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. M Chemicals, Sachin 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. Toxic release 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 CHEMICALS

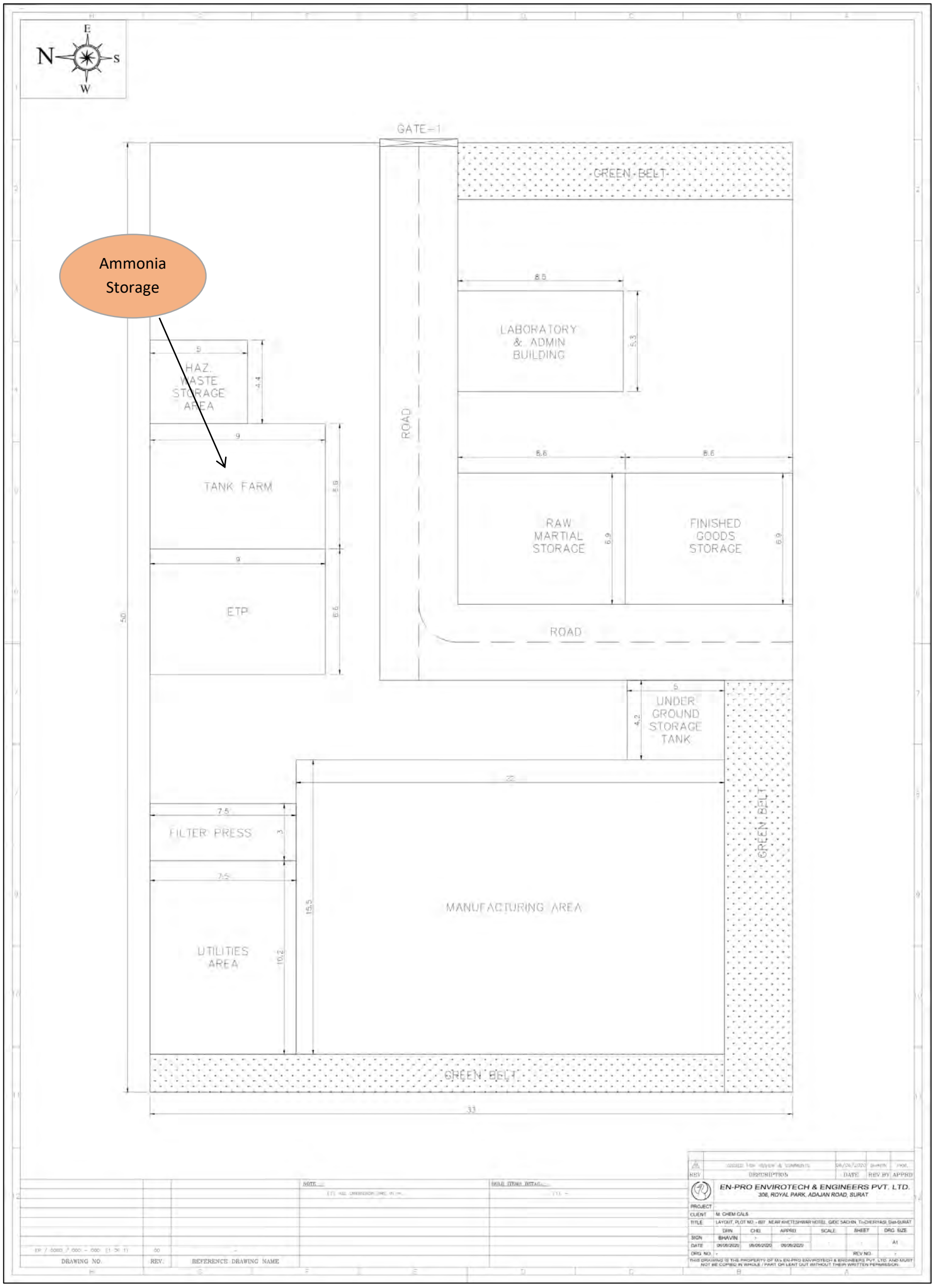


TABLE 7.1 A - STORAGE DETAILS OF RAW MATERIALS

Sr. No.	Name of the Raw Materials	Individual Capacity	Total Quantity stored	Mode of Storage	State	Possible type of hazards	Control Measures Provided
1.	Ammonia	15 KL	15 KL	Tank	Liq.	• Toxic	• Proper storage area for tank and dyke is provided. • Eye was station and Safety Shower is provided. • PPEs like Splash goggles, Full suit, Boots, Gloves etc., are used while handling this chemical. • Well ventilated storage area is provided. • Specialist will be consult, if required. • Fire control plan is provided in section 7.4.2.

NOTES:

1. Size of the biggest storage tank is 15 KL and dyke of sufficient capacity i.e. 10% extra than tank capacity is provided.
2. The unit is not classified as Major Accident Hazard (MAH) unit based on the quantity of Hazardous Chemicals stored at site, as the quantity of these chemicals being stored well within the threshold storage quantity as per schedules of Manufacture, Storage & Import of Hazardous Chemicals (MSIHC) Rules of major hazardous chemicals.

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

Sr. no	CHEMICAL	Physical State	FP (oC)	BP (°C)	SP. GR @ 20°C	Vap. Den. vs air	Vap. Pr. @ 20°C	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	Ammonia	Liq.	NA	24.7-37.7	0.89	NA	287.9 kPa	-	-	350	NA	2000 ppm (rat, 4 hours)	300	ACGIH TLV-STEL: 35	ACGIH: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. M Chemicals**, major risks have been identified for the following areas:

- Tank Farm

As a conservative approach, **we have analyzed the risk qualitatively and quantitatively both.**

In this study, we have considered the following:

- Storage & Handling of hazardous Ammonia **have been considered for Consequence Analysis**. Its 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 of Solid Chemicals, Caustic Lye & Acids **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 and Handling of Solid Chemicals.
2. Storage and Handling of Acids.
3. Storage and 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**
impossible	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.

STORAGE AND HANDLING OF SOLID CHEMICALS

[√] Risks and Recommendations:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING 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. are used. • Standard Approved respirators are used. • Eyewash station and safety showers are made available. • Dust monitoring is 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.

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
2.	Cleaning of Chemical Spillage.	• Fumes Inhalation. • Dust Exposure.	• Severe irritation to eyes, skin. • Inhalation.	3	3	**M**	• Certified Dust respirator is used. • PPEs are used. • Chemicals are stored in isolated storage rooms having provision for natural & forced ventilation. • Spillage is cleaned or neutralized with suitable media. • Firefighting facilities is made available near storage locations, if required.	2	2	**L**	

STORAGE AND HANDLING OF ACIDS

[√] Risks and Recommendations:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING 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 is carried out in well-ventilated area. • Neutralization media is made available in areas where acid is stored/handled/used. • PPEs are used.	2	2	**L**	
2.	Working in Storage Area.	• Exposure to acid fumes.	• Severe irritation to eyes, skin. • Body burns.	2	3	**M**	• Storage area is well ventilated. • Dyke is provided. • Neutralization is done immediately with soda ash/lime or spill shall be absorbed in sand or	2	1	**L**	

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
							by suitable adsorbent. • PPEs like face mask, gloves etc. are 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.

STORAGE AND HANDLING OF CAUSTIC LYE

[√] Risks and Recommendations:

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
1	Caustic Lye handling /Loading & Unloading	• Exposure due to leakage from joints, corroded lines failure etc.	• Skin burn. • Eye irritation and respiratory disorder.	2	3	**M**	• Dyke is provided. • It is stored in well-ventilated area. • Eye wash station is made available nearby. • Maintenance is carried as per schedule. • PPEs are used.	2	2	**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.	2	2	**M**	• Neutralization media is kept available. • PPEs like face mask, gloves etc. are worn by	2	1	**L**	

SR. No.	PROCESS OR ACTIVITY	ASSOCIATED HAZARDS	HEALTH & SAFETY IMPACT (RISK)	INITIAL RISK			EXISTING MEASURES	RESIDUAL RISK			ADDITIONAL RECOMMENDATIONS
				SEVERITY	LIKELIHOOD	RISK		SEVERITY	LIKELIHOOD	RISK	
			• Internal body burns.				concerned person. • Eye wash station is made available nearby.				
3	Tank overflow	• Chemical Exposure	• Eyes and Skin irritation.	3	3	**M**	• Level indicator is installed and the same shall be checked for proper operation. • Dyke is available to contain the spill.	2	1	**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 electric hazard.
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).

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: 30^0C 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 7.4 - 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, IDLH & LC_{50} 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,

4. 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

5. SCENARIOS IDENTIFIED for consequence analysis

Scenarios	Description of Scenario	Storage Pressure & Temp.	Scenarios considered
Toxic Scenarios			
1	Release of Ammonia	Pressure: 1 bar Temp.: Atmospheric	Dispersion

❖ **Considerations Made:**

- In **Case of Ammonia,** we have considered the failure case of unloading line (2" i.e. 50 mm pipe dia.) during the unloading of these chemicals from their respective tankers for a period of 10 mins.

✓ Considering LC_{50} concentration – 2000 ppm & IDLH concentration – 300 ppm
✓ Leak from 2 mm hole size.

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

SCENARIO # 1 – Release of Ammonia

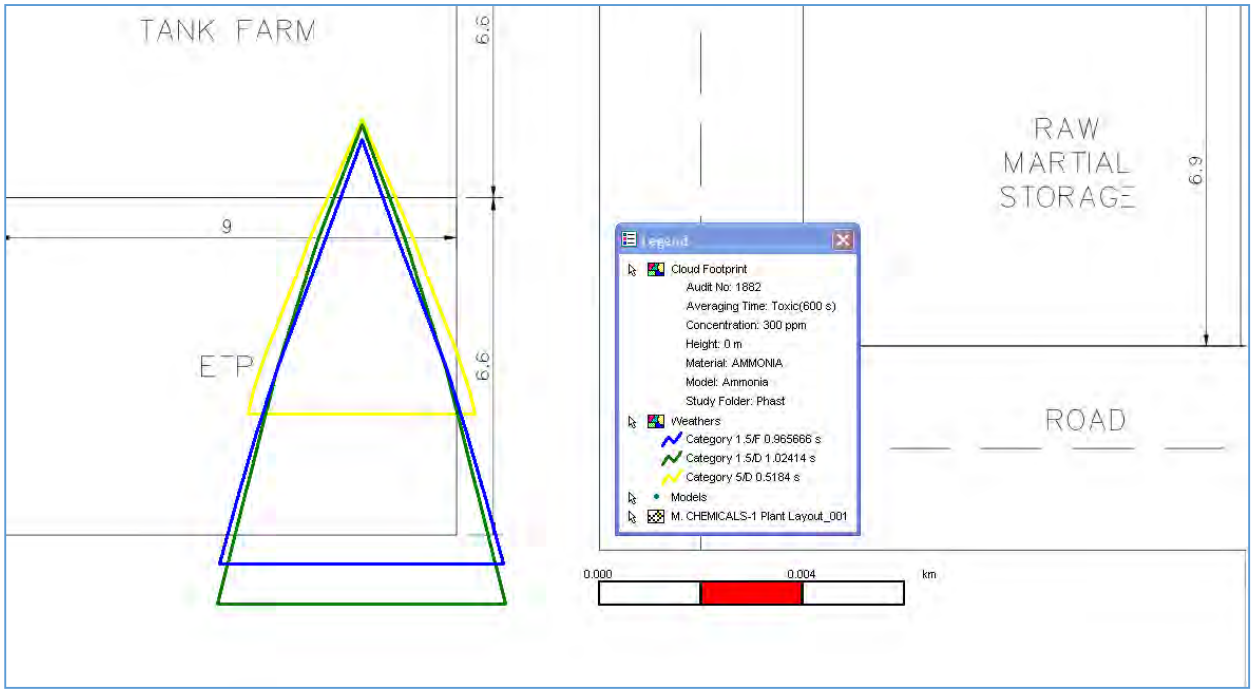
Basis: Possible Release/Leakage due to failure of Unloading Arm of Tanker.	
Input Data	
Leak Size Considered	50 mm
Release Duration	600 Secs
Release Rate	5.29 gms/sec
Pressure	1 bar
Temperature	30 deg C
Weather Condition	1.5/F, 1.5/D, 5/D
IDLH	300 ppm
LC50	2000 ppm

Result:

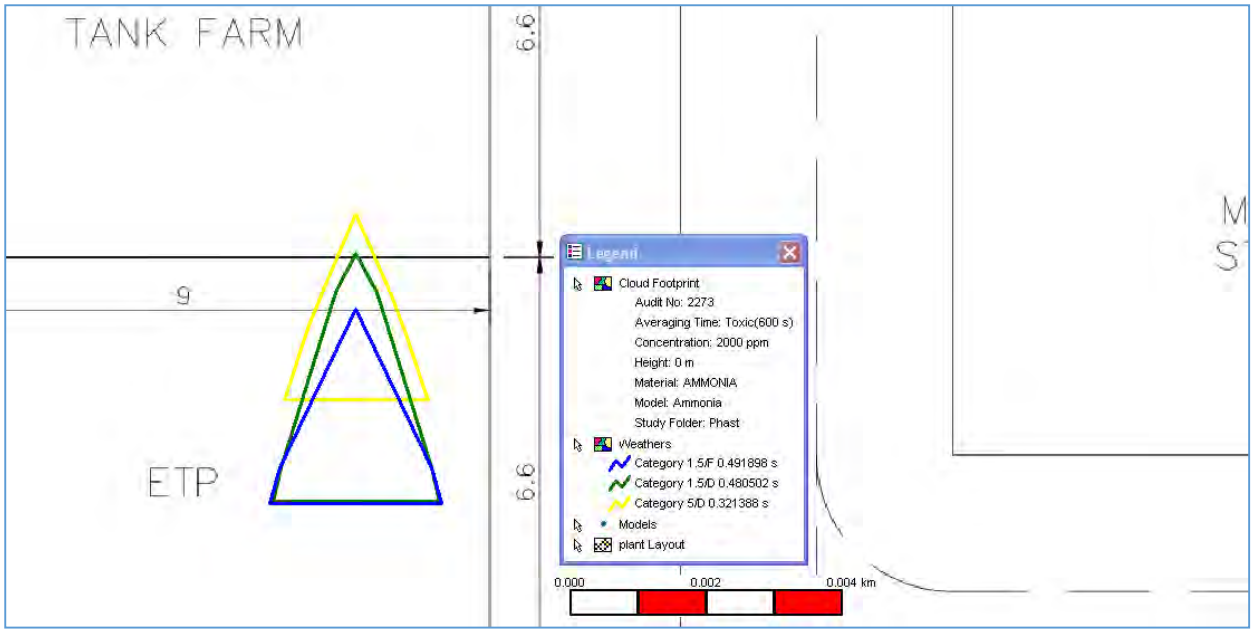
SR. No.	Concentration	Downwind Distance (meters)		
		Category 1.5/F	Category 1.5/D	Category 5/D
Ammonia				
1	IDLH (300 ppm)	10.26	12.35	7.18
2	LC_{50} (2000 ppm)	7.12	7.05	4.89

- **13 meters in downwind direction is considered as evacuation area.**

Risk Contour for IDLH Concentration:



Risk Contour for LC_{50} Concentration:



❖ **CONSEQUENCE ANALYSIS SUMMARY**

Toxic Scenarios:

SR. No.	Concentration	Downwind Distance (meters)		
		Category 1.5/F	Category 1.5/D	Category 5/D
Ammonia				
1	IDLH (300 ppm)	10.26	12.35	7.18
2	LC_{50} (2000 ppm)	7.12	7.05	4.89

7.3 COMMENTS / RECOMMENDATIONS BASED ON CONSEQUENCE ANALYSIS

Toxic Release Scenarios:

- Dispersion of Ammonia covers more distance in case of IDLH concentration (300 ppm) that is 12.35 Mtr. 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 guidelines of OISD.
- Details on hazard identification i.e. HAZOP, HAZAN, Fault tree analysis, Event tree analysis, Checklist Audit, safety audit and their compliance, etc. to be adopted for the safe operation of plant at appropriate stage.

7.4 OTHER SAFETY PRECAUTIONS / RECOMMENDATIONS

7.4.1 SAFETY/CONTROL MEASURES TO REDUCE THE RISK OF TOXIC RELEASE:

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

Sr.	ACTIVITY	SAFETY PRECAUTIONS
1	Transportation of Chemicals by road truck, tanker.	• 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. • 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).
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

		firefighting/extinguishing systems. • 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. • Breather valve has been provided for storage tanks. • Dyke wall is provided to storage tanks. • Vents are connected to water trap and vent of water trap are provided with flame arrestor. • Dumping /Drain vessel/alternate vessel is made available to collect the spillage material inside the dyke wall. • Flame proof electrical fittings are available. • Double static earthing shall be provided to storage tank as well as day tank, as per the requirement.
4	Chemicals transfer from storage areas to Process Plant.	• Double mechanical seal type FLP type pump shall be provided. • Flame arrestor with breather valve is provided on vent line. • Lightening arrestor is provided on the top of tallest structure. • Over flow system is provided for additional safety and it is connected to main storage tank. • NRV's shall be provided on pump discharge line.

7.4.2 FIRE CONTROL PLAN

M/s. M Chemicals 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/firefighting 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 expansion facility if required:

- Firefighting facilities comprising of two main pumps, two stands by pump, jockey pump and fire water reservoir as per the GFR and TAC guidelines shall be updated after the expansion of new facilities, if required.
- Fire Extinguishers like DCP, Carbon Dioxide & Foam types have been provided as per the GFR and IS-2190 at conspicuous locations.
- Fire adequacy study to be carried out.
- Working staff is given training to operate DCP and CO_2 extinguishers.
- Emergency Action Team members are working round the clock in all shifts.
- First aid is available round the clock in all shifts of all plants / sections.
- Volume level indication with alarm and trips for high level are provided for vessels containing flammable materials.
- DG Set is 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 existing 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 Proposed methodology for unloading of Oleum from tanker to storage tank.

- Loading & Unloading activity is carried out in well-ventilated area.
- Vapor balancing hose is provided (i.e. tanker top is connected with the vent of storage of tank) to ensure close loop unloading and to avoid release of oleum fumes in atmosphere.
- Tanker is placed at the designated place for unloading and wheel chokes are provided to prevent movement of tanker / vehicle during unloading.
- Key of the engine is kept with the operator and it is returned to the driver only when unloading operation is over.
- Before starting the unloading process, level of the storage tank is measured by level indicator. The level of the storage tank must be sufficiently low for tanker unloading.
- Unloading is done by Oleum Pump.
- Flexible hose connection (SS braided) shall be done from tanker bottom line to pump suction line.
- Complete unloading is ensured by level indicator and pump discharge pressure.
- PPEs like face mask, gloves etc. are worn by concerned person during unloading.

Preparedness for First Aid & Anti dotes:

Eye contact

Arrangement is done to flush eyes with running water for a minimum of 20 minutes holding eyelids open during flushing. Eyewash stations will be provided near the storage & handling area. It is ensured that fresh potable water is available with sufficient pressure and at a temperature of 20-30 ^{o}C in the eye washer. If required, the supply lines of eye washer will be insulated to prevent it from heating due to direct sunlight.

Skin contact

Affected are of skin is flushed with running water for a minimum of 20 minutes. Contaminated clothing is removed. Cold water is made available at site which can be used for flushing if medication treatment is delayed. Training for first aid in case of eye contact, skin contact or ingestion is given to operational staff.

Anti-dotes:

There is no specific anti-dote for oleum. However, for acids ingestion; following anti-dotes are applicable:

- 4% solution of Sodium Hydrocarbonate
- Milk
- Lime Water
- Milk of Magnesia

Site shall ensure that such anti-dotes are available in sufficient quantity.

1. Safety Measures for storage of Oleum

- Oleum is stored in MS tanks of. Tank is provided with silica gel breather to avoid ingress of moisture and consequential formation of sludge.
- Dyke is provided considering 110 % volume of the storage tank.
- Flooring of dyke is made impervious and acid proof.
- Neutralization media (hydrated lime) is made available in designated place near storage tank.
- Appropriate personal protective equipment (PPE) such as goggles, full-body suit, safety shoes and gloves are used during handling of oleum.
- Eye wash station are made available in vicinity to storage location.

2. Procedure and measures for transfer of Oleum from storage tank to reactor/process plant.

- Oleum is transferred from storage tank to reactor by Oluem pump.
- Transfer lines shall permanent piping (not flexible hoses)
- Flange guards are provided in all flange joints.
- Inspection (for pumps, flange joints etc) is carried out on regular basis.
- Proper training is provided to the operators/workers.
- Complete transferring is done in close supervision and monitoring of level.
- PPEs like face mask, gloves etc. are worn by concerned person during unloading.

7.4.5 ANTIDOTES DETAILS:

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

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

Chemical	Antidote / Medical Treatment
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.

7.4.6 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. to be 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.

7.5 ONSITE AND OFFSITE EMERGENCY PLAN

M/s. M Chemicals has prepared the Onsite Emergency Plan which is linked with District Disaster Management Plan. This plan has been prepared based on the risk contours plotted on the plant layout map clearly showing the facilities that would be affected, in case an accident takes place.

The purpose of this plan is to provide **M/s. M Chemicals** with the means to effectively utilize all the resources at its disposal for the protection of life, environment and property. The same ERP shall be updated after expansion to cover new plants or facilities, if required. The details of the same are discussed in the following sections.

7.5.1DEFINING 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. It may be due to:

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

LEVEL - 2:

The emergency, which is confinable within the factory premises. It may arise due to –

a) Leakage of toxic chemicals for long duration.
b) Medium scale explosion confined to the factory premises.
c) 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 –

a) Heavy / Profuse leakage of toxic / flammable gases for a long duration.
b) Explosion of high magnitude affecting the adjacent area.
c) 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 define and assess emergencies, including risk and environment impact assessment.
- To control and contain incidents.

- To safeguard employees and people in vicinity.
- To minimize damage to property or/and the environment.
- To inform employees, the general public and the authority about the hazards/risks assessed, safeguards provided, residual risk if any and the role to be played by them in the event of emergency.
- To be ready for 'mutual aid' if need arises to help neighbouring unit. Normal jurisdiction of an OEP is limited to the own premises only, but looking to the time factor in arriving the external help or off-site plan agency, the jurisdiction must be extended outside to the extent possible in case of emergency occurring outside.
- To inform authorities and mutual aid centers to come for help.
- To effect rescue and treatment of casualties. To count injured.
- To identify and list any serious injuries and or fatalities.
- To inform and help relatives.
- To secure the safe rehabilitation of affected areas and to restore normally.
- To provide authoritative information to the news media.
- To preserve records, equipment etc, and to organize investigation into the cause of the emergency and suggest preventive measures to stop its recurrence.
- To ensure safety of the works before personnel re-enter and resume duty.
- To work out a plan with all provisions to handle emergencies and to provide necessary inputs for emergency preparedness and the periodical rehearsal.

7.5.3 STRUCTURE OF EMERGENCY MANAGEMENT SYSTEM

M/s. M Chemicals has developed an emergency management team. The management structure includes the following personnel's;

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

The other elements of Disaster Management Plan are:

- Assembly points.
- Emergency control center.
- Fire control arrangements.
- Medical arrangements.
- Other arrangements.

❖ **SITE MAIN CONTROLLER**

He is the head authority of the organization. V.P. – Operations holds the responsibilities of the site main controller or emergency controller. He is having overall responsibilities for directing operation.

Immediately on hearing of emergency, he will proceed to Gate House, where he will meet the Communication Officer.

- From time to time, he will assess the magnitude of the situation and decide if staff needs to be evacuated.

- Exercise direct operational control of those parts of the works outside the affected area.
- Maintain a continuous review of possible developments and assess these to determine the most probable course of event.
- Initiate the shutting down and evacuation of plant in consultation with the Incident Officer.
- Liaise with Police Services and provide advice on possible effects on areas outside the factory.
- Issue authorized statements to the news media. Where appropriate, inform the Director.
- Ensure that proper consideration is given to the preservation of evidence.
- Control rehabilitation of affected areas on cessation of emergency.
- Determine what investigations and reporting should be carried out and by whom, to determine cause and prevention of reoccurrence.

❖ 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 firefighting and rescue team and other emergency services.
- 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.

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. Assembly Point is marked at a safe place, well away from area of risk and least affected by the down wind direction.

To ensure that workers do not have to approach the affected area to reach the Assembly Point, proper location and 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 room near Security Gate has been earmarked/identified as the Emergency Control Room.

Telephone and other facilities required with necessary documents are displayed in ECC for ready reference. ECC has been operated by Site Main Controller, key personnel and Senior Officers of the Fire, Police, Factory Inspectorate, District Authorities and Emergency Services.

The ECC centre is equipped with the following facilities:

- Internal and external telephone including STD facility.
- Telephone directory/ Telephone nos. of mutual aid centres.

- Factory Layout showing evacuation plan, firefighting arrangements, emergency control centre, location of assembly points, etc.
- First Aid.
- Gate pass book.
- Muster roll of Workers.
- Work permit book.
- Identity card register.
- Copy of ON SITE/ OFF SITE PLAN.
- Stationeries like- note book, pen, pencils etc.
- SCBA Sets.
- Adequate numbers of PPE's

❖ FIRE CONTROL ARRANGEMENTS (FIRE FIGHTING, GAS LEAK CONTROL AND RESCUE OPERATION)

A. Role of EHS Representative:

1. On being notified about the location of fire, he immediately proceeds to the help.
2. Decides his line of action in consultation with Incident controller and takes appropriate measures to handle the emergency.
3. Assessing the severity of the incident, immediately report to emergency controller about the gravity of the situation.
4. He assesses the extra requirement required if any, from the neighbouring industry.

❖ MEDICAL SERVICES

The roles of Medical officers are as follows;

(a) He will report immediately to the SMC/IC.
(b) He will render necessary treatment, at Occupational Health Center.
(c) He will arrange for Hospitalization and Treatment at outside hospitals, if required.
(d) He will mobilize in getting the services of External medical agencies, other Para – medical services etc. and transportation services etc.
(e) He will arrange for extra medical assistance/antidotes, from out, if required.
(f) He will arrange for first-aid trained volunteers for necessary help.
(g) He will 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 has Mutual Aid with various nearby factories and GIDC fire station etc.
- 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, Utilities, generator sets to supply emergency power, environment monitoring equipment, special instruments/equipments, rescue items etc. is made available from Sachin Association or nearby locations, when available resources do not meet the requirements.

STANDARD OPERATING PROCEDURE (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/Firefighting 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

After assessing the risk of the emergency / incident, the second step of the plan is communication.

This chapter deals with the procedure to be followed at the time of emergency to inform following personnel.

- Incident controller
- Site main controller
- Other key personnel
- Mutual aid centers
- Neighbouring industries and public in vicinity
- Government authorities.

The communication of emergency begins with sounding the siren from the emergency. The procedure us as under;

❖ 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

The nominated persons are technically qualified and experienced. They will advise the incident controller or the Site main controller. The site main controller with the consultation to technical persons declare major emergency.

The joint decision to declare major emergency shall be taken as early as possible and without wasting time.

❖ TELEPHONE MESSAGES

After hearing the emergency siren or even receiving the emergency message on phone, the telephone operator (security officer) transmit the message to site main controller and key personnel as per the instruction received from incident controller.

❖ COMMUNICATION OF EMERGENCY & STATUTORY INFORMATION

Communication of Emergency:

An effective system to communicate emergency has been 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 is prepared by the unit. This information is printed in the local language and given in the form of booklet to all workers including contract workers.

b) To the outside emergency services and District Emergency Authority

Statutory information in the form of booklet is given to outside emergency services and authorities, if required.

c) Specific Safety Measure to be taken for neighbouring firms, general public vicinity& Factory Inspectorate

- Statutory information in the form of booklet, is given to neighbouring units and the general public of the villages in the vicinity of the unit, if required.
- General Public in the vicinity shall be trained for associated chemical hazards, safety measures, on-site & off-site emergencies, individual actions required during emergencies, first aid, etc.
- General Awareness Seminars will be conducted.
- Required safety drills, Off Site drill, etc will be conducted.

7.6 OCCUPATIONAL HEALTH & SAFETY PROGRAMME (Specific Program to Monitor Safety and Health Protection Of Workers)

M/s. M Chemicals, 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.

Safety of both men and materials during construction and operation phases is of concern. Safety plan shall be prepared and implemented in the proposed expansion activity. The preparedness of an industry for the occurrence of possible disasters is known as Emergency Plan. The disaster in the plant is possible due to collapse of structures and fire/explosion etc.

- The proposed expansion facility would formulate safety policy keeping in view the safety requirement during construction, operation, maintenance phases, with the following regulations:
- To allocate sufficient resources to maintain safe and healthy conditions of work;
- To take steps to ensure that all known safety factors are taken into account in the design, construction, operation and maintenance of plants, machinery and equipment;
- To ensure that adequate safety instructions are given to all employees;
- To provide wherever necessary protective equipment, safety appliances and clothing and to ensure their proper use;
- To inform employees about materials, equipment or processes used in their work which are known to be potentially hazardous to health or safety;
- To keep all operations and methods of work under regular review for making necessary changes from the point of view of safety in the light of experience and up to date knowledge;
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work;
- To provide appropriate instruction, training, retraining and supervision to employees in health and safety, first aid and to ensure that adequate publicity is given to these matters;
- To ensure proper implementation of fire prevention methods and an appropriate firefighting service together with training facilities for personnel involved in this service;
- To organize collection, analysis and presentation of data on accident, sickness and incident involving people injury or injury to health with a view to taking corrective, remedial and preventive action;
- To promote through the established machinery, joint consultation in health and safety matters to ensure effective participation by all employees;
- To publish/notify regulations, instructions and notices in the common language of employees;

- To prepare separate safety rules for each type of occupation/processes involved in a plant; and
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipments, work places and operations.

7.6.2 HOSPITAL FACILITIES /FACTORY MEDICAL OFFICER & OHC

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

7.6.3 Ambulance Van & First Aid Box

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

First Aid Boxes are made available at the different location in the plant. Training is 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;

Periodic Medical examination is being conducted as per the following schedule;

(1) Workers employed are 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, once in a period of 6 months, to ascertain physical fitness of the person to do the particular job;
c. Once in a period of 6 months, to ascertain the health status of all the workers in respect of occupational health hazards to which they are exposed and in cases where in the opinion of the Factory Medical Officer it is necessary to do so at a shorter interval in respect of any workers;
d. In periodic and pre-medical examinations, various parameters will be checked. Viz., LFT, Chest X-rays, Audiometry, Spirometry, Vision testing (Far & Near vision, color vision and any other ocular defect) ECG, Blood Pressure, Sugar, CBC, Lung Function test & routine urine test and other parameters as will be found necessary as per the opinion of Factory Medical officer.

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

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 existing 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.

Impacts of the above mentioned unsafe conditions/acts on workers are:

- Body Injury,
- Suffocation,
- Accident,
- Toxication, etc.

Remedial measures for the same is to follow the action plan strictly.

OR

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

OR

For the details of: Occupational health impacts on employees/workers arising out of above chemicals/solvents exposure &unsafe conditions and mitigation measures proposed to avoid the human health hazards along with the personal protective equipment, please refer Qualitative Risk Assessment Section 7.3.1.

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 labors 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

7.6.10 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.

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

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

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

- Ammonia

2. 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
- Process drains
- LPDs (Low Point Drains)
- HPVs (High Point Vents)

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

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
- Ammonia Torch
- Etc.

4. Scheduling and checklist for Leak Detection:

All points shall be checked as per the checklist given below.

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.

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.

7.7 Fire Load

Details of the Fire extinguishers and Fire Hydrant is given below **Table 7.5.**

TABLE 7.5- FIRE LOAD CALCULATION

1	Name & Address of factory	:	**M Chemicals**						
			Plot No.807, Near Kheteshwar Hotel, Sachin GIDC, Taluka- Chorasi, Surat, Gujarat.						
2	Phone Number	:	9067496300						
3	Name of Occupier	:	Santosh Harichandra C. (Partner)						
4	Total Floor of the factory	:	maximum 2 Floors						
5	Detail of Combustible Area (In sq. Meter)								
a)	Total Floor Area	:	1626.40	M^2					
b)	Open Space Area in which Combustible Material stored	:	179.10	M^2					
c)	Area having more than 15 meter Height	:	0.00	M^2					
d)	Area having Wooden material	:	90.00	M^2					
	Total (a + b + c + d)	:		M^2					
6	a+b+c+d = /20	:	1895.50	/ 20 =	94.78	L/Min			
7	Total Requirement of Water (based on area in sr. no-6)	:	4738.75	Ltrs					
8	Current Water storage Capacity for fire hydrant	:	10000.00	Ltrs					
	Underground Tank + overhead tank + On ground Tank	:	Underground - 10 KL	Ltrs					
9	In case of Fire, Arrangement for water to be used in fire fighting								
a)	Is Hydrant Line available? If Yes give dimension of Pipe.	:	Fire hydrant line will be constructed after getting EC. Diameter of fire hydrant pipe: 80mm - 100 mm						
b)	Which type of arrangement are available for Supply water on ground or upper floor i.e. Pipe line and it's Diameter (c.m.); Give detail	:	For individual floor lines, pipes of diameter 25mm to 32mm should be used						
c)	Are Fire Water Pump Available or Not? Give detail	:	Water pump will be installed.						

10	If the Value of Sr. 6 is more than 550, then requirement of trailer Pump is applicable. If it applicable then what is the arrangement for the Same. Give detail	:	Not Applicable				
11	How many water buckets required?	:	17				nos
	Fire Extinguisher required =				17 /6=3		
	Bucket may be dispensed with provided supply of extinguisher						
	is double than indicate above =				0+3=3		
13	Requirement of 5 Kg CO2 Type Fire Extinguisher for Class - E fire. Floor wise (1 for every 15 m length)	:	2				nos
	Total requirement of Fire extinguishers (5 Kg ABC).	:	3	+	0	3	nos
14	Details of installed Fire Extinguishers.						
	Type		nos				
	ABC	:	3				
	CO2	:	2				
	SAND BUCKET	:	10				
	FOAM	:	3				
	DCP	:	3				
	TOTAL	:	21				
15	Additional Fire Extinguisher Required	:	No				
16	Emergency Fire Exit provided to Each Floor? Ladder Provided to Each floor?	:	Yes				
17	Arrangement for Fire warning. i.e. Hooter / Ele. Bell / Other	:	Yes				
18	Water Sprinkler Provided?	:	Yes				

7.8 STORAGE AND SAFETY OF CHEMICALS

Details of Storage Tanks:

Sr.no.	Capacity of Tank	Number of Tanks	Total Storage Capacity	Diameter of tank	Height of tank
1.	15 KL	4	60	2	4.5

Name of Chemicals Stored in Tanks:

- Sulphuric Acid
- Liq. Ammonia
- Hydrochloric Acid
- Oleum etc.

Details of Storage of major hazardous chemicals, its nature of hazard, chemical and physical properties and storage details are given in **TABLE 7.6.**

TABLE 7.6 - Details of Major Hazardous raw material and its storage

Sr. No.	Name of Chemical	Nature of Chemical	Physical State	Type of storage	Boiling Point °C	Melting Point °C	Flash Point °C	Vapor Pressure	Flammability or Explosive limit	Handling and Storage Safety
1	Sulphuric Acid	Health Hazard, Flammable	Liquid	Tank	**290 to 338**	**10**		< 0.001 mm Hg @ 20 deg C		**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not allow water to get into the container because of violent reaction. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Discard contaminated shoes. Use only with adequate ventilation. Do not breathe spray or mist. Do not use with metal spatula or other metal items. Inform laundry personnel of contaminant's hazards. **Storage:** Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store near alkaline substances. Store protected from moisture. Ideally, sulfuric acid should be stored in isolation from all other chemicals in an approved acid or corrosives safety cabinet.

Sr. No.	Name of Chemical	Nature of Chemical	Physical State	Type of storage	Boiling Point °C	Melting Point °C	Flash Point °C	Vapor Pressure	Flammability or Explosive limit	Handling and Storage Safety
2	HCL	Health Hazard, Flammable	Liquid	Tank	90 (for 30 % conc. solution)	-52 (for 30 % conc. solution)	-	125 mbar @ 20 °C	-	**Handling:** Wear personal protective equipment. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Do not ingest. **Storage:** Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area
3	Nitric Acid	Health Hazard, Flammable	Liquid	Drum	-	-41	-	0.94 kPa (20°C)	-	**Handling:** Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Do not breathe vapors or spray mist. Keep away from clothing and other combustible materials. **Storage:** Keep containers tightly closed in a cool, well-ventilated place. Do not store near combustible materials.

Sr. No.	Name of Chemical	Nature of Chemical	Physical State	Type of storage	Boiling Point °C	Melting Point °C	Flash Point °C	Vapor Pressure	Flammability or Explosive limit	Handling and Storage Safety
4	Oleum	Health Hazard, Flammable	Liquid	Tank	290 to 338	10		< 0.001 mm Hg @ 20 deg C		**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not allow water to get into the container because of violent reaction. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Discard contaminated shoes. Use only with adequate ventilation. Do not breathe spray or mist. Do not use with metal spatula or other metal items. Inform laundry personnel of contaminant's hazards. **Storage:** Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store near alkaline substances. Store protected from moisture. Ideally, sulfuric acid should be stored in isolation from all other chemicals in an approved acid or corrosives safety cabinet.
5	Liq.Ammonia	Irritant, Corrosive	Liquid	Tank	36	-72		115 at 20 C	-	-

Sr. No.	Name of Chemical	Nature of Chemical	Physical State	Type of storage	Boiling Point °C	Melting Point °C	Flash Point °C	Vapor Pressure	Flammability or Explosive limit	Handling and Storage Safety
6	Para Cresidine	Irritant, Health Hazard	Solid	Drum	235	49 to 55	111	-	-	**Handling:** Do not breathe dust. Do not get in eyes, on skin, or on clothing. Handle product only in closed system or provide appropriate exhaust ventilation. **Storage:** Keep in a dry, cool and well-ventilated place. Refer product specification and/or product label for specific storage temperature requirement. Keep container tightly closed. Store under an inert atmosphere.
7	Sulphanilic Acid	Irritant	Solid	Drum		287.8	-	-	-	**Handling:** Wear personal protective equipment. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation. **Storage:** Keep containers tightly closed in a dry, cool and well-ventilated place.