CHAPTER 7
ADDITIONAL STUDIES

In order to support the Environment Impact Assessment and Environment Management Plan, following additional studies have been included in this report.

- Risk Assessment
- On-Site / Off-Site Emergency Plan
- Occupational Health Programme

7.1 INTRODUCTION TO RISK ASSESSMENT

M/s. Orgochem (Guj) Pvt. Ltd., Sachin will handles chemicals, some of which are hazardous in nature by virtue of their intrinsic chemical properties or their operating temperatures or pressures or a combination of them. Fire, toxic release or combinations of them are the hazards associated with industrial plants using hazardous chemicals. More comprehensive, systematic and sophisticated methods of Safety Engineering, such as, Hazard Analysis and Qualitative/Quantitative Risk Assessment have been developed to improve upon the integrity, reliability and safety of industrial plants, the same has been discussed in detail under their respective headings.

7.1.1 Objectives of Risk Assessment

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighbouring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

Risk assessment is carried out for the following objectives:

1. To identify hazard and risk resulting from the hazards
2. To study and foresee the effects of such risks on the workers, public, property and environment and to find out necessary control measures to prevent or minimize risk.
3. To comply the legal requirement by various safety and environment laws of the country like…

- The Factories Act, 1948 / The Gujarat Factories Act, 1963
- The Environment Protection Act and Rules, 1986
- Hazardous waste (Management & Handling) Rules, 1989
- Public Liability Insurance Act & Rules,1991
- Chemical Accident, (Emergency, planning, preparedness and response) Rules, 1996.

4. To get the necessary information for Emergency planning and evacuation.

7.1.2 Plant Layout

FIGURE 7.1 - PLOT PLAN OF M/S. ORGOCHEM (GUJ) PVT. LTD., SACHIN

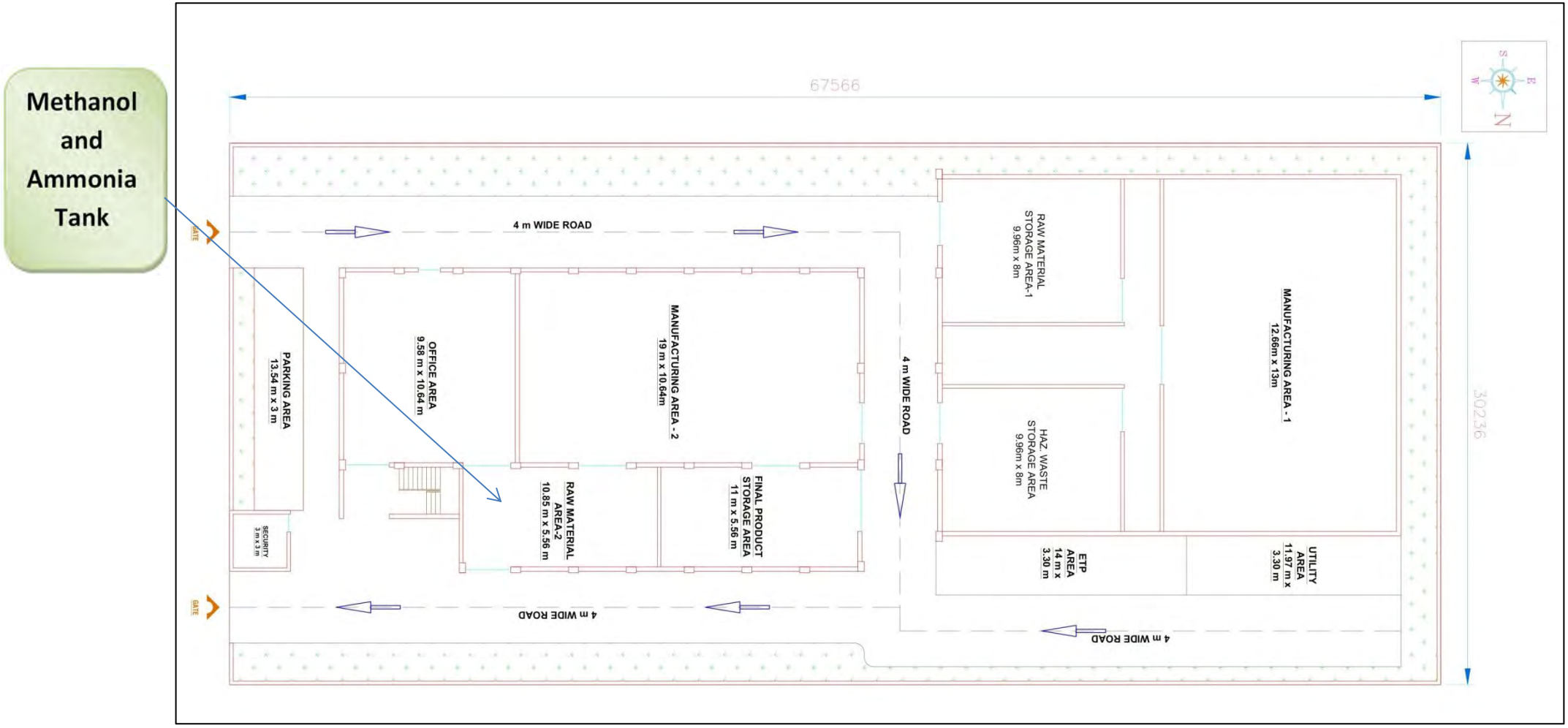


TABLE 7.1 (A) - STORAGE DETAILS OF RAW MATERIALS

SR. No.	NAME OF THE RAW MATERIALS	CAPACITY	MODE OF STORAGE	STATE	POSSIBLE TYPE OF HAZARDS	Proposed Control Measures
1.	Methanol	9MT	MS Tank	Liq.	• Flammable	• Proper storage area and dyke is provided. • PPEs like Splash goggles, Full suit, Vapor respirator or self-contained breathing apparatus, Boots, Gloves etc., are used while handling this chemical. Specialist will be consult, if required. • For detailed control measures & fire fighting facilities, refer section 7.5. • Self-contained breathing apparatus are used.
2.	Ammonia	9MT	MS Tank	Liq.	• Toxic	

NOTES:

1. Size of the biggest storage tank is 9MT and dyke of sufficient capacity i.e. 10% extra than tank capacity is provided.
2. The unit is classified as Non Major Accident Hazard (NMAH) unit based on the quantity of Hazardous Chemicals stored at site, as the quantity of these chemicals being stored within the factory premises are well within the threshold storage quantity as per schedules of Manufacture, Storage & Import of Hazardous Chemicals (MSIHC) Rules of major hazardous chemicals.
3. Considering the maximum quantity of the solvents mentioned in above table; PESO license is applicable for all the solvents falling under Class A, B, and C as per petroleum rules. PESO licence is not required for Ammonia as it is not considered petroleum products as per petroleum rules. PESO licence is for Methanol as it is considered petroleum products as per petroleum rules.

TABLE 7.1 (B) - PROPERTIES OF HAZARDOUS CHEMICALS (I.E. HAZARDOUS CHARACTERISTICS & TOXICITY)

Sr. No.	CHEMICAL	PHYSICAL STATE	FP (^oC)	BP (^oC)	SP. GR @ 20^oC	VAP. DEN. VS AIR	VAP. PR. @ 20^oC	LEL %	UEL %	LD_{50} ORAL MG/ KGS	LD_{50} DERMAL MG/KGS	LC_{50} MG/L	IDLH VALUE BY ACGIH/ NIOSH	STEL BY OSHA (PPM)	TLV-TWA BY OSHA (PPM)
1.	Methanol	Liq.	12	64.5	0.79	1.1	12.26 kPa	6	36	5628 mg/kg [Rat].	20 mg/kg (Rabbit)	64000 ppm (Rat)	200	310	200 ppm
2.	Ammonia	Liq.	NA	24.7-37.7	0.89	NA	287.9	-	-	350	NA	2000 ppm (rat, 4 hours)	300	35	25

7.2 RISK ASSESSMENT

Identification of hazards in the proposed project activity is of primary significance. Hazard states the characteristics of system/plant/process that presents potential for an accident. All the components of a system/plant/process are need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

IDENTIFICATION OF HAZARDOUS AREAS

At **M/s. Orgochem (guj) Pvt.Ltd. Sachin,** major risks will identify for the following areas:

- Raw Material Storage Area

As a conservative approach, **we will analyze the risk qualitatively and quantitatively for the same.**

In this study, we have considered the following:

- Storage & Handling of hazardous chemicals like Ammonia and Methanol have been considered for Consequence Analysis. Their storage location has been shown in Figure-7.1. Hazardous (physical & chemical) properties of the chemicals have been summarized in **Table 7.1B**.
- Storage & Handling Solid Chemicals, Acids and Caustic Lye have been considered for **Qualitative Risk Assessment**.

7.2.1 Qualitative Risk Assessment

Many a times Risk involved in various processes / process equipments cannot be addressed completely by Consequence Analysis. As a conservative approach, these risks have been considered separately under this topic. The approach is to identify hazards associated in operation of equipments as well as in processes, assessing its impacts, ranking the risk posed by it and finally to propose remedial actions/mitigation measures such that the risk is minimized to tolerable level.

The Risk Matrix presented below should be referred in evaluating this assessment.

In **Qualitative Risk Assessment,** risk has been analyzed using methodology called HIRA-Hazards Identification & Risk Assessment. In HIRA, major manual activities carried out by plant personnel as well as contract labors have been considered.

Qualitative Risk Assessment has been carried out for the following areas:

1. Storage & Handling of Solid Chemicals.
2. Storage & Handling of Acids.
3. Storage & Handling of Caustic Lye.

TABLE 7.2 - RISK MATRIX FOR QUALITATIVE RISK ASSESSMENT

LIKEHOOD/ PROBABILITY		SEVERITY				
		Catastrophic (Death/ System Loss)	Major/ Critical (Serious injury/ illness)	Moderate (Less Serious Injury/ illness)	Minor/ Marginal (Minor Injury/ illness)	Insignificant/Negligible (No injury/ illness)
		5	4	3	2	1
Almost Certain	5	**H**	**H**	**H**	**M**	**M**
Likely	4	**H**	**H**	**M**	**M**	**L**
Possible	3	**H**	**M**	**M**	**M**	**L**
Unlikely	2	**M**	**M**	**M**	**L**	**L**
iimpossible	1	**M**	**M**	**L**	**L**	**L**

TABLE 7.3 - RISK ACCEPTABILITY CRITERIA

Risk Range	Risk Acceptability Criteria	Remarks
H	Unacceptable/ High	Management's Decision/Action Plan Required. Potential off-site Impact.
M	Medium	Generally Minor Impact. Acceptable with Management's Review. Specific monitoring or SOP to be followed.
L	Low	Acceptable without Review. Manage through Routine Procedure.

7.2.1.1 STORAGE AND HANDLING OF SOLID CHEMICALS

TABLE 7.4 - [√] RISKS AND RECOMMENDATIONS:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			PROPOSED MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
1.	Handling Chemical bags	• Chemical Exposure. • Dusting.	• Skin/Eye irritation. • Ingestion & Inhalation of dust powder.	2	3	**M**	• PPEs like suitable protective clothing, gloves, face shield, dust and splash proof safety goggles; chemically resistant safety shoes, etc. will be used. • Standard Approved respirators will be used. • Eyewash station and safety showers will be made available. • Dust monitoring will be carried out periodically.	2	2	**L**	1. Operators/Workers to be trained for Safe Work Practices. 2. Chemical handling bags & dusty area to be labelled properly for each chemicals.

2.	Cleaning of Chemical Spillage.	• Fumes Inhalation. • Dust Exposure.	• Severe irritation to eyes, skin. • Inhalation.	3	3	**M**	• Certified Dust respirator shall be used. • PPEs are will be used. • Chemicals should be stored in isolated storage rooms having provision for natural & forced ventilation. • Spillage will be cleaned or neutralized with suitable media. • Fire fighting facilities will be made available near storage locations, if required.	2	2	**L**	

7.2.1.2 STORAGE AND HANDLING OF ACIDS

TABLE 7.5 - [√] RISKS AND RECOMMENDATIONS:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			PROPOSED MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
1.	Loading & Unloading of Acids.	• Exposure to Acid fumes due to leakage in pipe/container/valves etc. • Spillage of liq. Acid.	• Skin/Eye irritation. • Toxic Vapour inhalation etc.	2	3	**M**	• Loading & Unloading activity shall be carried out in well-ventilated area. • Neutralization media will be made available in areas where acid is stored/handled/used. • PPEs will be used.	2	2	**L**	
2.	Working in Storage Area.	• Exposure to acid fumes.	• Severe irritation to eyes, skin. • Body	2	3	**M**	• Storage area shall be well ventilated. • Dyke shall be	2	1	**L**	

			burns.				made. • Neutralization will be done immediately with soda ash/lime or spill shall be absorbed in sand or by suitable adsorbent. • PPEs like face mask, gloves etc. shall be worn by concerned person.				
3.	Tank overflow/leakage from joints etc.	• Exposure to acid fumes.	• Severe irritation to eyes, skin.	3	3	**M**	• Same as Above.	2	1	**L**	3. Work Instruction for checking tank level to be prepared and followed.

7.2.1.3 STORAGE AND HANDLING OF CAUSTIC LYE

TABLE 7.6 - [√] RISKS AND RECOMMENDATIONS:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			PROPOSED MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
1	NaOH handling /Loading & Unloading	• Exposure due to leakage from joints, corroded lines failure etc.	• Skin burn. • Eye irritation and respiratory disorder.	4	C	**M**	• Dyke will be made available. • NaOH will be stored in well-ventilated area. • Eye wash station will be available nearby. • Maintenance will be carried as per schedule. • PPEs will be used.	4	B	**L**	4. Proper trainings to be provided to the operators/workers. 5. SOPs to be prepared and followed the same. 6. Corroded lines to be painted/replaced.
2	Working in Storage Area	• Exposure due to spillage	• Severe irritation to eyes, skin etc. • Internal body burns.	4	C	**M**	• Neutralization media will be kept available. • PPEs like face mask, gloves etc. will	4	B	**L**	

							be worn by concerned person. • Eye wash station will be available nearby.				
3	Tank overflow	• Chemical Exposure	• Eyes and Skin irritation.	4	C	**M**	• Level indicator will be available and the same is checked for proper operation. • Dyke wall will be available to contain the spill.	4	B	**L**	7. Working of level gauge to be checked.

7.2.2 QUANTITATIVE RISK ASSESSMENT

Quantitative Risk Assessment (QRA) is a structured approach to identifying and understanding the hazards & risks associated with Storage and Handling of flammable/toxic chemicals. The assessment starts by taking into account an inventory of hazardous chemicals stored, likelihood of leakage/spillage associated with it and selecting the worst case scenario for consequence estimation.

Finally, suggesting the measures to minimize or mitigate risks to meet appropriate acceptability criteria. The planning for emergency evacuation shall be borne in mind whilst interpreting the results.

❖ CONSEQUENCE ANALYSIS

In a plant handling hazardous chemicals, the main hazard arises due to storage and handling of hazardous chemicals as mentioned above. If these chemicals are released into the atmosphere, it may cause damage due to resulting fires or vapour clouds. Blast Overpressures depend upon the reactivity class of material between two explosive limits.

❖ DAMAGE CRITERIA

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

1. Heat radiation, from a 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 as per the Guidelines for QRA – Phast (Micro) Software (DNV) & Purple Book for QRA released by Centre for Chemical Process Safety (CCPS).

Heat Radiation

The consequence caused by exposure to heat radiation is a function of:

- The radiation energy onto the human body [kW/m2];
- The exposure duration [sec];
- The protection of the skin tissue (clothed or naked body).

In this report following damage criteria has been considered for the effects due to Fire/Explosion.

TABLE 7.7- EFFECTS DUE TO INCIDENT RADIATION INTENSITY

INCIDENT RADIATION – kW/m^2	TYPE OF DAMAGE
37.5	Immediate ignition of wood (without flame Contact). 100 % fatal.
25	Minimum Energy required for igniting wood. (Without flame contact). 100 % fatal in 1 min. Significant injury in 10 sec.
12.5	Minimum heat required to ignite wood (With flame contact). 1 % fatal in 1 min. First. degree burn in 10 sec.
4	Pain after 20 sec. Blistering unlikely.
2	No discomfort for long exposure.

Explosion

In case of vapour cloud explosion, two physical effects may occur:

- A flash fire over the whole length of the explosive gas cloud;
- A blast wave, with typical peak over pressures circular around ignition source.

As explained above, 100% lethality is assumed for all people who are present within the cloud proper.

The following damage criteria may be distinguished with respect to the peak over pressures resulting from a blast wave:

TABLE 7.8- DAMAGE DUE TO OVER PRESSURES

Peak Overpressure	Damage Type
0.40 bar	Ear Drum Rupture to humans 50 % probability of fatality inside 15% probability of fatality in open
0.21 bar	Structural Damage to buildings 20% probability of fatality to personnel inside 0% probability of fatality in the open
0.13 bar	Minor Structural Damage to nearby structures 10% probability of fatality to personnel inside 0% probability of fatality in the open
0.02 bar	Glass Damage
0.01 bar	Minor Damage

Intoxication

In this report, IDLH & LC_{50} Concentrations have been considered for Consequence Analysis.

❖ ASSUMPTIONS FOR CONSEQUENCE ANALYSIS

For Consequence Analysis, assumptions regarding Meteorological, Pasquil Stability Classes, Wind velocity, Ambient Temperature, Relative Humidity, Inventory, Ground Roughness, Model used etc. are very important. In this report, the following assumptions have been considered.

i. Meteorological Data

- Atmospheric Conditions: No Inversion
- Ambient Temperature: 30°C has been considered as MCA approach.
- Relative Humidity: As the site is not in rainy zone RH of 50% has been considered.

ii. Pasquil Stability Classes

- Pasquil Stability category D/F is considered as conservative approach.

iii. Other assumptions:

- Ground Roughness: Ground Roughness has been considered as 0.3 M.
- Dispersion model of both Heavy Model and also Gaussian distribution have been used as applicable/appropriate.
- Inventory: Release of 100% of the inventory has been considered. For this, failure of the container has been considered from the bottom.
- Storage conditions: Storage conditions have been considered as they are practically stored at site.

Following Weather data has been used for the study:

TABLE 7.9 - WEATHER DATA USED FOR THE STUDY

WIND SPEED (M/S)	PASQUILL STABILITY
1.5	F
1.5	D
5	D

❖ SOFTWARE USED FOR CALCULATIONS

1. PHAST MICRO

❖ SCENARIOS CONSIDERED FOR CONSEQUENCE ANALYSIS

1. In this study, the scenarios for consequence analysis have been selected considering:

- The physical and chemical properties of hazardous materials.
- Storage conditions & Modes of Storage (Above ground Tanks).
- Hazards ranking by NFPA.
- Guidelines by OSHA (29 CFR).
- Operating and storage conditions of handling and storage of hazardous chemical.

2. This report considers the worst case scenario which is possible during any set of operation variable and production methodologies. 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.

3. Identification of solvents/chemicals to be considered for Consequence Modeling:
   Out of all the chemicals and solvents being handled and used within the site; most hazardous chemicals have been identified based on their properties like flash point, LEL & UEL Limits and NFPA rating. The results, outcomes, effects and recommendations suggested for these chemicals will be applicable for all the other chemicals which are less hazardous in nature

In this regard, **the failure cases which may lead to release of hazardous chemicals are as under, out of which maximum worst case shall be considered:**

- Failure of unloading arm of the ISO tanker during unloading of solvents,

4. The scenarios of flammable solvent storage tanks (if it is stored in tanks) have been considered assuming unavailability of bunds. Practically a bund shall be provided as per OISD guidelines.

5. In this study, results of consequence analysis shall be used for;

- Emergency Planning
- Deciding Evacuation Routes
- Deciding Location of Assembly Points and ECC
- Resource Allocation for mitigation

TABLE 7.10 - SCENARIO IDENTIFIED FOR CONSEQUENCE ANALYSIS

Scenarios	Description of Scenario	Storage Pressure & Temp.	Scenarios considered
FIRE SCENARIOS			

1.	Release of Methanol	Ambient	Flash Fire, Late Pool Fire
TOXIC SCENARIOS			
2.	Release of Ammonia	Press.: Atm.; Temp.: 30 deg.C	Dispersion

❖ **Considerations Made:**

- In **Case of Solvents Methanol** we have considered the failure case of unloading line (2" i.e. 50 mm pipe dia.) during the unloading of these chemical from the tank for a period of 10 mins. As the solvent tanker is compartmentalized, the maximum release quantity equals the storage quantity of a single compartment.

- In Case of Dispersion for **Ammonia**, we have considered the following scenarios:

✓ Leak from 50 mm hole size for LC50 (2000 ppm) concentration.
✓ Leak from 50 mm hole size for IDLH (300 ppm) concentration.

Note: Release of above chemicals from process equipments like Reactor or any other equipment is not possible as these chemicals will be in diluted/intermediate form in all process equipments and not in pure form.

❖ **Selection Criteria of Scenarios:**

- As per the relevant guidelines for consequence analysis, we have considered the maximum credible scenarios for all the above mentioned chemicals, which is the representative of all kinds of minor/major leakages for the respective chemicals.
- Modelling has been carried out for dispersion up to IDLH concentration, in case of toxic chemicals. Evacuation should be carried out in less than 30 min from the areas covered under IDLH in case of relevant leakage scenario. The purpose is to avoid irreversible health effects to persons inside the area of IDLH concentration.
- Based on the above considerations and the input parameters considered for worst case scenarios & maximum credible scenarios, the risk contours are plotted on the plant layout map clearly showing which of the facilities would be affected in case of an accident taking place. Based on the same the safety measures/recommendations are proposed and On-Site & Off-Site Emergency Plan shall be prepared as mentioned under the section 7.5. Competency.
- The worst-case scenario has taken into account the maximum inventory of storage at site at any point of time.

TABLE 7.11-SCENARIO # 1 – RELEASE OF METHANOL

Basis: Possible Release/Leakage due to failure of Unloading Arm of Tanker.

Input Data

Leak Size Considered	50mm
Release rate	1.04639 kg/s
Release Duration	600 s
Pressure	Ambient
Temperature	30 ° C
Weather Condition	1.5/F, 1.5/D, 5/D
LFL	73000
UFL	360000

CASE:1 FLASH FIRE

			Distance (m)		
			Category 1.5/F	Category 1.5/D	Category 5/D
Furthest Extent	36500	ppm	4.21789	3.1513	2.18971
Furthest Extent	73000	ppm	1.9794	1.94837	2.18108

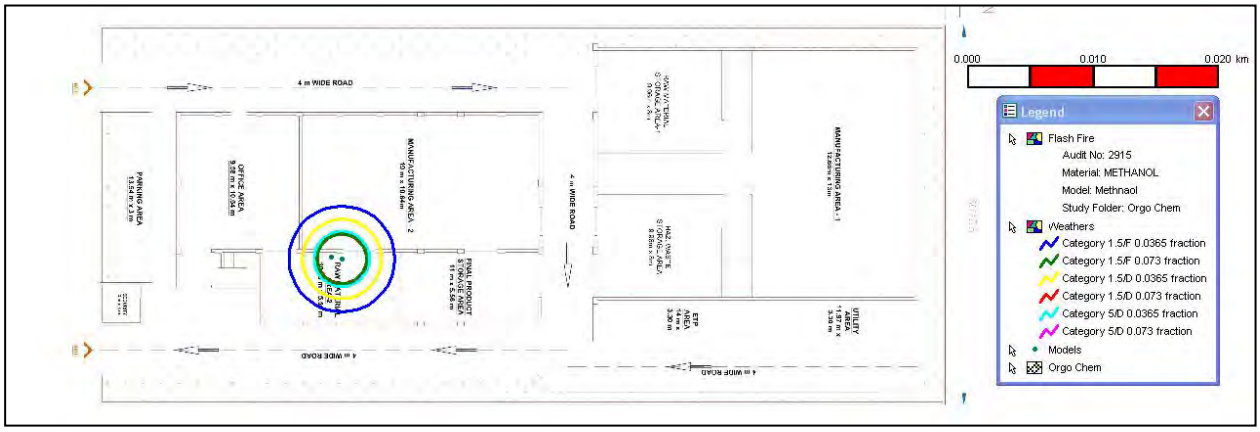
CASE:2 VAPOUR CLOUD EXPLOSION (OVERPRESSURE RESULTS)

Not Reached

CASE:3 LATE POOL FIRE (EFFECTS OF RADIATION LEVEL)

			Distance (m)		
			Category 1.5/F	Category 1.5/D	Category 5/D
RadiationLevel	4	kW/m2	16.2748	16.244	16.0928
RadiationLevel	12.5	kW/m2	10.929	10.8982	11.4931
RadiationLevel	25	kW/m2	8.79195	8.76111	9.52721
RadiationLevel	37.5	kW/m2	7.62334	7.5925	8.63904

Risk Contours for Flash Fire:



Risk Contour for Late Pool Fire:

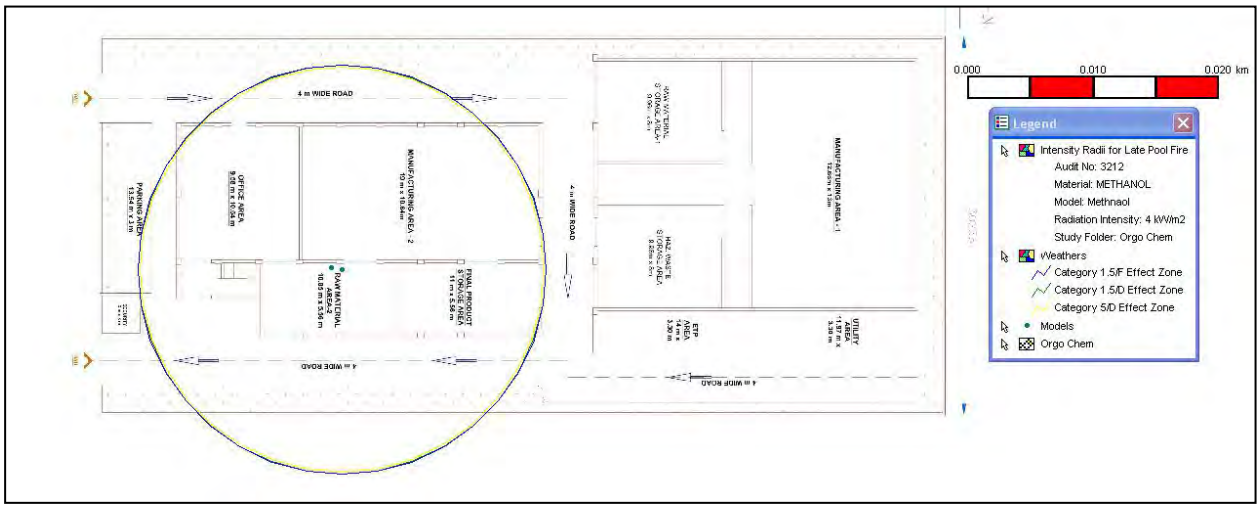


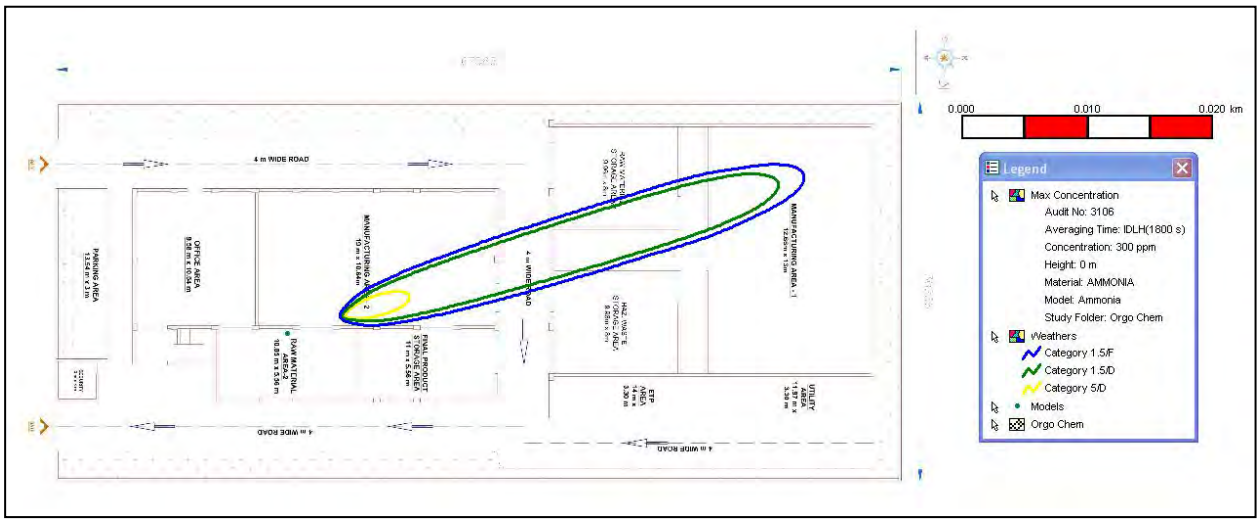
TABLE 7.12-SCENARIO # 2 – RELEASE OF AMMONIA

Basis: Possible Release/Leakage due to failure of Unloading Arm of Tanker.	
Input Data	
Leak Size Considered	50 mm
Release rate	1.4466 kg/s
Release Duration	600 s
Pressure	1 Bar
Temperature	Ambient
Weather Condition	1.5/F, 1.5/D, 5/D
IDLH	300 ppm
LC50	2000 ppm

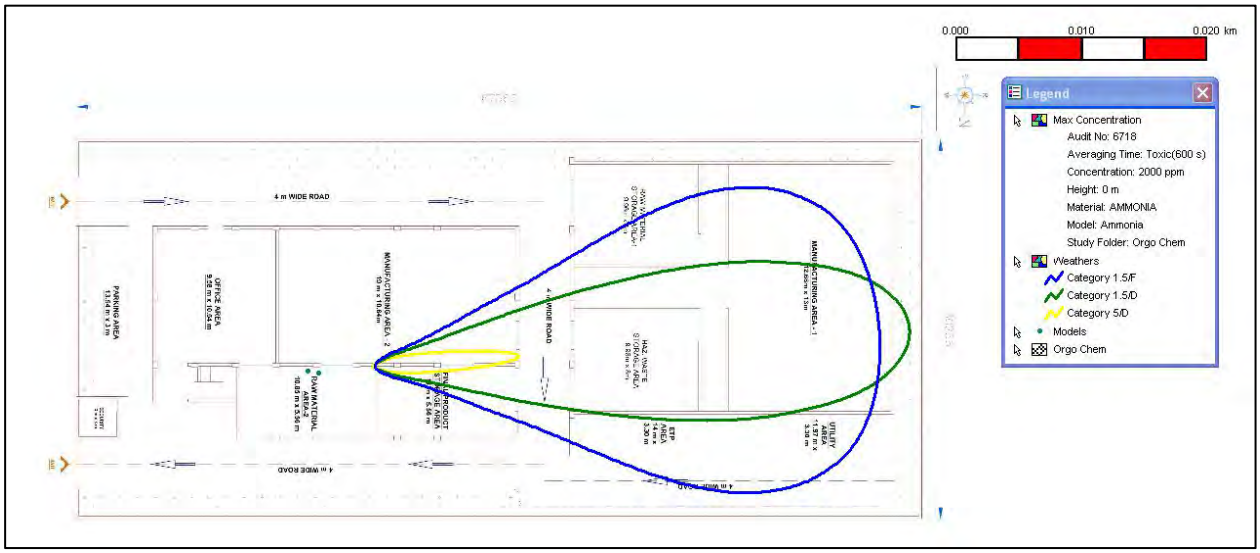
TABLE 7.13-RESULTS

Sr. No.	**Concentration**	**Downwind Distance (meters)**		
		Category 1.5/F	**Category 1.5/D**	**Category 5/D**
1	LC_{50} (2000 ppm)	46.39	48.58	17.04
	IDLH(300 ppm)	34.72	31.60	Not Reached

Risk Contours for IDLH Concentration:



Risk Contours for LC_{50} Concentration:



❖ CONSEQUENCE ANALYSIS SUMMARY

TABLE7.14 - FLASH FIRE SCENARIOS

SR. No.	Scenario	Concentration (ppm)	Distance (meters)		
			Category 1.5/F	Category 1.5/D	Category 5/D
1.	Release of Methanol	LFL Frac.36500	4.21	3.15	2.18
		LFL. 73000	1.97	1.94	2.18

TABLE 7.15 – LATE POOL FIRE SCENARIOS

SR. No.	Scenario	Radiation Level (KW/m^2)	Downwind Distance (meters)		
			Category 1.5/F	Category 1.5/D	Category 5/D
1	Release of Methanol	4	16.27	16.24	16.09
		12.5	10.92	10.98	11.49
		25	8.79	8.76	9.57
		37.5	7.62	7.59	8.63

TABLE 7.16 - TOXIC SCENARIOS

Sr. No.	Concentration	Downwind Distance (meters)		
		Category 1.5/F	Category 1.5/D	Category 5/D
Ammonia				
1	LC_{50} (2000ppm)	46.39	48.58	17.04
	IDLH(300ppm)	34.72	31.60	Not Reached

7.3 COMMENTS / RECOMMENDATIONS BASED ON CONSEQUENCE ANALYSIS

Flash Fire, UVCE and Late Pool Fire Scenarios:

- In case of release of Methanol vapour travels to the farthest distance (4.21m) in 1.5/F weather condition. In case of release of Methanol vapour travels to the farthest distance (16.27 m) in 1.5/F having radiation level 4 Kw/m2.
- Evacuation plan to be designed considering the worst case scenario of Methanol as mentioned above.

Toxic Release Scenarios:

- Dispersion of Ammonia covers more distance in case of LC50 concentration (2000 ppm) that is 48.58mts in 1.5/D weather condition.
- Evacuation plan to be designed considering the worst case scenario of the same.

Recommendations:

- Evacuation routes shall be planned such that alternate route is available from any corner in more than one direction.
- Extra precautions to be taken in unloading of flammable/toxic chemicals. The details of precautions during storage handling and transportation of chemicals have been given in separate paragraph.
- Firefighting arrangements shall be provided as per the appropriate guidelines.
- Hazard Identification Studies like HAZOP, HAZAN, Fault tree analysis, Event tree analysis, Checklist Audit etc. will be carried out (if required) for safe operation of plant.
- Safety audit (i.e. Third Party Safety Audit as per IS: 14489) and its Compliance shall be carried out as per the frequency decided by the management. Audit is an important tool to identify organizational & operational safety policy, and practices, plant conditions or operating procedures that could lead to an accident and significant losses in life or property and their effectiveness against accident preventative program.

Storage Location:

Storage location for flammable solvents must be kept separate and away from plant, boiler, DG Set or any other source of ignition. The storage to be done in accordance with the guidelines of PESO mentioned below:

Guidelines for storage of petroleum products as per PESO:

- Precautions against fire.

- No person shall smoke in any installation, storage shed or service station saves in places specifically authorized by the licensing authority for the purpose.
- No person shall carry matches, fuses or other appliances capable of producing ignition or explosion in any installation or storage shed, which is used for the storage of petroleum.
- No fire, furnace or other source of heat or light capable of igniting inflammable vapour shall be allowed in any installation, storage shed or service station save in places specially authorized by the licensing authority for the purpose.
- An adequate number of portable dry chemical powder or any other fire extinguisher capable of extinguishing oil fires shall always be kept in every storage shed and small class B or C installations at strategic point and all persons employed at such locations shall be conversant with the use of such fire extinguishers.
- Supervision of operations within an installation, service station or storage shed. –
- All operations within an installation, service station or storage shed shall be conducted under supervision of an experienced responsible agent or supervisor who is conversant with the terms and conditions of the licence held for the installation, service station or storage shed as the case may be and those persons should have proper safety training.
- Cleanliness of installation, service station or storage shed. – The ground in the interior of an installation or service station and the protected areas surrounding any installation, service station or storage shed shall be kept clean and free from all vegetation, waste material and rubbish.
- Drainage. –
- All enclosures surrounding above ground tanks in an installation shall be provided with proper drainage facilities in such a way that no water is allowed to accumulate in the enclosures.
- No part of the enclosure referred to in sub-rule (1) shall be below the level of the surrounding ground within the protected area.
- Where drainage is affected by means of a pipe, the pipe shall be fitted with a valve which is capable of being operated from the outside of the enclosure.
- All valves and other opening for draining off water shall be kept closed except when water is being drained off.
- The nature of the drainage arrangements and the position of all openings and valves therein shall be shown in the plan/layout.

7.4 OTHER SAFETY PRECAUTIONS / RECOMMENDATIONS

7.4.1 SAFETY/CONTROL MEASURES TO REDUCE the risk of fire, explosion and toxic release:

Following **Mitigation Measures** are followed /practiced and same shall be updated during **transportation, unloading and handling of flammable & toxic chemicals,** in order to **ensure health & safety of workers involved in handling of hazardous chemicals** and to avoid the human health impacts.

TABLE 7.17-SAFETY PRECAUTIONS

Sr.	ACTIVITY	SAFETY PRECAUTIONS
1	Transportation of Chemicals by road truck.	• Training is given to driver and cleaner regarding the safe driving, hazards of chemicals, emergency handling, and use of SCBA sets. • TREM card is kept with TL. • SCBA set is kept with TL. • Fire extinguishers are kept with TL. • Flame arrestor is provided to TL exhaust. • Instructions are given not to stop road tanker/truck in populated area. • Hazard Identification symbol and emergency telephone number are displayed as per HAZCHEM CODE. • Appropriate PPEs are kept with TL.
		In case of leak or spill: • Source of leakage are checked. • Damaged containers or spilled material are not attended without wearing appropriate protective clothing. • Leak is stopped, if possible to do so without risk. • Water spray is used to reduce vapours (but do not put water directly on leak, spill area or inside container). • Combustibles (wood, paper, oil, etc.) are kept away from spilled material.
2	Unloading of Chemicals from tanker/truck.	• Priority is given to Tanker/truck to immediately enter the storage premises at site and shall not be kept waiting near the gate or the main road. • Security person checks License, TREM CARD, Fire extinguisher condition; SCBA set condition, Antidote Kit, required PPEs as per SOP laid down. **Following precautions are taken during unloading:** • Wheel stopper is provided to TL at unloading platform. • Static Earthing is provided to road tanker. • Tanker unloading procedure is followed according to check list and implemented strictly. • Flexible SS hose connection is done at TL outlet line. • All TL valves are closed in TL.

		• Only day time unloading is permitted.
3	Chemicals Storage Area safety.	• Pipes and equipment are inspected at regular intervals. • All storage areas are isolated from all sources of open flame and well posted with "Hazardous Chemical Storage", "No Smoking", "Hot work Restricted" and provided with adequate fire fighting/extinguishing systems. • Spark-resistant tools are used. • Water spray is used to reduce vapours (but do not put water directly on leak, spill area or inside container). • Combustibles (wood, paper, oil, etc.) are kept away from spilled material. • Flame arrestors and breather valve has been provided for solvent storage tanks. • Dyke wall is provided to storage tanks. Separate area has been provided for drums storage. • Level transmitter is also available with low level/high level auto cut-off provision. • Vents are connected to water trap and vent of water trap are provided with flame arrestor. • Fire hydrant monitor with foam attachment facility is available. • Dumping /Drain vessel/alternate vessel shall be made available to collect the spillage material inside the dyke wall. • FLP type pumps shall be provided. • Flame proof electrical fittings are available. • Double static earthing shall be provided to storage tank as well as day tank, as per the requirement. • Double Jumper clip shall be provided to all solvent handling pipeline flanges.
4	Chemicals transfer from storage areas to Process Plant.	• Double mechanical seal type FLP type pump shall be provided. • Flame arrestor with breather valve shall be provided on vent line. • Lightening arrestor is provided on the top of tallest structure. • Over flow system shall be provided for additional safety and it is connected to main storage tank. • NRV's shall be provided on pump discharge line. • Double Jumper clip shall be provided to all solvent handling pipelines.

7.4.2 FIRE CONTROL PLAN

M/s. Orgochem (guj) Pvt.Ltd. Sachin has considered fire prevention measures at the project planning stage to avoid any outbreak of fire by looking to the hazardous nature of process and the chemicals that are handled and processed, the chances of outbreak of fire cannot be totally ignored. Hence to tackle such a situation, company has planned to develop a well- resourced and adequate fire protection system/fire fighting network.

The company has planned to keep the different types of fire extinguishers at various conspicuous locations.

Other details on Fire Control Plan and same shall be updated for proposed facility if required:

- Fire fighting facilities will have two main pumps, two standby pump, jockey pump and fire water reservoir will be installed as per the GFR and TAC guidelines, the same shall be updated for new facilities, if required.
- Fire Extinguishers like DCP, Carbon Dioxide & Foam types should be provided as per the GFR and TAC guidelines, at conspicuous locations.
- Other Fire fighting facilities like, fire monitor, foam trolley, fire hose boxes with hose pipe, sand buckets, fire blanket, Jumbo bags, Water Jet Fire Blanket, etc. should be provided within the company at conspicuous locations.
- Working staff will be given training on how to operate DCP and CO2 extinguishers.
- The Fire Hydrant Network shall be installed; capacity of the same shall be updated after the for new facilities, if required.
- Emergency Action Team members will be working round the clock in all shifts.
- First aid would be made available round the clock in all shifts of all plants / sections.
- Rescue kits with SCBA sets will be available at site to treat with any kind of chemical emergencies.
- Volume level indication with alarm and trips for high level will be provided for vessels containing flammable materials.
- DG Set should be made available for power backup.

7.4.3 DO'S & DON'TS

Management has listed some of the Do's & Don'ts activities to strengthen the **SAFETY AT WORK**, which will be followed strictly:

For Preventive Maintenance

Do's:

- Inspection of Storage Area, Earthing & Bonding system.
- Inspection of all Fire Fighting Facilities /Check Alarms operation.
- Ensuring that operators/workers etc. follows the SOPs, Safety procedures & standards, work permit system etc.
- Checking the availability of Spill Containment Kit.
- Make sure fire extinguishers are fully charged and ready for action.
- Inspections of plant, machinery, tools, equipment, premises, work practices, processes, procedures and general environment must be carried out for the health and safety of plant, people and surrounding.
- On-site and Offsite Emergency Plans shall be reviewed and updated, as per the requirement.

Don'ts:

- Don't allow anyone who hasn't received specific safety and operational training to get indulge in any site activity.

- Don't perform your own maintenance.
- Don't compromise on Design and Engineering part.
- Don't perform any activity without proper permit.
- Don't panic if you are in a risky situation.
- Don't allow spilled chemicals to drain to sewers/gutters etc.

Strengthening of HSE (Applicable for Manufacturing Utility Staff)

Do's:

- Follow instructions. Do not take chances. If you don't know, ask.
- Correct or report unsafe conditions.
- Include a timeline for completion of each recommendation.
- Make recommendations that are measurable and track able.
- Ensure that each recommendation is assigned to an individual to oversee implementation.
- Help keep things clean & orderly. Keep gangways clear.
- Do not Horseplay. Do not run. Avoid distracting others. Avoid throwing things.
- Report all injuries. Get first aid promptly.
- Use, adjust and repair equipment only, when authorized.
- Use right tools & equipments for the job, use them safely.
- Do not smoke in restricted areas. Do not flick cigarette / beedi in company.
- Use prescribed protective equipment; keep them in good working conditions.
- Respect signs / warnings. Abide by rules laid down for your safety.

Don'ts:

No worker in a factory-

- Shall wilfully interfere with or misuse any appliance, convenience or other thing provided in the factory for the purpose of securing the Health, Safety or Welfare of the workers therein:
- Shall wilfully and without reasonable cause do anything likely to endanger himself or others; and
- Shall wilfully neglect to make use of any appliance or other thing provided in the factory for the purposes of securing the Health or Safety of the workers therein.
- Do not make vague statements, do not overrule supervisor, do not adopt shortcuts.

7.4.4 ANTIDOTES DETAILS:

The appropriate antidotes for the hazardous chemicals for the facility are available at site and the same shall be updated & kept available.

Following Antidotes for major hazardous chemicals are kept available at the site.

TABLE 7.18-ANTIDOTES/ MEDICAL TREATMENT

Chemical	Antidote / Medical Treatment

Methanol	• Ethanol (30% solution from inside, 5% solution from outside i.e. by intravenous injection), Epicake Syrup. • In case of acidosis give Sodium bicarbonate. • In case of delirium give Diazepam 10 mg. by intravenous injection. • Folinic acid (Leucovorin), 1 mg/kg, iv, 4 hourly.
Ammonia	• If skin is affected then wash with plenty of water for 15 min. and then wash with dilute lactic acid and apply soframycin cream. • If eye is affected, then wash by eye fountain with plenty of water for 15 min. Put one drop of 0.4% Benzocaine (Novocaine) solution in eye. Boric or lactic acid solution eye drops can also be given, • If entered in throat, then give smell through cotton dipped in ethanol or ether through nose. • Administer oxygen in case of breathing difficulty.

7.4.5 WAYS TO MINIMIZE THE MANUAL HANDLING OF THE HAZARDOUS CHEMICALS

1. Fork lifts are used for unloading chemical barrels/carboys, their movements within plant, handling carboys, bulk chemical bags, etc.
2. Cranes, hoists, pallet trucks, conveyors, etc. are used as per the requirement, to eliminate manual handling.
3. Lifting tools & tackles are used, wherever required.
4. SOPs, work instructions are prepared and followed.
5. Trainings are provided to relevant staff, operators, workers for the risk associated with manual handling of hazardous chemicals, ways to overcome those risk, etc.

7.4.6 SAFETY PRECAUTIONS FOR AMMONIA

- In event of a spill or leak, escape-type respirator shall be used.
- Non-sparking ventilation systems and intrinsically safe electrical systems shall be used.
- An automatic leak detection system shall be used.
- Water Sprinklers shall be checked for its proper working condition.
- HCl torch shall be made available to be used for the detection of ammonia leakage.
- Safety warning postures/signs shall be displayed inside the area.
- A dead-end siding shall be provided to limit the movement of tankers while storage and handling.
- Excess-flow protection valves shall be provided in the distribution lines.
- Antidotes (Skin): Wash with Lactic Acid, Apply soframycin, (Eye): Benoxynate , (Throat) :Smelling Ethanol or Ether.
- Name plate shall be provided for electrical fittings.

7.4.7 SAFE OPERATING PROCEDURE

- SOP is a procedure which is specific to the operation that describes the activities necessary to complete tasks in accordance with industrial activities.
- SOP shall be well prepared, documented and displayed in local language.
- SOPs like Raw Material Charging, Operation of APCM and Operation in utilities already being followed.
- Some of the following SOPs will be prepared on need basis:

- Raw material Charging
- Loading & Unloading Activities
- Pre Start Up Safety Review (PSSR)

7.5 ON-SITE AND OFF-SITE EMERGENCY MANAGEMENT PLAN

M/s. Orgochem (guj) Pvt.Ltd. Sachin shall prepare the **Proposed On-Site / Off-Site Emergency Plan** which shall be followed from the project construction & erection phase.

The purpose of this plan is to provide **M/s. Orgochem (guj) Pvt.Ltd. Sachin,** with the means to effectively utilize all the resources at its disposal for the protection of life, environment and property.

The details of the same are discussed in the following sections.

7.5.1 DEFINING THE NATURE/LEVEL OF EMERGENCY

THE LEVEL OF EMERGENCY CAN BE CLASSIFIED IN THREE CATEGORIES:
LEVEL - 1:

The leakage or emergency, which is confinable within the plant/area which may arise due to:

- Small pipe/valve rupture or similar leakages that do not affect outside premises.
- Release of toxic chemicals for short duration.
- Small fire in the plant.

LEVEL - 2:

The emergency, which is confinable within the factory premises which may arise due to -

- Leakage of toxic chemicals for long duration.
- Medium scale explosion confined to the factory premises.
- Medium scale fire inside the factory premises.

LEVEL - 3:

The emergency, which is not confinable within the factory premises and general public in the vicinity are likely to be affected. It may arise due to -

- Heavy / Profuse leakage of toxic / flammable gases for a long duration.
- Explosion of high magnitude affecting the adjacent area.
- Major fire inside the factory premises.

7.5.2 OBJECTIVES OF EMERGENCY MANAGEMENT SYSTEM

The objectives of the emergency management system are summarized as under.

- To identify and assess types of emergencies due to different types of hazards.

- To work out plan with all provisions to handle emergencies and safeguard employees and people in the vicinity of the factory.
- To provide for emergency preparedness and the periodical rehearsal of the plan.
- To plan mode of proper communication and actions to be followed in the event of emergency.
- To keep all necessary information with respect to hazard/accident control and emergency contacts in one document for easy and speedy reference.
- To inform employees, general public and the authorities about the hazards/risk if any and the role to be played by them in the event of emergency.
- To control and contain the accident.
- To effect rescue and treatment of casualties.
- To inform and help relatives of casualties.
- To secure rehabilitation of affected area and restore normalcy.
- To provide information to media and government agencies.
- To preserve record, equipment etc. for investigating cause of emergency.
- To be ready for "mutual aid" if need arises to help neighbouring units.

7.5.3 STRUCTURE OF EMERGENCY MANAGEMENT SYSTEM

M/s. Orgochem (guj) Pvt.Ltd. Sachin, shall develop an Emergency Management Team. The management structure shall include the following personnel's;

- Site Main Controllers.
- Incident Controllers and Deputy Incident Controllers.
- Key Personnel's.
- Essential Workers.

The other elements of Emergency Plan shall be:
- Assembly points.
- Emergency control centre.
- Fire control arrangements.
- Medical arrangements.

❖ **SITE MAIN CONTROLLER**

Senior most Executives (i.e. Director& Supervisor) of the company shall be nominated as SMC. 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:

- Immediately on being informed of the emergency and its location, will arrive at the site, review the situation and control further actions.
- Direct all Emergency Operations within the approved area with the following priorities:

a. Personnel Safety,
b. Plant, Property and Environment Safety and
c. Minimum loss of production.

- 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 and if necessary, instruct the supervisor / security personnel to evacuate that area.
- 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 is 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 cross-checking 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.

❖ ROLE OF INCIDENT CONTROLLER AND DEPUTY INCIDENT CONTROLLER

His primary duties shall be 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 will take the charge of incident controller, if he is not available due to any reason. They will be always available in each shift and can take charge of the incident.

Responsibilities/Duties of Incident Controller and Deputy Incident Controller:

-
- Managers connected with Plants/the respective Plant-In-Charge from each shift have been designated as I.C.
- Two Production officers in each shift will be identified as Deputy Incident Controllers.
- He shall take charge at the scene of incident.
- He shall immediately assess the gravity of risk and alert panel and field operators to start controlling their respective section.
- He will work under the direction of the SMC, but till his arrival he may have to execute following responsibilities.
- He will 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.
- Preserve evidences. This will be necessary for investigation for cause and concluding preventive measures.

❖ KEY PERSONNELS

Senior officers of various departments like Fire, Security, Safety, Administration, Engineering, Project, Production, Transport, Pollution control, Technical Services and Stores shall be nominated as Key Personnel in their respective fields. As necessary, they shall decides 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 & neighbouring industries, action at assembly points, outside shelters and mutual aid centre under the direction of the SMC. All the key personnel and other called in so to assist, shall report to the ECC. They are available at any time on duty or on call or on holidays.

❖ ESSENTIAL WORKERS

Essential Workers shall be those who shall be trained in Fire Fighting and First Aid. One Supervisor and two helpers from each shift will be Identified as E.W.'s & shall supposed to report at EMERGENCY SITE to take instructions from I.C. or Dy. I.C. Such work instructions will include:

- Fire fighting and spill control till a Fire Brigade takes the charge.
- To help the Fire Brigade and mutual aid teams, if it is so required.
- Shutting down plant and making it safe.
- 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.
- Provision of emergency power, water, lighting, instruments, equipments, materials, etc.
- Movement of equipment, special vehicle and transport to or from the scene of the accident.
- Search, evacuation, rescue and welfare.
- The injured will be given First Aid.
- Carrying out atmospheric test and pollution control.
- Manning of assembly points to record the arrival of evacuated personnel. Manning for outside shelters and welfare of evacuated persons there.
- Assistance at causalities reception areas to record details of causalities.
- Assistance at communication centres to handle outgoing and incoming calls and to act as messengers if necessary.
- 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.
- Informing surrounding factories and the public as well as directed by the Site Main Controller.
- Any special help required.

OTHER ELEMENTS OF DMP:

❖ **ASSEMBLY POINT**

In affected & vulnerable plants, all nonessential workers (who are not assigned any emergency duty) will be evacuated from the area & they shall report to specified Assembly Points.

To ensure that workers do not have to approach the affected area to reach the Assembly Point, proper location and number shall be marked at Assembly Points. Each Assembly Point shall be manned by a nominated person to record the names and dept. At each Assembly Point, duties of Assembly Point In-charge are 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., shall be issued & made available with workers.

❖ **EMERGENCY CONTROL CENTER**

The Emergency Control Centre is the place or room from where the operations to handle the emergency are directed and coordinated. A safe room near security gate shall be earmarked /identified as the Emergency Control Room.

Telephone and other facilities required with necessary documents shall be displayed in ECC for ready reference. Designated trained personnel shall operate ECC. In case of Major Emergency, the Site Main Controller will operate from ECC.

The ECC centre shall be equipped with the following facilities.

- Internal and external telephone including STD facility
- Telephone directory/ Telephone nos. of mutual aid centres
- First Aid
- Muster roll of Workers
- Identity card register
- Layout plan of the factory showing the location of hazardous materials, assembly point, and first aid centres etc.
- Map of surrounding area with Fire Extinguishers location
- M.S.D.S

❖ **MEDICAL SERVICES**

The roles of Medical officers are as follows;

- He will report immediately to the SMC/IC.
- He will render necessary treatment, at Occupational Health Centre.
- He will arrange for Hospitalization and Treatment at outside hospitals, if required.
- He will mobilize in getting the services of External medical agencies, other Para –medical services etc. and transportation services etc.
- He will arrange for extra medical assistance/antidotes, from out, if required.
- He will arrange for first-aid trained volunteers for necessary help.

- He will liaise with the Government Health Authorities for treatment of the affected persons nearby.

❖ ROLE OF SECURITY IN-CHARGE (SECURITY OFFICER)

- On hearing the emergency siren, he shall find out the location of the incident (fire / gas leak / spill / explosion) and inform the location of the same to the key personnel coming to the plant.
- He will depute the security guards for managing gates and traffic control at the incident site & send remaining guards to the site of incident.
- He will prevent unauthorized entry in to the site
- He will render assistance as demanded by the safety in-charge.
- He will mobilize additional security force for help, if required.
- He will direct ambulance(s) and emergency vehicle(s) to the scene of incident.
- He will help evacuate persons within the scene of incident.
- As directed by the site main controller, he may be required to address the public of surrounding villages for warning / evacuation.

❖ ROLE OF MUTUAL-AID MEMBERS

- Company will have Mutual Aid with various nearby factories.
- On receiving the call, they shall proceed immediately with fire squad & fire tenders.
- They will be guided to the place of the incident by the main gate security guard.
- The fire squad in-charge will report to the safety in-charge of the unit in which the incident has occurred.

❖ OTHER ARRANGEMENTS

Other arrangements include external transport (transport centre), heavy vehicles, lift/cranes, generator sets to supply emergency power, environment monitoring equipment, special instruments/equipments, rescue items etc. shall be made available (if required) from near-by Industries /locations, when available resources do not meet the requirements.

STANDARD OPERATING PROCEDURE (SHALL BE FOLLWED DURING 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.

7.5.4 COMMMUNICATION SYSTEM

Communication System is a Crucial Factor while handling emergency. Company has quick & effective Communication System through which, any situation, which can lead to emergency, can be informed or known to…

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

Each and every section, Plant & Department of the Factory will be connected by internal telephones with SMC, Supervisor or IC's. External Phone at Office and Residence and Mobile shall also be made available with Key Personnel and top executive of the factory. The Communication System shall begin with raising the alarm declaring the emergency, Telephone messages and Procedure to communicate the emergency to other persons & General Public.

❖ **RAISING THE ALARM**

As soon as incident takes place inside the factory and is noticed by someone, the first step shall be to raise the nearest manual emergency bell to alert the nearby people. Next, he/she shall inform the security persons to raise the emergency siren located at the factory gate. The security personnel sound the siren.

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 shall takes charge of the scene.

❖ **DECLARING THE MAJOR EMERGENCY**

Major emergency is declared after sufficient and thorough 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 shall nominate the persons (SMC: Director & Incident Controllers) who can declare the emergency; we have selected them on the basis of their knowledge & experience. These persons will be technically qualified and experienced. The decision about major emergency shall be taken as early as possible and without wasting time so that control action can be started immediately.

❖ **TELEPHONE MESSAGES**

A Telephone operator who is precise, sharp, attentive and quick in receiving and noting the message and subsequently effective in further Communication, shall be appointed. A form to record emergency telephone calls will be available with telephone operator or Person available in Emergency Control Centre, who shall 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 will also be given to authorities and external agencies to describe the type of emergency. All details of emergency will be collected /delivered according to this format, available with the telephone operator.

❖ COMMUNICATION OF EMERGENCY & STATUTORY INFORMATION

Communication of Emergency

An effective system to communicate emergency shall be made to communicate about the emergency situation as mentioned below:

- 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 neighbouring factory & the General Public in the vicinity.

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 will be 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 will be given to outside emergency services and authorities, if required.

c) To neighbouring firms and the general public

Statutory information in the form of booklet will be given to neighbouring units and the general public of the villages in the vicinity of the unit, if required.

❖ EMERGENCY TIME ACTIVITIES

The probable emergency situation that can arise in the unit and the corresponding control actions as described below shall be followed:

1. FLAMMABLE RELEASES

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

Following Control actions shall be taken –

1. Anyone 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 / CO2 fire extinguisher or sand.
- He informs 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 are asked for help in the form of first-aid, transport etc.
- If fire is growing, fire officer informs IC who alerts neighbouring 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 is likely to occur. 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.

2. TOXIC RELEASES

- Source / Incident – Pressure release due to failure of

a. Stuffing box gland packing
b. Pressure release valve
c. Vessel / pipeline failure

Following Control Actions will be taken –

1. Anyone 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

3. CHEMICAL SPILL

Most of the chemicals will be stored in tank and shall be located in separate isolated storage area. Neutralizing material shall be kept available. Spill containment kit shall be kept available. For dilution, water connection will be provided on all sides of Storage Area. Sand buckets shall be available for covering spillage of flammable / corrosive materials. Fire fighting facilities shall be made available nearby.

7.6 OCCUPATIONAL HEALTH & SAFETY PROGRAMME

(Specific Program To Monitor Safety And Health Protection Of Workers)

M/s. Orgochem (guj) Pvt.Ltd. Sachin has prepared the **Occupational Health Surveillance Program** which shall be followed right from the project construction & erection phase and the same shall be updated for the upcoming new facility, if required.

The details of the same are described in the following sections.

7.6.1 OCCUPATIONAL HEALTH & DAMAGE CONTROL DURING DIFFERENT PHASES

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.

7.6.2 HOSPITAL FACILITIES /FACTORY MEDICAL OFFICER & OHC

Company shall made formal agreements with nearby hospitals having facilities to attend fire and toxic effect cases, emergency cases, attending the affected persons in the emergency arising out of accidents, if any, etc.

All types of first aid related accessories, Medicines & Antidotes as prescribed by FMO, etc shall be made available at conspicuous locations.

7.6.3 Ambulance Van & First Aid Box

An Emergency Vehicle shall be made available round the clock to be used as an Ambulance during emergency.

First Aid Boxes will be made available at the different location in the plant. Training shall be given to employees for First Aid.

7.6.4 PLAN FOR PERIODIC MEDICAL CHECKUP

Periodic Medical Examination shall be conducted as per the following schedule;
Workers employed will be examined by a Qualified Medical Practitioner/ Factory Medical Officer, in the following manner:

a) Before employment, to ascertain physical fitness of the person;
b) During employment, every six months (blood & physical examination) as per Gujarat Factories Rules, to ascertain physical fitness of the person to do the particular job;

7.6.5 DETAILS OF OCCUPATIONAL HEALTH IMPACTS AND SAFETY HAZARDS

Occupational Hazards Identification

- Exposure to Toxic Chemicals.
- Exposure to Flammable Solvents.
- Fire due to Static charge generation
- Slip/trip, fall, electric shock, etc.
- Spillage/leakage,
- Overflow,
- Exposure to Corrosive Chemicals.

Occupational Health Impacts

- Toxication, Irritation,
- Fall Injury, Electrocution,
- Body Injury, Burns, Skin sensitization,
- Severe irritation to eyes & skin,
- Respiratory disorder,
- Damage to nearby equipments,
- Fatality, etc.

Mitigation measures/Safety Measures proposed to avoid the human health hazards are mentioned under **section 7.4.** In addition to these safety measures, personal protective equipment (IS approved) like safety Helmet, Safety shoes/ Gumboots Hand gloves, Gas Mask / Nose Mask, PVC apron, SCBA Set, PVC pressure suit, goggles, hood, etc. will also be provided to the required personnel.

7.6.6 DETAILS OF WORK PLACE AMBIENT AIR QUALITY MONITORING PLAN

Work zone monitoring will be carried out by independent competent third party every month. Records will be kept in Form No. 37 as per Gujarat Factories Rules. Location for samplings shall be identified. Ambient Air & Noise Monitoring shall be done every 3 months as per GPCB CCA requirements. Following information will be incorporated in the format for maintaining records of work zone monitoring:

Location/Operation monitored

- Identified contaminant
- Sampling instrument used
- Number of Samples
- Range of contaminant concentration as measured in sample
- Average concentration
- TWA concentration of contaminant (As given in Second Schedule of Factories Act)
- Reference method used for analysis
- Number of workers exposed at the location being monitored
- Signature of the person taking samples
- Other relevant details

7.6.7 MONITORING OF THE OCCUPATIONAL INJURY & IT'S IMPACT ON WORKERS

Following action plan will be prepared & followed to monitor the occupational injury to workers:

- Each workplace will be evaluated for the work conditions.
- Unsafe Act & Unsafe Practices will be identified.
- Unsafe equipment, unsafe areas, etc., will be identified.
- Area will be checked for proper Ventilation and Illumination.

- Air-borne concentration of toxic chemicals will be measured and records will be kept.
- Evaluation of training & on the job work.

Impact of the above mentioned unsafe conditions on workers will be studied and remedial measures for the same will be adopted.

7.6.8 PROVISION OF INDUSTRIAL HYGIENIST & HEALTH EVALUATION OF WORKERS

1. It is proposed that management will devise 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. Complete medical examinations including PFT, Urine and Blood examination, Liver Function tests, chest X-ray, Audiometry, Spirometry Vision testing, ECG, etc. shall 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, also 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. Again, 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, will be maintained.

7.6.9 SAFETY TRAININGS & MOCK DRILLS

Safety trainings (on Safe Material Handling, First Aid, & all Safety Aspects) shall be provided every 15 days by the Safety Officers with the assistance of faculty members called from other Professional Safety Institutions and Universities. In addition to regular employees, limited contractor labours will also be given safety training. To create safety awareness, safety films shall be shown to workers and leaflets are distributed.

MOCK DRILLS

To evaluate the effectiveness of emergency preparedness and to spread the awareness among employees mock drill will be carried out at the interval of every six months.
After completion of the mock drill, summary report shall be made and corrections will be done if any weakness has been observed.

FREQUENCY OF mock DRILLS:

- On-site emergency: Once every 6 months
- Off-site emergency: Once every year

7.7 Plan to curb release of VOCs in the air:

Leak Detection and Repair (LDAR) Program

Leak Detection and Repair (LDAR) is a program implemented to comply with environmental regulations for reducing the fugitive emissions of targeted chemicals into the environment. In addition to control fugitive emissions, LDAR Program also helps the industries to reduce unwanted losses of chemicals and thereby conserving energy & increasing their profitability.

Need of Leak detection and Repair (LDAR) programs:

Fugitive emissions constitute a source of air pollution and fire. EPA has determined that leaking equipment, such as valves, pumps, and connectors, are the largest source of emissions of volatile organic compounds (VOCs) and volatile hazardous air pollutants (VHAPs) from chemical manufacturing facilities.

A benefit of LDAR program is reduction of product losses. Facility that apply LDAR also increase safety for workers and operators, decrease exposure of the surrounding community, reduce emission fees and help facilities avoid enforcement action.

The typical flow of the activities of the LDAR program will be as follows:

❖ **Identifying Components**

- Assign a unique identification (ID) number to each regulated component.
- Identify each regulated component on a site plot plan or on a continuously updated equipment log.
- Promptly note in the equipment log when new and replacement pieces of equipment are added and equipment is taken out of service.

❖ **Leak Definition**

- A leak is detected whenever the measured concentration exceeds the threshold standard (i.e., leak definition) for the applicable regulation.
- Leak definitions vary by regulation, component type, service (e.g., light liquid, heavy liquid, gas/vapor), and monitoring interval.
- Many equipment leak regulations also define a leak based on visual inspections and observations (such as fluids dripping, spraying, misting or clouding from or around components), sound (such as hissing), and smell.

❖ **Monitoring Components**

- Monitoring intervals vary according to the applicable regulation, but are typically weekly, monthly, quarterly, and yearly.
- For connectors, the monitoring interval can be every 2, 4, or 8 years.
- The monitoring interval depends on the component type and periodic leak rate for the component type.

❖ **Repairing Components**

- Repair leaking components as soon as practicable, but not later than a specified number of calendar days (usually 5 days for a first attempt at repair and 15 days for final attempt at repair) after the leak is detected.
- First attempts at repair include, but are not limited to, the following practices where practicable and appropriate:
- Tightening bonnet bolts
- Replacing bonnet bolts
- Tightening packing gland nuts

❖ **Recordkeeping**

- Maintain records of the equipment ID number, the instrument and operator ID numbers, and the date the leak was detected.
- Maintain a list of the dates of each repair attempt and an explanation of the attempted repair method.
- Note the dates of successful repairs.
- Include the results of monitoring tests to determine if the repair was successful.

Following steps shall be followed for effective implementation of LDAR Program:

1. Process Controls:

- To control fugitive emission from process / reaction, all reactor condensers shall be connected to a scrubber to minimize loss of solvents / fugitive emission in to the atmosphere.
- Solvent recovery system shall be followed.

2. Emissions control program:

Following steps shall be followed for effective implementation of LDAR Program

a. Identification of volatile chemicals which may contribute in VOCs :

In plant, following are the list of chemicals which may contribute in VOCs.

- Methanol
- Ammonia

b. Identification of all the probable sources of leakage; such as valves, pumps, and connectors.

List of the sources of probable leakage is as follows:

- Valves/Flanges
- Pump glands handling above chemicals
- Open vents from the tank top
- Pump seals Compressor seals
- Pressure relief devices
- Process drains
- LPDs (Low Point Drains)
- HPVs (High Point Vents)

TABLE 7.19- DETAILS OF PROBABLE SOURCES LEAKAGE

Leakage/ Component	Source of equipment leak	Detection Method
Valves	Flange leakage	Visual Check
Pump	From pump seal	Visual Check
Open vents from the tank top	Overflow of tank	High level alarm
High pressure leak	-	Audible Method
Connectors	Gasket failure and improperly torqued bolts on flanges.	For welded flanges place the probe at the outer edge of the flange-gasket interface and sample the circumference of the flange. If the source is rotating shaft, position the probe within 1 cm of the shaft seal interface for the survey.
Open ended line	At the point of line Incorrect implementation of block and bleed procedure	Place the probe inlet at approximately the entry of the opening to the atmosphere.

A list of all such items shall be made and same shall be incorporated in the checklist for LDAR.

3. Selection of appropriate method for leak detection:

Considering the nature of the chemical; appropriate method shall be selected for leak detection of individual chemicals from the list given below:

- Visual Checks
- LEL meter
- VOC meter
- Gas Detector
- Etc.

4. Scheduling and checklist for Leak Detection:

All points shall be checked as per the checklist given in Table 7.5.7.1

5. Methods for rectification of identified leaks:

For all identified leaks, closure shall be ensured with the help of maintenance department and records for the same shall be maintained.

TABLE 7.20- Preventive Measures for Leakage

Leakage/ Component	Preventive measures
Valves	• Use sealless design • Plug type valves can be lubricated with grease to reduce emission.

	• Many valves have no means of in service repair and must be isolated from the process.
Pump	• Use sealless design • Use dual mechanical seal with barrier fluid maintained at a higher pressure than the pump fluid • Provide closed vent system • Use spare pumps at the time of repair • Tighten the packing glands.
Open vents from the tank top	• Dyke area to be provided with proper slope and pit
Connectors	• Proper welding to be done • Flange gaskets to be replaced to avoided flange leakage.
Open ended line	• It can be controlled by using blind, cap, and plug.

6. Frequency of Monitoring

The monitoring interval is the frequency at which individual component monitoring is conducted. For example, valves are generally required to be monitored once a month using a leak detection instrument, but the monitoring interval may be extended (e.g. to once every quarter for each valve that has not leaked for two successive months OR on a process unit basis of once every quarter for process units that have less than a 2% leak rate.

7. Record keeping of LDAR Program:

- An internal and third-party audit of LDAR records will be conducted on a regular basis to ensure compliance.
- All records will be electronically monitored and stored for reference and further actions.
- Environment cell shall continually search for and update the regulatory requirements and other government guidelines regarding emission control and LDAR program shall be updated accordingly.
- Properly record and report first attempts at repair.
- Proper records of components, equipment and instruments required for LDAR program shall be maintained to ensure its quality, integrity and operability.

TABLE 7.21- CHECKLIST FOR IMPLEMENTATION OF LDAR PROGRAM TO REDUCE EMISSIONS OF VOCS.

Sr. No.	List of Source of leakage	Name of Chemical	Method of leak check	Frequency Weekly/Monthly / Quarterly	Checked on	Checked by	Observations/ Remarks	Leak to be attended by (Repair to be done within 5 working days)	Leak attended on	Closure Note

Records of leak detection have been maintained by client and are available at site.