police or fire officer co-ordination with site main controller. He will utilize emergency control center.

6.31.4. Role of Local Authority

- Preparation of Off Site Plan lies with local authorities. An emergency-planning officer (EPO) works to obtain relevant information for preparing basis for the plan and ensures that all those organization involved in offsite emergency and to know their role and responsibilities.

6.31.5. Role of Fire Authorities:

- The fire authorities will take over the site responsibility from incident controller after arrival. They will be familiarized with site of flammable materials, water and foam applies points, firefighting equipment.

6.31.6. Role of the Police and Evacuation Authorities:

- Senior Police Officer designed, as emergency co-ordination officer shall take over all control of an emergency. The duties include protection of life, property and control of traffic movement.
- Their functions include controlling standards, evacuating public and identifying dead and dealing with casualties and informing relatives of dead or injured.
- There may be separate authorities/agencies to carry out evacuation and transportation work.
- Evacuation depends upon the nature of accident, in case of fire only neighboring localities shall be alerted. Whole areas have to be evacuated in case of toxic release.

6.31.7. Role of Health Authorities

- After assessing the extent of effect caused to a person the health authorities will treat them.

6.31.8. Role of Mutual Aid Agencies

- Various types of mutual aid available from the surrounding factories and other agencies will be utilized.

6.31.9. Role of Factory Inspectorate

- In the event of an accident, the Factory Inspector will assist the District Emergency Authority for information and helping in getting Neighboring Industries/mutual aid from surrounding factories.
- In the aftermath, Factory Inspector may wish to ensure that the affected areas are rehabilitated safely.

6.32. Mock Drills and Records

6.32.1. Need of Rehearsal & Training

- Regular training and rehearsal program of emergency procedures shall be conducted with elaborate discussions and testing of action plan with mock drill. If necessary, the co-operation/guidance of outside agencies will be sought.

6.32.2. Some Check Points

- The extent of realistic nature of incidents.
- Adequate assessment of consequences of various incidents.
- Availability of sufficient resources such as water, firefighting aids, personnel.
- The assessment of time scales.
- Logical sequences of actions.
- The involvement of key personnel in the preparation of plan.
- At least 24 hour's covers to take account of absences due to sickness and holiday, minimum shift manning.
- Satisfactory co-operation with local emergency services and district or regional emergency planning offices.
- Adequacy of Site.

6.32.3. Records and Updating the Plan

All records of various on-site and off-site emergency plans of the factory will be useful alone with those of the factors by which statutory authorities draw a detailed plan for the whole area/district. The records of the activity will be updated regularly.

6.33. Public Hearing

Public hearing was organized for 'M/s Swarup Chemicals Pvt. Ltd., for the Proposed Agrochemical and Intermediates Manufacturing Plant at B-15 to B-22 Phase-2, UPSIDC, Industrial Area Tehsil-Sandila, to obtain EC for the proposal as per the EIA Notification No. S.O. 1533, dated 14th September 2006 was conducted by UPPCB on 30th December 2017 at 12:00 a.m. regarding the proposal, Public Hearing meeting was started with the permission of Chairman.

Issues raised during the public hearing proceeding are presented with reply by Proponent / Consultant

S. No.	Name of the	Question / Issue	Answer

	Person		
1.	Shri. Vishnu Swarup Village Kalan, Sandila	He asked that the farmers can use the products/ chemicals in their Paddy and Wheat or not.	Dr. Ajay Bhatnagar G.M. of *M/s* Swarup Chemicals Pvt. Ltd. replied that all our products will be used in all cultivated crops i.e. fruits, vegetables, grains and other cultivated crops to protect from fungus and insects.
2.	Sri. Hans Ram, *Village Umartali, Sandila*	He asked about adverse impacts on the agriculture due to the proposed expansion project.	Representative of M/s EQMS India Pvt. Ltd., Delhi-92 as Environmental Consultant *Mr. Yashwant Bordia* replied that the chemicals (insecticides and fungicides) will be used to protect all the cultivated crops from fungus and insects resulting high crop production and economic growth of farmers.
3.	Shri. Suresh Singh, Village Katiyamau, Sandila	He asked about product impacts on earthworms as well as soil organisms in our agriculture fields.	Environmental Consultant *Mr. Yashwant Bordia* told that the land/soil will not be affected due to the application of chemicals on cultivated crops as the chemicals decomposed within the prescribed time period.
4.	Shri. Anurag Som, *Sandila*	He asked about impacts on the surrounding area people from Ash generated due to the proposed expansion project.	Environmental Consultant *Mr. Yashwant Bordia* replied that the generated Ash will be used in the landfill sites and proper ash disposal shall be done.
5.	Shri. Sudhakar Singh, *Atwa, Sandila*	He asked that, how we will came to know about advantage or disadvantage due to use of chemicals in cultivated crops.	Environmental Consultant *Mr. Yashwant Bordia* replied that the Pesticides / Insecticides are used in prescribed and fixed quantities and periodically which decomposed within the prescribed time period.
6.	Shri. Ishu Srivastava, *Sandila*	He asked that, who will inform the farmers regarding the quantities of Pesticides / Insecticides to be used, whether Industry or Government	Environmental Consultant *Mr. Yashwant Bordia* replied that both the Industry and Government will inform regarding the use of Pesticides / Insecticides through T.V. Programmes, by organizing camps and public meetings in the region. Information brochures also attached with the packets of chemicals containing all important information about the use of such chemicals and by reading and understanding that information, knowledge can be obtained.
7.	Shri. J. B. Singh, *Village Namvar,*	He asked that, which is the major chemical	Environmental Consultant *Mr. Yashwant Bordia* replied that no chemical gas will be

	Sandila	gas out of all products of the proposed production	produced from the proposed plant and if required, 'Scrubber' shall be installed for gaseous emission control.
8.	Shri. Arvind Kumar, *Village Jansar, Sandila*	He asked regarding the adverse impacts on fruit orchards and surrounding area people. He also told that the recently installed '*Pepsi Plant'* could not provide the employment to the local resident people.	Environmental Consultant Mr. Yashwant Bordia replied that the Pesticides / Insecticides are used in prescribed and fixed quantities and periodically which decomposed within the prescribed time period. He also suggested the people to meet with the industry management as per the requirement for skilled or unskilled staff for the new and proposed production unit. Project management should prefer the local people for providing the employment for the proposed unit because the staff hired from the far distances may create problems as they goes on leaves to their native places and the production work became affected and local people rarely goes on leaves for a long period.

Chairman/A.D.M. of district Hardoi also said to increase the knowledge about surrounding activities related to the industrialization, employment available in the project vicinity, so they can get the job opportunities in their nearby areas as the area wise District Hardoi is on third rank but least backward on development bases. In the district, Sandila is on high rank in comparison with Hardoi, may be due to installation of various industries. In U.P., / eastern part, of Lucknow, only district Hardoi is backward in the west and most of the districts of western U.P. are well developed due to industrialization. Except few (2/4) states in our country mostly are developed. There are various small countries in comparison to our country but are well developed. Only industrialization can developed the district due to the development of basic infrastructure. Unemployed people of the district will not go far from their home district for the employment, if such industrialization undertaken in the district.

Pollution control measures shall be adopted in the proposed expansion project activities and verified as per the prescribed standards by the State Pollution Control Board officials. This industrial project is agro-chemical based. Products of this industry shall be used to protect the cultivated crops from fungus/insects, so the crop yields will be increased.

At the end with the permission of Chairman Dr. Anant Prasad Dubey 'Assistant Scientific Officer, UPPCB' concluded the public consultation meeting.