



OFFSITE EMERGENCY PLAN
FOR
KURNOOL DISTRICT
ANDHRA PRADESH

BY



CHOLAMANDALAM MS RISK SERVICES LTD.
CHENNAI, INDIA
WWW.CHOLARISK.COM

MARCH 2024



DOCUMENT HISTORY

Sr. No.	Document Identification	Revision		Comments / Nature of Changes
		No	Date	
1	OFEP/SR/Kurnool-MAH/23-24/ 01	01	26/03/2024	Preparation of Draft Report

Prepared By	Reviewed and Approved By
<p>Arun Shourie Senior Manager – Risk Services</p> <p>Yeshwanth Yogesh Dy. Manager – Risk Services</p>	<p>Parthasarathy R Principal Consultant – Process Safety</p> <p>Jithesh SV Dy. General Manager – Risk Services</p> <p>Srenivas DS Asst. General Manager – Risk Services</p>
Cholamandalam MS Risk Services Limited	

EXECUTIVE SUMMARY

Kurnool, a district located in the state of Andhra Pradesh, is home to several Major Accident Hazard (MAH) industries, which significantly contribute to the region's economic growth and development. These industries encompass a wide range of sectors, including **chemical manufacturing, LPG bottling plants, and heavy engineering.**

Considering the presence of **major accident hazard (MAH) factories** in Kurnool which handle, use, or store hazardous chemicals, it is crucial to establish an **efficient off-site emergency plan** for ensuring that a **centralized coordination** mechanism involving local authorities, emergency services, industry stakeholders, and community representatives is in place.

An important aspect of developing this plan involves **consequence modelling**, which aids in locating the Emergency Control Centre (ECC). This off-site emergency plan for Kurnool covers the potential maximum credible accident scenarios that could extend beyond the plant premises of the MAH units and the proposed plan of actions to respond to such emergencies.

Personnel from Cholamandalam MS Risk services (hereinafter referred to as "CMSRSL") visited the MAH industries that are part of the Kurnool (BPCL, Kurnool and TGV SRAAC from 14th March 2024 to 15th March 2024 for identification of potential offsite scenarios and extracted consequences results from the existing QRA reports which were obtained. **Consequence contour** is prepared as part of the emergency preparedness planning process and has highlighted the potential hazards posed by flammable and toxic chemicals. Based on the consequence modelling results, it has been suggested to establish a District emergency control centre outside the contours / vulnerable zones.

Department of Factories, Kurnool District has approached Cholamandalam MS Risk Services (hereinafter referred to as "CMSRSL") to prepare an off-site emergency plan for 2 MAH units located at Kurnool district namely:

1. Bharat Petroleum Corporation Limited, LPG bottling plant, Kurnool

2. TGV SRAAC LIMITED

The "**Emergency Preparedness**" chapter delineates the roles and responsibilities of statutory authorities, providing a comprehensive emergency organization chart outlining roles and triggering mechanisms for varying levels of disasters. It serves

as a foundational resource for coordinating response efforts, clarifying the specific duties of each entity involved in emergency management.

In the “**Emergency Response**” chapter, procedures have been outlined for promptly notifying relevant authorities, emergency responders, and affected stakeholders about the incident. These procedures ensure swift and effective communication in the event of an emergency involving toxic substance and flammable chemicals, pipelines and road transports.

“**Post recovery and clean up**” chapter outlines steps which need to be taken up for mobilizing resources and personnel to support the recovery efforts. This involves coordinating with government agencies to provide assistance, supplies, and expertise.

In “**Mock drill**” chapter, importance of mock drills has been emphasized. Off-site emergencies often require coordination among multiple agencies and stakeholders. Mock drills provide an opportunity to practice coordination and collaboration between different organizations, such as emergency services, industry stakeholders, and local authorities.

The annexure chapter contains the format for Declaration and Calling off the off-site emergency, investigation reporting, mock drill reporting, Emergency Response Data sheet (ERDS), Material Safety Data Sheet (MSDS), Consequence results and any specialized equipment needed for handling specific chemical hazards.

The summary of consequence modelling is as follows:

BPCL LPG Bottling Plant, Kurnool

S. No	Scenario No	Description	Flammable Gas Dispersion Impact Distance (m)	
			10% LEL (1800 ppm)	60% LFL (10800 ppm)
1	2	125 MT Above ground Bullet SRV Release	618	212
2	6	600 MT Mounded Storage due to SRV Pop up	319	98
3	12	Road Tanker 18 MT SRV Release	337	105

Pool Fire

S. No	Scenario No	Description	Pool Fire Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	4	125 MT Above Ground Bullet Rupture	89	62	47
2	11	Road Tanker Rupture 18MT	89	57	44

Jet Fire

S. No	Scenario No	Description	Jet Fire Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	5	Leak (2 inch) from 125 MT Above ground Bullet Body	120	76	52
2	8	Leak (2 inch) from Road Tanker 18MT Body	123	80	57
3	22	FBR (6 inch) of liquid pipeline	162	105	74

BLEVE

S. No	Scenario No	Description	BLEVE - Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	10	ROAD TANKER 18MT TANK UNDER BLEVE	697	448	317

Overpressure

S. No	Scenario No	Description	Overpressure - Damage Distance (m)		
			1 psi	3.5 psi	8 psi
1	1	125 MT – Above ground Bullet SRV Release	232	121	NR
2	13	ROAD TANKER 18MT Unloading arm failure	119	79	NR

TGV SRAAC Limited, Kurnool**Scenarios Identified**

In line with the QRA Study of TGV SRAAC Limited, it is understood that no scenarios are identified to have thermal radiation & overpressure impact beyond the facility i.e., offsite.

S. No	Scenario No	Description	Toxic Gas Dispersion Impact Distance (m) Corresponding to ERPG-2	
			1.5F Weather	5D Weather
1	ISO-03-1	25mm leak from Chlorine gas line from electrolyser up to PV-1151A/B	1927	424
2	ISO-03-2A	25mm leak from Chlorine Drying Tower	1420	222
3	ISO-3-3A	25mm leak from Chlorine Compressor (K-701A)	1490	1167
4	ISO-3-5	25mm leak from Chlorine Liquefier No. 1	1804	1229
5	ISO-03-6	25mm leak from Chlorine Tank - A	1174	880.8
6	ISO-4-1C	25mm leak from HCl Anhydrous Vapour line from Thermal Chlorination (ERPG-2 is 20ppm)	723.6	774.7
7	ISO-5-1	25mm leak from Chlorine Vaporizer	1230	1310
8	ISO-09	25mm leak from Carbon Tetra Chloride Storage (CCl4) ERPG-2 is 200 ppm	1441.5	401.09
9	IS-New	25mm leak from Leak from one (01) Cl2 Tonner (900 kgs, 12 barg) at Cl2 filling & storage area	3941.56	3820.56

ABBREVIATIONS

- APSPDCL : Andhra Pradesh Southern Power Distribution Company Limited
- APPCB : Andhra Pradesh Pollution Control Board
- BPCL : Bharat Petroleum Corporation Limited
- CA (EPPR) : Chemical Accident (Emergency Planning, Preparedness and Response)
- DC : District Collector
- DCG : District Crisis Group
- DEA : District Emergency Authority
- DDMA : District Disaster Management Authority
- DECC : District Emergency Control Centre
- DGP : Director General of Police
- DIG : Deputy Inspector General of Police
- DMA : Disaster Management Act
- ECC : Emergency Control Centre
- ERDMP : Emergency Response and Disaster Management Plan
- ERPG : Emergency Response Planning Guidelines
- ERDS : Emergency Response Data Sheet
- GIS : Geographical Information System
- HSD : High Speed Diesel
- HSSE : Health Safety Security and Environment
- IDLH : Immediately Dangerous to Life or Health
- IMD : India Meteorological Department
- LCG : Local Crisis Group
- LEL : Lower Explosive Limit

- LOC : Loss of Containment
- LPG : Liquefied Petroleum Gas
- MAH : Major Accident Hazard
- MoEF : Ministry of Environment and Forestry
- MFR : Medical First Responders
- MSDS : Material Safety Data Sheets
- MSIHC : Manufacture, Storage and Import of Hazardous Chemicals
- NDMA : National Disaster Management Authority
- PNGRB : Petroleum and Natural Gas Regulatory Board
- PPE : Personal Protective Equipment
- PWD : Public Works Department
- QRA : Quantitative Risk Assessment
- QRMT : Quick Response Medical Team
- SOP : Standard Operating Procedure

KEY TERMINOLOGY

Chemical accident means an accident involving a fortuitous, or sudden or unintended occurrence while handling any hazardous chemicals resulting in continuous, intermittent or repeated exposure to death, or injury to, any person or damage to any property but does not include an accident by reason only of war or radioactivity.

Disaster: A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

Emergency: A situation or scenario which has the potential to cause serious danger to persons, environment or damage to property and which tends to cause disruption inside or outside the premises and may require the help of outside resources.

Emergency response vehicle (ERV): Vehicle for handling emergencies having necessary equipment meant for rescue and relief operations and ERV can be put to use within installation, outside of installation including road incident.

Hazard: An event related to the property of substance or chemicals with a potential for human injury, damage to property, damage to the environment or some combination thereof.

Incident: An unplanned or unintended or intended event having potential to cause damage to life, property and environment.

Leak: Release or discharge of a hazardous chemical(s) or substances or material in any state into the environment.

Major accident: An incident involving loss of life inside or outside the installation, or ten or more injuries inside and/or one or more injuries outside or release of toxic chemicals or explosion or fire or spillage of hazardous chemicals resulting in on-site or off-site emergencies or damage to equipment leading to stoppage of process or adverse effects to the environment.

Major Accident Hazards (MAH) installations - isolated storage and industrial activity at a site handling (including transport through carrier or pipeline) of

hazardous chemicals equal to or, in excess of the threshold quantities specified in, MSIHC Rules 1989, Column 3 of schedule 2 and 3 respectively.

Mutual aid group: An industrial mutual aid association in which participating industries as a community shall assist each other in case of emergency. Mutual aid associations supplement a site's emergency control plan. Services of member industries shall be requested only when the emergency threatens to exceed the capability of otherwise available resources.

Offsite emergency: An emergency that takes place in an installation or site and the effects of emergency extends beyond the premises or the emergency created due to an incident, catastrophic incidents, natural calamities, etc. It no longer remains the concern of the installation management alone but also becomes a concern for the general public living outside and to deal with such eventualities shall be the responsibilities of district administration.

Offsite emergency plan means a response plan to control and mitigate the effects of catastrophic incidents in above ground installation (AGI) or underground installations (UGI) or road transportation. This plan shall be prepared by the district administration based on the data provided by the installation(s), to make the most effective use of combined resources, i.e., internal as well as external to minimize loss of life, property, and environment and to restore facilities at the earliest

Risk means the chance of a specific undesired event occurring within a specified period or in specified circumstances and it may be either a frequency or a probability of a specific undesired event taking place.

Site means any location where hazardous chemicals are manufactured or processed, stored, handled, used, disposed of and includes the whole of an area under the control of an occupier and includes pier, jetty or similar structure whether floating or not.

Spill means an unintended release or discharge of hydrocarbon or any other hazardous liquid into the environment.

Transport: movement of hazardous chemicals by any means over land, water or air.

Transport Emergency (TREM) card means a card containing details about the nature of hazards, protective devices, emergency telephone numbers and actions related to spillage, fire, first aid and other details of national and international (UN) numbers or signage which is common in India and abroad.

CHAPTER 1
INTRODUCTION USE, AND CONTROL OF OFF-SITE
EMERGENCY PLAN

INTRODUCTION USE, AND CONTROL OF OFF-SITE EMERGENCY PLAN

1 Emergency

An emergency can be defined as an accident/incident that can potentially cause serious injuries or loss of life. It may cause extensive property damage, serious disruption both in production and working of the factory, and adversely affect the environment.

- ✚ Plant failure
- ✚ Human error
- ✚ Vehicle crash/ toppling
- ✚ Sabotage
- ✚ Natural Calamities
- ✚ Fire and Explosion
- ✚ Loss of Containment

1.1 Offsite Emergency

The chemical release, fire, explosion or spillage in an industrial unit including isolated storage that may have ramifications outside the boundary of that particular industrial unit or such a chemical release, fire, explosion or spillage during the transportation of hazardous chemicals by road or by pipeline, all of which may pose a threat to life and property of public at large, is a situation qualifying to be an offsite emergency with the declaration to this effect by the District emergency authorities.

1.2 Background to Offsite Emergency

Manufacture, storage and use of hazardous substances pose a serious risk to industry, people in the neighbourhood and the environment. Accidental release of hazardous chemicals, which are flammable, explosive or toxic, may lead to emergencies. Depending upon the nature of the substance and magnitude of the release, an emergency could either be confined within the industry (On-site Emergency) or could transgress the boundary of the industry and affect the public in the neighbourhood in which case it would be an Off-site Emergency. The Off-site Emergency Plan is a comprehensive document detailing procedures for managing emergencies arising from potential major accidents involving hazardous chemicals in industrial settings. This plan addresses situations where accidents extend beyond the facility's boundaries, potentially impacting surrounding areas and communities.

Schedule 5 of MSIHC rules (under rule) requires the District Authorities to prepare an Off-site Emergency Plan in consultation with the Chief Inspector of Factories and with assistance from the Chief Controller of Explosives. The details to be furnished in the Off-site Emergency Plan are given in Schedule 12 of the Rules.

These are:

- The types of accidents and releases to be taken into account
- Organizations involved include key personnel and responsibilities and liaison arrangements between them
- Information about the site including likely locations of dangerous substances, personnel, and emergency control rooms
- Technical information such as chemical and physical characteristics and dangers of the substances and plant.
- Identification of the facilities and transport routes
- Contact for further advice e.g., meteorological information, transport, temporary food and accommodation, first aid and hospital services, water and agricultural authorities.
- Communications links telephones, radios and standby methods
- Special equipment including firefighting materials, damage control and repair items
- Details of emergency response procedures
- Notification to the public
- Evacuation arrangements
- Arrangements for dealing with the press and other media interests.
- Long-term clean up

1.3 Need for Offsite Emergency Plan

1.3.1 Societal need:

The effects of a major accident in an industrial setup are not always restricted to the boundaries of the industrial installation. They may spill over to the community and the environment in the vicinity. Therefore, the authorities and agencies are required to prepare themselves and be in a state of readiness at all times to limit the consequences of any such emergency to protect the people and the environment. A systematic approach is required to plan and prepare the authorities and agencies to tackle any emergency due to hazardous chemicals.

1.3.2 Statutory need:

The Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and the Chemical Accidents (Emergency Planning, Preparedness and Response) CA(EPPR) Rules, 1996 provide a statutory structure for controlling major hazards posed by hazardous chemicals. Rule 13(1) of MSIHC Rules requires the occupier of any Major Accident Hazard (MAH) installation to prepare and On-site Emergency Plan. Likewise, rule 14(1) of MSIHC Rules requires the District Authorities to prepare an Off-site Emergency Plan. The Plan is prepared in consultation with the occupiers of MAH installation in the area.

1.4 Essential Responsibilities Assigned under Important Regulations

1.4.1 Responsibility under MSIHC Rules, 1989

The MSIHC Rules, 1989 via its Schedule-5 assigns the responsibility of preparation of the Offsite Emergency Plan of a district to the District Collector of the district or the District Emergency Authority, if such is explicitly designated by the State Government. The Chief Inspector of Factories appointed under the Factories Act, 1948 is required to assist the District Collector (or the DEA, as the case may be) in the preparation of the Off-site Emergency Plan. The other authorities whose assistance shall be sought by the District Collector (or the DEA) wherever applicable in the preparation of Off-site Emergency Plan are the Chief Inspector of Dock Safety appointed under the Dock Workers (Safety Health and Welfare) Act, 1986, Chief Inspector of Mines appointed under the Mines Act, 1952, Atomic Energy Regulatory Board appointed under Atomic Energy Act, 1972, the Chief Controller of Explosives appointed under the Indian Explosives Act and Rules, 1983.

1.4.2 Responsibility under CA (EPPR) Rules, 1996

The CA(EPPR) Rules, 1996 calls for the formation of District Crisis Group along with Central Crisis Group, State Crisis Group and Local Crisis Group. The CA(EPPR) Rules, 1996 via Schedule-7, designates the DEA of the district as the Chairman of the District Crisis Group. Rule 9 of the CA(EPPR) Rules specifies the District Crisis Group as the apex body in the district to deal with major chemical accidents and to provide expert guidance for handling chemical accidents.

1.4.3 Responsibility under DMA Act, 2005

The Disaster Management Act, 2005 calls for establishment of District Disaster Management Authority for every district. The District Collector, District Magistrate or the Deputy Commissioner as the case may be is declared as the ex-officio chairman of the District Disaster Management Authority as per Section 25 (2) (a)

of the Act. Section 30 of the Act lists the powers and functions of the District Authority in event of a disaster. The section summarily assigns to the District Authority, the responsibility of planning for disaster management, taking appropriate measures for prevention of disaster and ensuring preparedness for a disaster as well as for co-ordinating and implementing response in event of a disaster.

1.5 Offsite Emergency Plan and its Use

This plan has been prepared in consultation with the MAH industries of Kurnool district. The following major aspects have been addressed in this offsite emergency plan:

- ✚ Information about the MAH industries which are part of Kurnool district
- ✚ Details of hazardous chemicals being handled in the identified MAH industries
- ✚ Emergency scenarios which may lead to an offsite emergency due to Loss of Containment (LOC) of hazardous chemicals/substances.
- ✚ Information about the current level of emergency preparedness
- ✚ Emergency Response Procedure

1.5.1 Pre-Emergency Use

The plan identifies the resources required for dealing with likely emergencies and draws attention to additional resources that may be required.

The plan helps to inform the necessary authorities and stakeholders of their responsibilities during the emergency.

1.5.2 During Emergency Use

The plan gives the procedures to be executed by various roles during the off-site emergency for its control and mitigation.

The plan serves as a ready-reckoned for all vital and factual information that is required during emergency.

1.5.3 Post-Emergency Use

The plan gives procedures for prevention of damage in the long term that may arise as effect of an emergency.

The plan lays for review of emergency to draw necessary observations and lessons for self-enrichment of plan for future emergencies.

1.6 Scope of Off-site Emergency Plan:

The Off-site Emergency Plan applies to the Kurnool district. The Off-site Emergency Plan compiles all the possible emergency scenarios pertaining to industrial or transportation hazards that may arise within the district boundaries and provides for the response mitigation of the same.

1.7 Declaration of Off-site Emergency and Enforcement of Plan

The responsibility and the power of declaring the off-site emergency in the district vests with the district emergency authorities.

In his absence, the responsibility and power vests with the authority appointed in place of the DEA.

The declaration of emergency shall be made using the procedure /format attached in Annexure 1.

1.8 Possessors of the Off-site Emergency Plan and the Maintenance Officer of the Off-site Emergency Plan

The copy of the off-site plan must be possessed by all the responders who contribute in the off-site planning process or in mitigation response. The list of all the possessors of the off-site plan is as following:

Sr	Authority Designation	Name of Office Holder	Address (O, R)	Contact (O, R, M)	Remarks

Legends: Address (O, R) is Address of Office (O) and Residence (R), Contact (O, R, M) is phone number of Office (O) and Residence (R) and Mobile (M)

The District Collector (or the DEA) is responsible for the maintenance and upkeep of the Off-site Emergency Plan. He may designate one officer to carry out the tasks pertaining to this role. This officer should be indicated in the 'Remarks' column of the table above.

1.9 Review and Amendment of Plan

The Off-site Emergency Plan must be circulated to all pertinent authorities, with the District Collector or the District Emergency Authority (DEA) tasked with ensuring the dissemination of current copies to relevant parties. Additionally, it is the responsibility of all relevant authorities to actively seek out and receive updated versions of the plan. Given the dynamic nature of this document, it should continuously reflect current realities and undergo regular revisions for optimal effectiveness.

DRAFT

CHAPTER 2
Profile of Kurnool District

2 Profile of Kurnool district

2.1 About Kurnool city

Kurnool city is governed by Municipal Corporation which comes under Kurnool Metropolitan Region. The city is located in Andhra Pradesh state of India. The current estimate population of Kurnool city in 2024 is 22,71,686.



Kurnool district map

2.2 Meteorological data:

From January to March, pleasant weather prevails with moderate winds blowing from the South-East. April and May are the hottest months, accompanied by Southwest winds that bring refreshing showers by the end of May. The subsequent four months see winds from the Western side, resulting in significant rainfall across the district. By late September, the wind becomes light and pleasant, signalling the onset of the Northeast monsoon. November and December typically feature fine weather with rare rainfall and gentle winds, often accompanied by heavy dew. On average, the district receives 614.7 mm of rainfall annually, but in the 2020-21 period, it recorded 841.8 mm.

2.3 RIVERS

The primary rivers coursing through the district includes the Tungabhadra, the Krishna, and the Kunderu.

The Tungabhadra originates in the Western Ghats and serves as the northern boundary, separating Kurnool from the Telangana region. It flows eastward, receiving the Hundri tributary and eventually merges with the Krishna River at Kudali Sangam. The Hundri, a tributary of the Tungabhadra, originates in the fields of Maddikera in Maddikera mandal. It receives a stream from Erramalas at Laddagiri in Kodumur Mandal before joining the Tungabhadra at Kurnool. The Hundri drains significant areas of Maddikera, Pathikonda, Devanakonda, Gonegandla, Kodumur, and Kallur mandals. It is characterized by turbid streams with sudden fluctuations in water levels.

The Kunderu, also known as Kumudvathi, originates on the western side of Erramalas and winds its way into the Kunderu valley.

2.4 Flora and fauna in the district

Kurnool district has diverse forest ecosystems, ranging from dry deciduous forests to scrub and thorn forests. Its rich vegetation includes iconic species like Neem, Tamarind, and Babul, along with a variety of other flora such as Ficus, Acacia, and Eucalyptus.

One of the district's unique features is the Rollapadu Wildlife Sanctuary, renowned for its dry rolling grasslands and as the habitat of the endangered Great Indian Bustard (GIB). Conservation efforts led by the Forest Department include establishing safe enclosures for the GIB and actively involving local communities in protection initiatives.

2.5 History of natural disasters in the Kurnool district

Hazard	Year	Impact
Flood	2009	Assets of department damaged
Drought	Kharif 2012	1706.95 ha. (13 Mandals), Crop losses
Heavy rains/unseasonal rains	2013	6681.92 ha (Atmakur & Sanjamala), Crop losses
Heavy rains/unseasonal rains	2013	2927.45 ha (17 Mandals), Crop losses

Hazard	Year	Impact
Heavy rains/unseasonal rains	2014	362.52 ha (Halaharvi, Chippagiri & Peapully), Crop losses
Heavy rains/unseasonal rains	2014	362.52 ha (Halaharvi, Chippagiri & Peapully), Crop losses
Drought	2014	Water scarcity, low yield from sources
Outbreak of Waterborne Disease	2015	293 people affected
Heavy rains/unseasonal rains	2015	95.338 ha (9 Mandals), Crop losses
HNSS Breach canals	2015	156.77 ha (1 Mandal), Crop losses
Drought	2015	Water scarcity, low yield from sources
Outbreak of Waterborne Disease	2016	34 people affected
Heavy Rains/unseasonal rains	Sep-2016	969.39 ha (Atmakur, Palapa & Velgode Mandals), Crop losses
Drought	2016	Water scarcity, low yield from sources
Heat Wave	2016	4 people died
Drought	2016-2017	249439.03 ha (26 Mandals), Crop losses

2.6 Seasonality of Hazards

Hazard	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Cyclone	---	---	---	---	Y	---	---	---	Y	Y	Y	Y
Flood	---	---	---	---	---	---	---	Y	Y	---	---	---
Fire	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Accident	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Heat wave	---	---	Y	Y	Y	Y	---	---	---	---	---	---
Earthquake	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

"Y" Indicates hazard during the particular months of the calendar year

2.7 MAH Industries in the Kurnool district

2.7.1 Bharat Petroleum Corporation Limited

The Kurnool LPG Bottling Plant, operated by Bharat Petroleum, is situated 12 km from Kurnool City on a 27-acre site (including a 7-acre green belt). It serves 130 distributorships and caters to a domestic customer base of 7.8 lakh. Established in 1995 as the first BPCL plant in Andhra Pradesh, it boasts a licensed storage capacity of 975 MT and an installed capacity of 108 TMTA. Bulk LPG from multiple plants is received through lorries, The Kurnool LPG Bottling Plant is equipped with a 5 Bay Tank Lorry Gantry specifically designed for unloading tank lorries carrying LPG. Bottling operations, conducted over two shifts, utilize advanced electronic equipment to produce various cylinder sizes. The plant adheres to OISD standards, featuring a robust firefighting system and strategically placed fire extinguishers. There are about 100 employees working in the plant (in each shift).

Sr. No.	Name of Material	Storage Size (Cu.m.)	Max. Qty. Stored	Type of Storage
01	LPG	125 MT x 3 Nos	375 MT	Bullets
02	LPG	600 MT x 1 No	600 MT	Mounded Storage Vessel

Details of chemicals handled in the facility

Operations	Description
Receiving Bulk LPG	Bulk LPG received from multiple sources via tank lorries (5 unloading bays are available in the plant)
Storage	Received LPG stored in terminal's storage tanks with a licensed capacity of 975 metric tonnes
Bottling Operations	LPG packaged into cylinders of various sizes suitable for domestic and commercial use using advanced electronic equipment

Overview of facility operations

2.7.2 TGV SRAAC LIMITED (formerly Sree Rayalaseema Alkalies and Allied Chemicals Ltd.)

TGV SRAACL established its plant in 1987 in Gondiparla, Kurnool District, an industrial hub. Presently, the plant manufactures 820 MT per day of Caustic soda/Potassium Hydroxide alongside Chlorine & Hydrogen as co-products. Chlorine is distributed in ton containers to Paper and Pharmaceutical manufacturers and for various applications like Chloro methane's, Stable Bleaching Powder, Hi-Strength Hypo, Mono chloro acetic acid, etc. A portion of Chlorine is also used to produce technical

grade and Food grade Hydrochloric Acid. Hydrogen is utilized for synthesizing HCl, manufacturing Hydrogenated Castor Oil, and as fuel for the Boiler. Excess Hydrogen is sold for bottling. Around 10 KL of Furnace Oil is monthly used for Boiler start-up. Coal-fired Boilers and Turbines replace D.G. sets for power generation.

To Utilize Chlorine, a Chloromethane plant is operational, producing Methyl chloride, Methylene Chloride, Chloroform & Carbon tetrachloride.

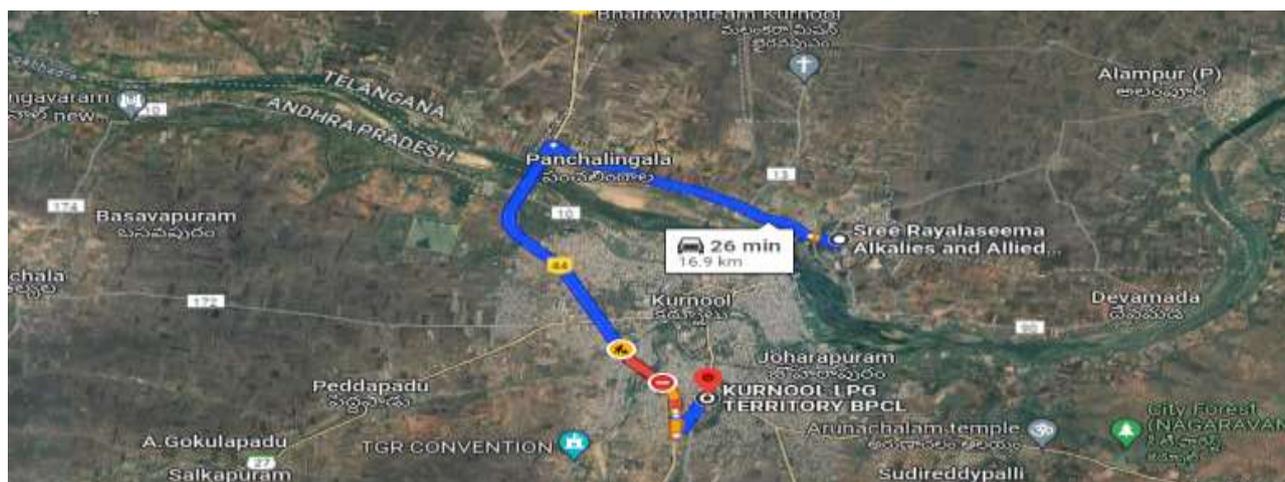
The below table outlines the storage capacities and chemicals which are being handled in the facility:

no.	Product	Storage Capacity
1.	Chlorine	4 x 100 MT in storage tanks Permission has been obtained to store 500 filled Chlorine tonners
2.	Hydrochloric Acid	3 x 290 M3 + 4 x 56 M3 = 1095 M3
3.	Sulphuric Acid	2 x 25 M3 = 50 M3 / 85 MTS
4.	Hydrogen	1 bullet x 150 m3 + 3 bullet X 18 M3 + 1 bullet X 22 M3
5.	Caustic Soda Lye	3400 MT
6.	Caustic Potash	500 MT
7.	HSD	155 KL
8.	F. O	50 KL
9.	Methyl Chloride	5 MT (Process Tank)
10.	Methylene Chloride	2 x 144.8 M3
11.	Carbon Tetra Chloride	1 x 51 M3
12.	Chloroform	2 x 166.4 M3
13.	Methanol	1 x 155 M3 2 x 553 M3
14.	New Methanol tanks	2 x 553 M3

2.7.3 Operations carried out in TGV SRAAC:

Process Stage	Description
Caustic Soda Production	
Electrolysis	Purified brine at 300 gpl concentration undergoes electrolysis in Ion-Exchange Membrane electrolyzers. Membranes separate sodium ions, generating chlorine and caustic soda.
Rectifier and Cell House Operation	Nine cell houses are operated, each connected to individual rectifiers, facilitating DC power supply.

Process Stage	Description
Chlorine and Caustic Handling	Depleted brine with dissolved chlorine is processed for chlorine extraction, while caustic soda is concentrated and sent for storage.
Potassium Hydroxide Production	
Electrolysis	Pure potassium chloride solution is electrolyzed using membrane cells, producing potassium hydroxide, chlorine, and hydrogen.
Potassium Hydroxide Processing	The potassium hydroxide liquid is concentrated to 48% and processed into flakes for storage and sales.
Hydrogenated Castor Oil Production	
Bleaching	Commercial castor oil undergoes bleaching with activated earth and carbon to obtain B.S.S. grade oil.
Hydrogenation	Unsaturated Retinoic acid in castor oil is hydrogenated to 12-Hydroxy Stearic Acid Glycerides using nickel catalyst.
Saponification and Acidulation	Hydrogenated Castor oil is saponified with caustic soda, then acidulated with sulphuric acid to produce 12-Hydroxy stearic acid and glycerine.
Glycerine Production	
Treatment	Glycerine water from the acidulation process is treated with lime, caustic soda, and alum to remove impurities and concentrate crude glycerine.
Concentration and Refinement	Crude glycerine is concentrated, distilled, and bleached with activated carbon to obtain C.P. grade glycerine.
Chloromethanes Plant	
Hydro Chlorination Section	Methanol and hydrogen chloride react in the presence of a catalyst to produce methyl chloride, which is then purified through washing and compression.
Chlorination Section	Methyl chloride reacts with chlorine to form higher chlorinated chloromethane compounds through vapor phase reactions.
Rectification Section	Product mixture is separated and purified via rectification, caustic washing, and water removal processes, resulting in distinct chloromethane compounds stored in separate tanks.



Location of -BPCL, LPG bottling terminal & TGV SRAAC plant are shown in the above figure

1. The distance between BPCL, LPG bottling plant and TGV SRAAC is approximately 17 km. Mutual aid is available between both the units.

CHAPTER 3

Hazard identification

DRAFT

3 Hazard identification

3.1 Identification of Hazards

The purpose of hazard identification is to highlight the critical operations of tasks, that is, those tasks posing significant risks to the health and safety of employees as well as highlighting those hazards pertaining to certain equipment due to energy sources, working conditions or activities performed.

Hazard identification technique has been used to identify potential leaks and major releases from failures of all process pipelines and associated facilities. After identifying the potential scenarios, the effects due to loss of containment of the material are evaluated. A Loss of Containment will lead to the release of significant quantities of hazardous substances from containment systems. This could involve leaks, spills and other incidents where hazardous substances are released into the environment, posing risks to safety, health, and the surround ecosystem.

The following data were collected to envisage scenarios:

- Composition of materials stored in storage tanks/ flowing through piping and equipment;
- Inventory of materials stored in storage tanks;
- Flow rate of materials passing through piping;
- Storage tanks/ piping and equipment physical conditions (phase temperature pressure);
- Connecting piping and piping dimensions.

Accidental release of flammable liquids/ gases can result in severe consequences. Delayed ignition of flammable gases can result in blast overpressures covering large areas. This may lead to extensive loss of life and property. In contrast fires can have localized consequences. Fires can be put out or contained in most cases; there are few mitigating actions one can take once a flammable gas or a vapor cloud gets released. Major accident hazards arise therefore consequent upon the release of flammable gases. However, in the case of facilities handling toxic materials the impact of toxic release is also of significant importance.

3.2 Factors for identification of hazards

In any installation the main hazard arises due to loss of containment during the handling of flammable and toxic chemicals. To formulate a structured approach for the identification of hazards an understanding of contributory factors is essential.

3.3 Inventory

Inventory analysis is commonly used in understanding the relative hazards and shortlisting of release scenarios. Inventory plays an important role concerning the potential hazard. The larger the inventory of a vessel or a system the larger the quantity of potential release. A practice commonly used to generate an incident list is to consider potential leaks and major releases from failure of pipelines and vessels/ tanks containing sizable inventories.

3.4 Parameters

Potential vapor release for the same material depends significantly on the operating conditions. This operating range is enough to release a large amount of vapor in case of a leak/rupture; therefore, the storage tank/pipeline leaks and ruptures are considered in the risk assessment calculations.

3.5 Initiating events

Both the complexity of the study and the number of incident outcome cases are affected by the range of initiating events and incidents covered. This not only reflects the inclusion of accidents/non-accident-initiated events but also the size of those events. Following events are considered in this study for consequence modelling:

- Catastrophic failure of storage tanks
- Small hole (continuous release)
- Leaks at fittings or valves (small continuous release)

3.6 Selecting of initiating events and incidents

Initiating events and incidents have been taken into account considering the goals and objectives of this study.

As per Reference Manual BEVI Risk assessment version 3.2, only the Loss of Containment (LOC) which is the release scenarios contributing to the offsite impact are included in the consequence modelling. LOC scenarios for the installation are included only if the following conditions are fulfilled:

- Frequency of occurrence is equal to or greater than 10^{-9} and
- Lethal damage (1% probability) occurs outside the establishment's boundary.

3.7 Types of outcome events

The following outcomes are expected from the LOC scenarios:

- Jet fire
- Pool fire
- Flash Fire (Flammable gas dispersion)
- Vapor Cloud Explosion
- Toxic Gas Dispersion

3.8 Jet fires

Jet fire occurs when a pressurized release (of a flammable gas or vapor) is ignited by any source. They tend to be localized in effect and are mainly of concern in establishing the potential for escalation effects and employee safety zones rather than for community risks. The jet fire model is based on the radiant fraction of total combustion energy which is assumed to arise from a point slowly along the jet flame path. The jet dispersion model gives the jet flame length.

3.8.1 Pool fires

This represents a situation when flammable liquid spillage forms a pool over a liquid or solid surface and gets ignited. Flammable liquids can be involved in pool fires where they are stored and transported in bulk quantities. Pool fires are associated with the difference between the release of material and the complete combustion of the material simultaneously. They are common when a large quantity of flammable material is released within a short time.

3.8.2 Flammable Gas Dispersion

Flammable vapours after loss of containment will normally spread in the direction of the wind. If it finds an ignition source before being dispersed to below its Lower Flammability Limit (LFL) a flash fire is likely to result and the flame may travel back to the source of the release. Any person caught in a flash fire is likely to suffer fatal burn injuries.

Typically, the burning zone is defined as 0.5 LFL and LFL limits back to the release point even though the vapor concentration might be above UFL.

3.8.3 Vapour Cloud Explosion (VCE)

A vapor cloud explosion is the result of flammable materials in the atmosphere a subsequent dispersion phase and after some delay ignition of the vapor cloud. Turbulence is the governing factor in blast generation which could intensify combustion to the level that will result in an explosion. Obstacles in the path of a

vapor cloud or when the cloud finds a confined area e.g., under the bullets often create turbulence. The VCE will result in overpressures.

3.8.4 Toxic Dispersion

The accidental release of toxic material into the atmosphere may result in dispersion. The extent of dispersion depends on the properties of released toxic material weather parameters and topographical conditions.

3.8.5 Identification of Emergency Scenario

Major industrial hazards are generally associated with the potential for toxic chemical release, fire or explosion.

Events involving the release of toxic materials

- Slow or intermittent release of toxic substance from a leaking valve
- Rapid release for limited duration due to fracture of pipe leading to a toxic cloud which may travel or dissipate
- Massive release of toxic substances due to failure of large storage or process vessel or uncontrolled chemical reaction.
- Loss of containment for a plant threatened by a fire
- ERPG-2 measurement criteria have been considered for toxic release to ensure emergency planning for worst case scenario

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

Events involving spillage of flammable liquids or loss of containment of flammable gases

- Confined spill
- Unconfined spill

3.8.6 Major fires with no danger of explosion Hazards from high levels of thermal radiation and smoke for example:

- Pool fire
- Flash fire
- Jet fire etc

3.8.7 Offsite Impact criteria

Thermal radiation impact criteria due to Jet fire and Pool fire:

4Kw/m²-First degree burns may be caused for persons who are within this distance.

Explosion/Overpressure impact criteria:

0.3 bar- Any building within this distance can experience steel frame distortion and possibly be pulled away from foundation, and it can also cause a lethality of around 100% for people within this distance.

Criteria of toxic gas impact on offsite:

ERPG-2 refers to the concentration where most people would experience significant, but not life-threatening, health effects.

3.8.8 Identification of emergency scenarios and delineation of vulnerable zones

- Explosion Events Hazards from blast waves flying debris and high levels of thermal radiation. Serious emergencies that can be envisaged are
- Confined explosions
- Unconfined vapor cloud explosion
- BLEVE

Assessment of possible incidents is to be carried out for each MAH installation in terms of:

- The quantity of hazardous material which could be released
- The rate of release
- Effects of such a release
- Thermal radiation from a fire at different distances
- Blast over-pressures due to an explosion as a function of distance from the incident spot
- Toxic effects affecting the vulnerable zone (circle showing concentrations)
- Number of people likely to be affected

3.8.9 Emergency Scenarios in MAH installations:

Level 1 (L1): A district level disaster within the capabilities of the district administration to deal with.

Level 2 (L2): A state level disaster within the capabilities of the state government to deal with.

Level 3 (L3): A National level disaster requiring major direct intervention of the Central Government.

Level 0 'L0' as 'No disaster situation. This is a level at which surveillance, preparedness and mitigation activities must be carried out.

The below levels are classified under Guidelines for preparation of off-site emergency plan by the Ministry of Environment and Forests (MoEF),

Level 1 (L1): A district level disaster within the capabilities of the district administration to deal with.

Level 2 (L2): A state level disaster within the capabilities of the state government to deal with.

Level 3 (L3): A National level disaster requiring major direct intervention of the Central Government.

Level 0 'L0' as 'No disaster situation. This is a level at which surveillance, preparedness and mitigation activities must be carried out.

Triggering mechanism for these levels are outlined in Section 4.4.

3.8.10 Scenarios identified to have potential offsite impact

S. No	Scenario Description	Failure Case	Consequence	Level	Maximum Damage Distance (m)
BPCL Bottling Plant					
1	Scenario #2 - 125 MT Above ground Bullet SRV Release Flammable Area of Vapor Cloud	SRV Release	Flash Fire	Level 1	Damage Distance: 212 Criteria: 60% LFL
2	Scenario #6 - 600 MT Mounded storage Flammable area of Vapour cloud due to SRV Pop up	SRV Release	Flash Fire	Level 1	Damage Distance: 98 Criteria: 60% LFL
3	Scenario #12 - Road Tanker 18 MT SRV Release	SRV Release	Flash Fire	Level 1	Damage Distance: 105 Criteria: 60% LFL
4	Scenario #4 - 125 MT Above ground Bullet Pool fire Thermal Radiation	Rupture	Pool Fire	Level 1	Damage Distance: 57 Description: Thermal radiation of 5 kW/m2 would result 2nd degree burns within 60 sec
5	Scenario #5 - 125 MT Above ground Bullet 2Inch Opening in the body Thermal Radiation Jet Fire	Leak (2 inch)	Jet Fire	Level 1	Damage Distance: 76 Description: Thermal radiation of 5 kW/m2 would result 2nd degree burns within 60 sec
6	Scenario #8 - Road Tanker 18MT 2-inch hole threat for UVCE	Leak (2 inch)	Jet Fire	Level 1	Damage Distance: 80 Description: Thermal radiation of 5 kW/m2 would result 2nd degree burns within 60 sec
7	Scenario #10 - Road Tanker 18MT under BLEVE	BLEVE	BLEVE	Level 1	Damage Distance: 448 Description: Thermal radiation of 5 kW/m2 would result 2nd degree burns within 60 sec
8	Scenario #11 - Road Tanker 18MT for Pool fire burning puddle	Rupture	Pool Fire	Level 1	Damage Distance: 62 Description: Thermal radiation of 5

S. No	Scenario Description	Failure Case	Consequence	Level	Maximum Damage Distance (m)
					kW/m2 would result 2nd degree burns within 60 sec
9	Scenario #22 - Jet fire pipeline Leak 6-inch dia liquid pipe Line full bore failure	FBR	Jet Fire	Level 1	Damage Distance: 105 Description: Thermal radiation of 5 kW/m2 would result 2nd degree burns within 60 sec
10	Scenario #1 - 125 MT Above ground Bullet SRV Release Overpressure (blast force) from vapor cloud explosion	SRV Release	Explosion	Level 1	Damage Distance: 79 Description: Overpressure of 3.5 psi would result serious injury
11	Scenario #13 - Road Tanker 18MT Unloading arm failure blast force	FBR (arm failure)	Explosion	Level 1	Damage Distance: 121 Description: Overpressure of 3.5 psi would result serious injury
TGV SRAAC Limited					
1	ISO-03-1_ Chlorine gas line from electrolyser up to PV-1151A/B	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.93kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.93kms for 1.5F weather condition
2	ISO-03-2A_ Chlorine Drying Tower	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.42kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.42kms for 1.5F weather condition
3	ISO-3-3A_ Chlorine Compressor (K-701A)	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.49kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.49kms for 1.5F weather condition

S. No	Scenario Description	Failure Case	Consequence	Level	Maximum Damage Distance (m)
4	ISO-3-5_Chlorine Liquefier No. 1	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.8kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.8kms for 1.5F weather condition
5	ISO-03-6_Chlorine Tank-A	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.17kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.17kms for 1.5F weather condition
6	ISO-4-1C_HCl Anhydrous Vapour line from Thermal Chlorination	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 775 Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (20ppm) concentration reaches up to 775m for 5D weather condition
7	ISO-5-1__ Chlorine vaporizer	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.31kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 1.31kms for 1.5F weather condition
8	ISO-09_Carbon Tetra Chloride Storage (CCl ₄)	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 1.44kms Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (200ppm) concentration reaches up to 1.44kms for 1.5F weather condition

S. No	Scenario Description	Failure Case	Consequence	Level	Maximum Damage Distance (m)
9	New IS - Leak from one (01) Cl2 Tonner (900 kgs, 12 barg) at Cl2 filling & storage area	Leak (25mm)	Toxic Dispersion	Level 2	Damage Distance: 3.95km Description: Toxic gas dispersion damage distance corresponding to ERPG-2 (3ppm) concentration reaches up to 3.95kms for 1.5F weather condition

DRAFT

CHAPTER 4
Emergency Preparedness

DRAFT

4 EMERGENCY PREPAREDNESS

4.1 Emergency Resources:

Emergency equipment's in BPCL, Kurnool: The facility is equipped with essential fire-fighting gear, including dry chemical powder extinguishers, CO2 fire extinguishers, and various nozzles. Following is the list of emergency equipment's which are available in BPCL, Kurnool.

Category	Particular	Quantity
A) Dry Chemical Powder	75 KG	5
	9 KG	97
B) CO2 F.E.	6.8 KG	7
	4.5 KG	7
	2 KG	10
C) Nozzles	Jet Nozzles	41
	Universal Nozzles	2
	Fog Nozzles	2
	Water Curtain Nozzles	3
D) Life Saving Equipment's	Safety Helmets	10
	Stretcher With Blanket	1
	Explosive Meter	2
	First Aid Box	5
E) Electric Siren	3 KM Range	1
	Hand Siren	5
F) Hydrant System	Diesel Driven Pumps	3
	Hydrant Points (Double)	33
	Water Cum Foam Monitor/ Water Monitor	24
	Hose Box	33
	Jockey Pumps	2
H) Water Storage Tanks	Static Water Tank	2
I) Water Source	Submersible Pump	2
J) Emergency Equipment's	Fire Proximity Suit	2
	Leak Control Kit	1

Category	Particular	Quantity
	Oil Spill Dispersant (Water Based)	1
	Breathing Apparatus Set (40 mins duration)	2
	Flame Proof Search Light	5
	Mega Phone Ex-Proof	2
	Manual Resuscitator	1
	Folding Stretcher	1
	Mechanical Tool Kit	1
	Electrical Rubber Hand Gloves	5
	Electrical Tester	5
	Chemical/Oil Splash Proof Goggles	1

4.1.1 Design details of fire hydrant system in BPCL, Kurnool

No.	Name of the Equipment	Quantity	Capacity
1.	Fire Engines	3	610 KL/hr
2.	Jockey Pumps	2	10 KL/hr
Details of fire water tank			
Fire Water Tank 1			2700 KL
Fire Water Tank 2			2700

4.1.2 Details of Emergency shutdown procedures established in the LPG bottling plant

Emergency push buttons are installed in various locations, including hazardous areas such as MCC, TLD Gantry, LPG P/H, and various sheds. Activation of an emergency push button triggers a shutdown of operations in the designated area, helping to prevent or minimize potential risks such as fire, gas leaks, or equipment malfunctions. List of emergency push buttons in the facility are provided below:

S.No.	ESD Type	Location
1	Flameproof	Admin Area
2	Flameproof	Canteen
3	Flameproof	Time Office
4	Flameproof	MCC
5	Flameproof	TLD Gantry
6	Flameproof	LPG P/H
7	Flameproof	MSV

S.No.	ESD Type	Location
8	Flameproof	Filling Shed
9	Flameproof	Filling Shed
10	Flameproof	Filling Shed
11	Flameproof	Filled Shed

4.1.3 Emergency equipment's in TGV SRAAC LIMITED

S.No.	Resources	Nos. available with Plant
1	MANPOWER	
	Regular employees – shift wise- General shift	1000
	Security staff	119
	Personnel Trained in first aid	117
	Doctors	1
	Nurses	5 (Male Nursing Asst.)
	Hospital Attendants	1
2	FIRE FIGHTING APPLIANCES/ EQUIPMENT/ CHEMICALS	
	Fire Tenders/ Firefighting engines	03 Fire Tenders
	Water storage capacity	1300 kl + 500 kl
	Fire Hoses	120
	Short fog Nozzles	4
	Foam Branch	8
	Jumbo Jet Equipment	12 (Jumbo water curtain at CMS)
	Foam Compound (KL)	2000 Litres.
3	SAFETY EQUIPMENTS	
	PVC Suit	50
	Compressed air B.A. Set	35
	Refill Cylinders for B.A. Set	40
	Cascade B.A Set	120
	Fire Proximity Suit	01
4	COMMUNICATION	
	Walkie-Talkie	Mobile Phones are available for all essential staffs
	Public Address System	Available
	Megaphone	3
5	TRANSPORT	

	Jeeps	1
	Cars	1
	Ambulance	3
	Buses	5
	Mobile Cranes	04
6	EQUIPMENTS FOR SHIFTING OF DISABLED/ CORPS DISPOSAL	
	Light Metal Stretchers	03 no's
8	LIST OF EMERGENCY DRUGS & APPLIANCES	
	Oxygen Cylinder	Medical Oxygen cylinders 12 no's
	Sterile Bandages	Available
	Cotton Sterilized	Available
	Antibiotics	Available
	Analgesics	Available
	Sedatives	Available
	Tetanus Toxoid	Available
	Dressing Instruments	Available
	Sterilizers	Available
	B.P. Apparatus	Available
	Suction Apparatus	03 no's

4.1.4 Details of firefighting equipment's available in TGV SRAAC LIMITED, Kurnool

Fire Safety Systems	Description
Water Supply Infrastructure	Water drawn from Tungabhadra River for firefighting and process needs
	Two dedicated water storages: 600 m3 and 700 m3 for firefighting requirements
Fire Pump Systems	Electric-driven and Diesel-driven fire water pumps with jockey pumps
	Automatic switchover mechanism ensures continuous operation in case of power outage or equipment failure
Ring Main Hydrant System	Fully approved ring main hydrant system laid out across the facility for efficient water distribution
Specialized Equipment	Water monitors, foam making branches, fire hoses, branch pipes, jet nozzles
	Stock of foam compound is maintained for firefighting needs

Fire Safety Systems	Description
Foam Pouring Arrangements	Foam pouring arrangements in critical storage areas (e.g., Furnace Oil, Diesel tanks, Methanol tanks)

4.1.5 Control measures established in the plant to prevent chlorine leaks:

Control measure	Description
Pipeline Inspection	Regular visual inspections are conducted to avoid damage or corrosion.
Pipeline Joint Testing	Testing joints with ammonia to check for leaks or weak points.
Thickness Measurement & Replacement	Thickness test is conducted for chlorine pipelines every 3 years.
Emergency Scrubbing System	System is installed to neutralize chlorine in case of tank leakages, which is also extended to the unit in which chlorine tonners are being filled. Doors are provided in the chlorine tonner filling section which will close upon sensing a chlorine leak. Backup power has been provided for the scrubbing system.

4.2 Formation of local crisis group

Local Crisis Group shall be the body in the industrial pocket (as per CAEPR Rules, 1996) to deal with chemical accidents and coordinate efforts in planning, preparedness and mitigation of a chemical accident:

4.2.1 Roles of the Local crisis group:

The Local Crisis Group shall:

- (a) prepare local emergency plan for the industrial pocket.
- (b) ensure dovetailing of the local emergency plan with the district off-site emergency plan.
- (c) train personnel involved in chemical accident management.
- (d) educate the population likely to be affected in a chemical accident about the remedies and existing preparedness in the area.
- (e) conduct at least one full scale mock-drill of a chemical accident at a site every six months and forward a report to the District Crisis Group.
- (f) respond to all public inquiries on the subject.

4.3 Composition of local crisis group (As per CAEPPR Rules,1996)

The local crisis group shall comprise of the members /departments listed in the below table This composition ensures a multidisciplinary approach to off-site emergency management, with representatives from various sectors collaborating to safeguard public safety and minimize the impact on the local communities.

No.	Designation/Role
1	Sub-divisional Magistrate / District Chairperson
2	Inspector of Factories Member Secretary
3	Industries in the District/Industrial area/ Member industrial pocket
4	Transporters of Hazardous Chemicals (2 Numbers)
5	Fire Officer
6	Station House Officer (Police)
7	Block Development Officer
8	One Representative of Civil Defence
9	Primary Health Officer
10	Editor of local newspaper
11	Community leader/Sarpanch/Village Pradhan nominated by Chairperson
12	One Representative of Non-Government Organisation to be nominated by the Chairperson
13	Two Doctors eminent in the Local area, to be nominated by Chairperson
14	Two Social Workers to be nominated by the Chairperson
15	PESO (Petroleum and Explosives Safety Organisation)
16	Kurnool Municipal Corporation
17	Pollution Control Board
18	APSPDCL (Andhra Pradesh Southern Power Distribution Company Limited)
19	Agriculture department /Civil supplies department
20	Disaster Centre/Office
21	Transport Department - Government of Andhra Pradesh
22	Water Supply Board (APWRD)

4.4 Role of Statutory bodies and other Stakeholders

4.4.1 The District Collector (or the District Emergency Authority if such is explicitly designated by the State Government under the MSIHC Rules 1989):

- ✚ Overall responsibility for combating the Off-site emergency.
- ✚ Ensure the Police and Fire, personnel combat the emergency.
- ✚ Arrange, if necessary, for warning and evacuating the public, through the Department of Police.
- ✚ Communicate with Media to disseminate vital information to public.
- ✚ Arrange for dispensing vital information to public using arrangements like mass-SMS, public announcement using pre-recorded tapes.
- ✚ Direct the team of doctors headed by the Medical Officer.
- ✚ Direct the local chief of State Transport Corporation to arrange for transport of victims and evacuation of people trapped within the hazard zone, if necessary.
- ✚ Direct the Electricity Board officials to give uninterrupted power supply.
- ✚ Direct the official in-charge to provide uninterrupted water supply as required.
- ✚ If evacuation of population is necessary direct the Revenue officer and the Supply officer to provide safe shelters, food and other life sustaining requirements for the evacuees, if required.
- ✚ Co-ordinate with the media.
- ✚ Arrange for, release and provide necessary funds at various stages of disaster mitigation.
- ✚ Direct railways to stop train, if required.
- ✚ Communicate to district control room details on the field activities including development and reinforcement of staff and resourced of staff and resourced of staff and resources and communicate nature and additional requirements.

4.4.2 Police:

- ✚ Communicate and co-ordinate with MAH units, DC, Fire Services, Transport authorities, medical department, Media, Civil Defence and Home Guard and Local Army established as required.
- ✚ Warn and advice the people in the affected area
- ✚ Regulate and divert traffic
- ✚ Arrange for evacuation
- ✚ Maintain law and order in the area

- ✚ Ensure protection of life and property of evacuees

4.4.3 Fire Fighting and Rescue department:

- ✚ Perform fire-fighting operations by deploying men and appliances
- ✚ Perform rescue operation in the affected area.
- ✚ Communicate and co-ordinate with Police, Medical Department of necessary information.
- ✚ Keep knowledge on appropriate response to different chemical emergency scenarios.
- ✚ Keep adequate stock and resource information on necessary means, material, appliances required to deal with particular emergency situations with updated details of suppliers and stockists.

4.4.4 Medical Department:

- ✚ Arrange for preparing casualties to be sent to government/private hospitals
- ✚ Set up temporary medical camp and ensure medical facilities at affected location and neighbourhood
- ✚ Keep knowledge on appropriate response to different cases of toxic consumption and injuries
- ✚ Set up temporary mortuary, identification of dead bodies and post-mortem

4.4.5 Department of Factories:

- ✚ Provide necessary direction to MAH unit and assistance to DC, Fire Department, Medical Department among others
- ✚ Seek help from and involve assistance of Technical Experts of relevant and appropriate expertise and specialization
- ✚ Initiate, facilitate and provide for investigation into the accident

4.4.6 Occupier of the MAH factories in the district

- ✚ Possess up-to-date copy of Off-site Emergency Plan
- ✚ Communicate promptly, if emergency scenario goes beyond the boundary as per Triggering mechanism.
- ✚ Communicate changes within the factory that may require inclusion or suitable modification in the off-site plan to the DC (Maintenance Officer) of the Plan.

4.4.7 Technical Experts:

- ✚ Promptly respond to provide the necessary technical advice to MAH unit, DC, Factory Inspectors, Fire Department, Medical Department among others
- ✚ Provide on-phone help after properly understanding and assessing the situation
- ✚ Make visit to the site in co-ordination with DC, Factory Inspectors to provide for appropriate technical assistance

4.4.8 Mutual AID Group:

- ✚ Coordinate with DC, Fire service, Police department and Kurnool MAH units.
- ✚ To quickly mobilize the resources required to emergency mitigation at the site or wherever required.

4.4.9 Pollution Control Board (APPCB):

- ✚ Project likely areas to be polluted.
- ✚ Carry out pollution assessment at suspected locations including soil, river and air assessment
- ✚ Ensure controlling of long-term pollution damage
- ✚ Identify unidentified substances, chemical releases, if any

4.4.10 Media:

- ✚ Disseminate vital information to public on direction of DC, Police and other Authorities
- ✚ Act responsibly in disseminating vital information and dispel rumours, if any

4.4.11 Railways:

- ✚ Act as per the direction of DEA to stop incoming trains, if required
- ✚ Arrange for evacuation, if required

4.4.12 Transporter of Hazardous Chemical:

- ✚ Possess up-to-date copy of Off-site Emergency Plan
- ✚ Communicate promptly, any foreseeable disaster during transportation to the DC, Police, Fire Service and Inspector of Factories.
- ✚ Communicate new assignments, newly added routes or other changes to the DC (Maintenance Officer) of the Plan.

4.4.13 Electricity Board (APSPDCL):

- ✚ Arrange for uninterrupted power supply to the plant, as required
- ✚ Arrange for lighting; at temporary medical camps etc
- ✚ Arrange for switching off power supply on request from District Authorities
- ✚ Take care of electrical equipment within the damaged zone

4.4.14 Telecommunication Department:

- ✚ Ensure working of communication lines to enable effective communication between various responder agencies

4.4.15 Aviation Department:

- ✚ Mobilise resources such as helicopters for knocking down vapour clouds etc

4.4.16 Civil Defence:

- ✚ Co-ordinate with Police authorities
- ✚ Extend help in evacuation
- ✚ Arrange for round the clock security arrangements in the affected and evacuation areas
- ✚ Safeguard the properties and belongings of evacuees

4.4.17 Home Guards:

- ✚ Co-ordinate with Police authorities.
- ✚ Extend help in evacuation.
- ✚ Arrange for round the clock security arrangements in the affected and evacuation areas.
- ✚ Safeguard the properties and belongings of evacuees

4.4.18 National Disaster Response Force (NDRF):

- ✚ Carry out tasks for disaster mitigation as required

4.4.19 NGOs:

- ✚ Act as per the direction of DEA, Police and other District Authorities
- ✚ Aid and assist the district authorities in emergency mitigation

4.4.20 Public Works Department (PWD):

- ✚ Ensure adequate water supply for fire- fighting.
- ✚ Arrange for drinking water for evacuated persons at rallying posts, parking yards and evacuation centres
- ✚ Arrange water for cattle.

4.4.21 Water Supply Board (APWRD):

- ✚ Arrange for supply of water to evacuees and all others involved in emergency control operations

4.4.22 Civil Supplies Department:

- ✚ Arrangement to provide food and clothing as necessary, to the evacuees and all others involved in emergency controlling operations.

4.4.23 Animal Husbandry Department

- ✚ Arrange for taking care of cattle - especially milch animals living in affected zone
- ✚ If evacuation of cattle is required, identify the evacuation area and shelter
- ✚ Transport arrangements for evacuation
- ✚ Fodder, drinking water arrangements for cattle.
- ✚ Arrange for veterinary doctor

4.4.24 Agriculture Department:

- ✚ Arrange for protection of food grains and standing crops in the vulnerable zone.
- ✚ Give instructions, to farmers, if any

4.4.25 Regional Transport Authority:

- ✚ To investigate into the cause of road accident involving hazardous goods carrier and take necessary action

4.5 List of Emergency Facilities and Resources for Off-Site Incident

4.5.1 Fire stations n Kurnool

This table provides information about the fire stations located in Kurnool district

S. No	Name of Fire Station	Address	Phone Number (with STD code)	Mobile Number
1	Kurnool	Kurnool Fire Station, H.No.3/5278, Near new Ayyappa Swamy Temple, Kurnool -518001	08518-255101	9963737924
2	Adoni	Adoni Fire Station, Near Railway Station, Adoni, Pin Code: 518301	08512-252299	9963738169
3	Yemmiganur	Yemmiganur Fire Station, Adoni Road, Opp: Indian Gas Godown, Yemmiganur, Pin Code: 518360	08512-255101	9963738627
4	Kodumur	Kodumur Fire Station, Veldurthy Road, Kodumur, Pin Code: 518464	08525-228188	9963739051
5	Alur	Alur Fire Station, Hollagondha Road, Alur, Pin Code: 518395	08523-229088	9963739178
6	Pattikonda	Pattikonda Fire Station, Adoni Road, Pattikonda, Pin Code: 518380	08520-226700	9963739458

4.5.2 List of Hospitals in Kurnool district

The below table provides the names, locations, addresses, and contact numbers of hospitals in Kurnool district, facilitating easy access to medical assistance during emergencies.

S.no	Hospital Name	Location	Address	Contact Number
1	KIMS Hospitals	Budhawarpet	Joharapuram Rd, near New Ayyapa Swamy Temple, Kurnool, AP 518004	8518352000
2	Government General Hospital	Kurnool City	Budhawarpet Rd, Budhawara Peta, Kurnool, AP 518002	8518255422
3	Sai Surya Multi Speciality Hospital	Bellary Chaurastha	R27W+XC4, near vinayak ghat, A Camp, Kurnool, AP 518002	085182 55501

S.no	Hospital Name	Location	Address	Contact Number
4	RDT Hospital	Bathalapalli	R3P3+727, N R Peta, Kurnool, AP 518001	085182 44534
5	Sanjeevani Hospitals	Adoni	Opposite Tungabhadra Pump House, Sunkesula Road, Kurnool, AP	88863 33765
6	Apollo Hospitals	Kurnool City	Door No 43-67/A, NR Peta, Kurnool - 518002 (Opposite Kurnool Municipal Corporation)	8518225888
7	Sri Sai Nursing Home	Kurnool City	8-5-26, Kadapa Road, Kurnool - 518543	7947424993
8	SVRR Government General Hospital	Kurnool City	Budhwarpet Rd, Budhawara Peta, Kurnool, AP 518002	9491043899
9	Vijaya Super Speciality Hospital	Kurnool City	R23W+5X2, C Camp Rd, near Big Bazaar - Kurnool, AP 518002	7947431320
10	Vishwa Bharathi Super Speciality Hospital	Nandyal	50-760/A/4, Road Number 4 Near Kotla Railway Station, Kurnool, AP 518002	8518229966
11	Sri Venkateswara Nursing Home	Kurnool City	Door No 43/63, Road No 3, NR Peta, Kurnool - 518002 (Opposite Aasha Kiran Hospital)	7947433354
12	Dhanalakshmi Hospital	Kurnool City	18/161/2a, Upstairs, Nehru Road, Kurnool - 518001	7947434689
13	Bollineni Hospital	Kurnool City	Joharapuram Rd, near New Ayyapa Swamy Temple, Kurnool, AP 518004	8518352000
14	Anand Hospital	Kurnool City	Shop 1/112, Main Road Poola Bazaar, Old Town, Kurnool - 518001	7947128520
15	Suraksha Super Speciality Hospital	Kurnool City	R2GG+5H4, New Bus Stand Rd, Indira Nagar, Kurnool, AP 518004	7945172810
16	Sri Vyshnavi Hospital	Kurnool City	R2MR+XGC, Municipal Office Rd, Prakash Nagar, Kurnool, AP 518001	8518225455

4.5.3 List of Blood banks in Kurnool district

No	Name and Address of the Blood Bank	Licensed Products
1	Indian Red Cross Society Blood Bank 1st Floor, Govt. Area Hospital, Adoni, Kurnool	Whole Human Blood Packed Red cells Fresh Frozen Plasma Platelet Concentrate Single Donor plasma
2	The Govt. District Hospital Blood Bank Nandyal, Kurnool	Human Blood
3	Santhiram Medical College, General Hospital Blood Bank SHAFSA Educational Society, NH-18, Nandyal, Kurnool Dist.	Human Blood
4	Belief Blood Bank Sai Complex, 3rd Floor, Addanki Bus Stop Centre, Kurnool Road, Ongole Prakasam Dist.	Whole Human Blood Packed Red Cells Fresh Frozen Plasma Platelets

4.5.4 Vulnerable zones

Offsite scenarios- BPCL, Kurnool:

The below contours show the affected zones due to the identified off-site scenarios:



Affected zones due to offsite site scenarios from BPCL, Kurnool

Following areas are located in the vulnerable zones

1. Edify World School
2. Sakshi Printing Press, Kurnool
3. Residential areas/Buildings



Affected zones due to offsite site scenarios from TGV SRAAC, Kurnool

The affected zones include residential areas located in the village E-Thandra padu

4.5.5 Mutual Aid

- ✚ Mutual aid is established between BPCL, LPG bottling plant and TGV SRAAC. The establishment of mutual aid between BPCL, the LPG bottling plant, and TGV SRAAC is collaborative effort to enhance preparedness and response capabilities in the event of emergencies.

CHAPTER 5
EMERGENCY RESPONSE

DRAFT

5 EMERGENCY RESPONSE

Emergency response procedures are detailed in this section to address and manage potential off-site chemical disasters efficiently. These procedures aim to safeguard lives, minimize damage, and maintain operational continuity during emergencies.

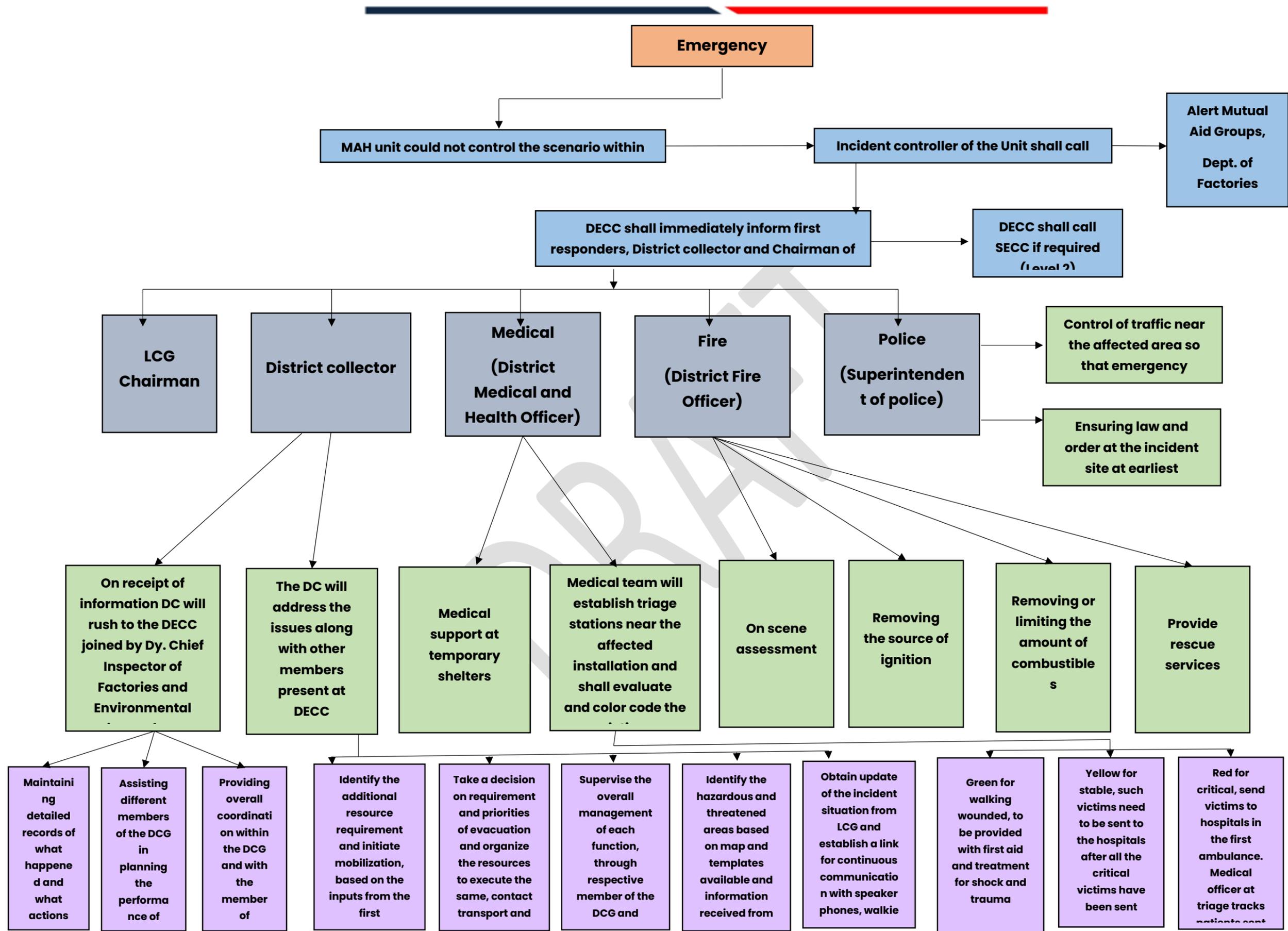
5.1 Action Plan for Offsite-Emergency

The Incident Controller within the establishment is tasked with promptly notifying the District Emergency Control Centre (DECC) of any incidents. Upon receiving first-hand information from the site's Incident Controller regarding an offsite incident, the DECC's designated authority must immediately inform the District Collector, Local Crisis Group, Police, Fire & Emergency Services, and Medical Services.

Subsequently, the District Collector is responsible for notifying both the State Emergency Control Centre and the Andhra Pradesh Pollution Control Board (APPCB) about the incident. Additionally, the District Collector, alongside other DECC members, is to address the issues at hand.

First responders are then required to conduct an on-site assessment of the emergencies, ensuring a comprehensive understanding of the situation for effective response measures.

The communication provided in the section below is to be adopted for emergency communication:



5.2 Evacuation and Mitigation:

Chief incident controller of facility from where off-site emergency is generated shall hand over the situation to the District Collector for implementing the offsite emergency plan.

District collector will declare an off-site emergency in consultation with relevant authorities and activate an off-site emergency plan (Annexure 9.1).

DC shall instruct Mutual aid Groups in the Kurnool district for assistance.

District Collector, Department of Factories, Home Department, Health Department, Industry/ Mutual aid Group shall:

- Arrange an immediate deployment of various ERTs in affected sectors. (Police, Fire, Medical etc.)
- Based on the emergency monitoring teams from off- site areas initiate counter measures such as sheltering and medical help.
- Arrange an evacuation of the affected/ likely to be affected workers and population to safer places.
- Activate systems of the State machinery to meet the necessary requirements of the public in the camp till the people are in a position to go back to their homes after the affected areas are cleared and declared safe.
- Deploy QRMTs/ MRFs consisting of physicians' triage officer nurses and paramedical staff

Fire and Emergency Rescue services, Municipal corporation shall:

- Assess the situation (information about the chemical leak/spill the action taken and current status).
- In case of fire, start firefighting with a suitable medium and also take care of surrounding storage/ tanks are overheated so that reduce the chances of domino effect.
- Police under Home department shall:
- Control and divert the traffic near the affected areas. Ensure law and order at the incident site during emergency and at evacuation centres too. Provide security in evacuated areas.
- Secretary Home and Director General of Police (DGP) will direct the participation of Police in the emergency response. Secretary Home and DG Police will constitute an integrated command. Secretary Home and DGP will

report to the CEO APSDMA immediately upon the receipt of information about the disaster.

- DGP will establish contact with the District Police Control Room immediately. He will get a situation estimate and assess the operational requirements for the police. DGP will issue an alert to the DIG and the surrounding districts. He will direct all the police officials and forces in adjacent Districts to be deployed if necessary. The DIG will ensure that the police forces required for traffic management evacuation and law and order are available with the District Administration.
- DGP will review the dissemination of warning and the need for evacuation. He will help the Fire & Emergency Services and the Factory Inspectorate of the Department of Factories with Police Wireless sets so that there is continuous communication among the first responders in the emergency situation.
- DGP will ensure that the police force will not enter the area under disaster without the permission of the Fire & Emergency Services and Health officials.
- The DGP will order deployment of the police force for evacuation of the people from the zone of the danger. The DGP will send instructions for the cordoning off of the area. People should not be allowed access anywhere close to the site of the disaster.
- The DGP will review the traffic management in the area. The primary aim would be to ensure the transportation of the injured to the hospital easy access for emergency responders and safe evacuation of the people from the danger zone.
- The DGP will also issue directives that all the Private and Public Transport (trains and buses) be diverted from the disaster area. The DGP will contact the DIG and ask him to organize the deployment of police force from other Districts based on the need assessment. The DGP will also contact the Central Industrial Security Forces and other paramilitary forces to seek their deployment if needed.
 - The DGP will supervise law and order situation. He will take all the possible precautions to ensure that public order is maintained and no one takes undue advantage of the situation.

5.3 Medical Assistance:

- Department of Health, Medical and Family Welfare shall address the health-related issues:
- Ensure that the required medical assistance/ aid and medicines are provided to the affected people at site as well as at evacuation/ relief centres in the affected area and necessary records are maintained.
- Ensure that the hospitals are well prepared to deal with seriously injured persons.
- Keep adequate stock of essential medicines antidotes first-aid etc.
- If required take the help of doctors/ paramedics from the list of doctors/ paramedics available in the vicinity (refer the hospital list shared with this report) surrounding for immediate medical assistance
- The Secretary – Health Commissioner of Health and emergency medicine experts will provide the necessary expertise and specialized services to the CEO APSDMA.
- The CEO APSDMA will consider the level of exposure on the basis of situation estimate received from the District Administration.
- Based on the information upon the level and extent of contamination the CEO APSDMA will decide on the issue of alert and warning to the people in the affected areas through the All India Radio, Doordarshan, Cable TV and social media.
- The CEO APSDMA will contact the Civil Surgeon and the District Health Officer of the concerned district and ask them to deploy all the necessary medical facilities including doctors' nurses' medicines and ambulances
- The CEO APSDMA will alert major hospitals in the Kurnool surrounding area and ask them to be in readiness for receiving patients
- The CEO APSDMA will review the diagnostic support services: clinical laboratory, blood banks, radiology, pathology, pharmacy, paramedics, Red Cross, NGOs and volunteer personnel. It will seek all the steps to organize the necessary medical help through the deployment of doctors' paramedics and provision of blood and medicines as required
- The CEO APSDMA will collect information on the number of deaths and persons injured; the nature of injuries and the likely long-term consequences
- The CEO APSDMA must assess the medical needs of the area on the basis of likely long-term consequences and take steps to equip local medical

facilities for treating people on a long-term basis. The CEO APSDMA must also make financial provision for spending on long-term treatment.

- Psychosocial care for the victims of disaster by the team of experts.

5.4 Disposal of Dead bodies:

District collector, Municipal Commissioner, Health Department, Police under Home Department, Local Authorities shall:

- Ensure following procedure is followed before disposal/ handing over of dead bodies:
- Photographs of the dead bodies are taken
- Identification of the dead bodies is done
- Post Mortem wherever necessary and possible is carried out
- Handing over dead bodies of persons known/identified to their relatives
- Disposal of unclaimed and unidentified dead bodies
- Animal Husbandry Departments Local Authorities and health department shall:
- Animal Husbandry Department to ensure medical aid to cattle that are injured.
- Disposal of animal carcasses with the help of local bodies/health department.

5.5 Response to Emergency Scenarios

5.5.1 Fire:

Follow the action plan as outlined in the Section 5.1

Consider indicative evacuation distance based on overall consequence summary to identified places of shelter

Refer Annexure 9.7 for MSDS of LPG.

The following fire tenders are available in the Kurnool IDA MAH units,

Industry Name	No. of. Fire Tenders
TGV SRAAC	06

5.5.2 Toxic (Chlorine):

Follow the action plan as outlined in the Section 5.1

Consider indicative evacuation distance (refer section 4.2) emergency responders shall ensure that evacuation is done outside the identified vulnerable zones (refer section 9.9)

Fire Services and Emergency Rescue and Police under Home department shall:

- Try to terminate the release/ stopping of leak with the use of proper PPE and to reduce/ eliminate the exposure using neutralize agent (Sodium hydroxide is a neutralized agent for Chlorine).
- Search and identify the risk and nullify the sources of leak/ toxic release. If any unclear or unidentified substance or source is identified or detected the team should send them immediately to the laboratory for further investigation/ analysis.

Refer Annexure 9.8 for Emergency Response Data Sheet (ERDS) - Chlorine

5.5.3 Road Transportation:

The driver of the tanker is expected to be trained to handle an emergency situation and have up to date contact information. He will contact the consignor and consignee of the cargo he is carrying and the local police station (the number should be available with the driver) on priority basis. The driver will also notify DEOC.

The information driver should provide include,

- Exact location of the tanker
- Identification of any critical or sensitive structures nearby (schools, hospitals, etc.)
- Name and telephone number of contact per consignor and consignee
- Name of the chemicals released
- An indication of whether the substance is extremely hazardous
- An estimate of the quantity released into the environment
- Estimated time and duration of the release
- Whether the release occurred into air, water, and/or land
- Any known or anticipated acute or chronic health risks associated with the emergency, and where necessary, advice regarding medical attention for exposed individuals.
- Suggested protective actions such as evacuation or sheltering in place.

Actions are same as outlined in Section 5.1. In case of road emergencies, police may be first on site ahead of fire brigade. Irrespective of who arrives on the site first, all first responders should have basic training to identify safe isolation distance and initial protective actions, and identify situations where they must wait for a qualified emergency response to control the situation.

Information available with driver - Under the Motor Vehicle Act 1988, every motor vehicle carrying hazardous substances should have the following:

- Emergency Information Panel with information on: (a) Correct, technical name of the substances being transported; (b) UN-number, HAZCHEM code, and UN hazard class label; (c) Emergency contact telephone; and (d) Any specialist advice
- The driver of the vehicles should possess the TRANSPORT EMERGENCY CARD or TREMCARD as per Central Motor Vehicles Rules 132 (2). TREMCARD carries detailed instructions on response actions for fire, spillage, or leakage. It also includes instruction to driver on his actions.

Protective actions by the driver:

- As per his training and hazard posed by the chemical, stop traffic and general citizens from approaching the accident site until police arrive for help.
- The driver of the tanker must be given appropriate level of protective clothing if he is expected to assist in response. He needs to protect himself before attempting response. If appropriate PPE is not available, then he should move to a safe distance and await response from offsite agencies.

Role of Consignor and Consignee in Response:

- Consignor must ensure that the driver of the tanker is well trained, carries valid license, has TREMCARD, and the emergency information panel is clearly visible as per the rules on the tanker.
- The driver should be provided with up-to-date contact information of police stations and DECC.
- The driver should have contact information (phones and mobiles) of contracted external experts, and in-house experts at consignor and consignee.
- The driver should be provided with appropriate protective equipment if he is expected to assist in response.
- Driver should handover TREM CARD to responding agencies.

- Consignor and consignee should coordinate with DEOC / SEOC to make arrangement for containment, transfer of content to other vehicles, and other response actions.
- Consignor and consignee should be encouraged to identify experts enroute to assist in emergency situations and include their contact information on TREMCARD.

DRAFT

DRAFT

CHAPTER 6
POST EMERGENCY RESTORATION AND CLEAN-UP

6 EMERGENCY RESTORATION AND CLEAN-UP

Information to Statutory Authority:

Once the incident has been called off, the following actions shall be carried out by the respective departments, and the District Administration.

6.1 Search & Detection of Leak / Toxic Release

The Search & Detection Team is responsible for identifying and neutralizing potential risks and sources of leaks or toxic releases. In cases where substances or sources remain unclear or unidentified, the team is required to promptly send them to the laboratory for thorough investigation and analysis. Additionally, the team should carefully preserve samples from the incident site, including sand, water, air, and other contaminated substances, to support future investigations and strengthen the case. Technical expertise of various State Department may be used by the Search & Detection Team in carrying out the activities if required.

6.2 Structural Inspections after Fires or Explosions

A significant explosion has the potential to cause extensive damage to numerous buildings, as well as nearby bridges or tunnels. Similarly, large fires can adversely impact buildings and other infrastructure facilities across a wide surrounding area. In such scenarios, residents or property owners of partially damaged buildings will naturally seek assurance regarding the safety of their structures before reoccupation during the repair period. Swift resolution of inquiries regarding the safety of highway or railway bridges is crucial to prevent traffic complications. It is imperative to ensure that inspection personnel are equipped with special precautions, such as chemical protective gear, in addition to standard safety equipment, particularly in cases where the structure may still be contaminated by hazardous residues.

Fire & Emergency Services personnel along with the structural experts from the PWD Department shall be responsible for inspecting the structural integrity of damaged buildings, bridges or other structures in the aftermath of a fire or explosion.

6.3 Search, Rescue and Evacuation

After receiving approval from technical experts responsible for building safety, the Search & Evacuation Team should evacuate the impacted populace from the event location. Brief the Information Officer on the rescue and evacuation status, including interim shelter location, to prevent misinformation from spreading and public fear. The team should work with police to prevent the general people from approaching the risk zone. The Team should guide people through the evacuation

route, first aid, and decontamination area. They should also assist the medical team in transporting sufferers to nearby hospitals.

6.4 Post Incident Testing for Contamination

The De-contamination Team will sanitise the impacted region, people, SRT members, and equipment used at the incident site. The Team should also be responsible for constructing decontamination chambers for the impacted populace. The De-contamination Team should discharge decontaminated water to a sewerage system outlet and safely dispose of it. Technical personnel from the APPCB, Fire & Emergency Services, nearby industrial units, and the Medical Team should assist with this task. The team should also inspect crops, water, homes, stored foods, and animals for contamination.

6.5 Providing Medical and First Aid to the Victims

The Medical Team should administer first aid to the victims of the tragedy. If needed, the team can assist hospital staff in transporting victims from the incident scene. Monitor the victims' triage status by checking their respiration and pulse. Determine the appropriate decontamination method (wet or dry) based on the chemicals employed during the disaster. The team should identify trauma situations and provide necessary counselling.

6.6 Counselling and Rehabilitation of Victims

Chemical disasters can cause psychosocial trauma, including psychological reactions, post-traumatic stress disorder, and other mental health issues in displaced victims that require treatment. Psychologists and psychiatrists provide crucial counselling for those experiencing mental trauma as part of their medical rehabilitation process.

6.7 Provision of Alternate Water Supplies

A potable water supply may become unsafe for human consumption and need to be replaced due to many factors. Typically, this involves bringing in bottled water and/or water-carrying tankers/trailers. The district administration must provide safe drinking water for both the impacted population and first responders at the incident location.

6.8 Re-Entry into Evacuated Areas

The District Collector will analyse the situation at the location and decide whether to end the emergency. Before making a decision, several actions must be taken, including restoring electricity, gas and water supplies in affected areas/buildings, arranging transportation for affected individuals, and restoring law and order in the

affected areas. These actions should be coordinated with relevant teams and departments.

6.9 Responsibility of the Other Statutory Authority

The authorised authority under several statutes, such as the Indian Boiler Act, Factory Act, E.P. Act, Explosive Act, Static and Mobile Pressure Vessel Act, etc must execute post-emergency actions as ordered by the District Collector under the Disaster Management Act, 2005.

- A. Immediate Financial Relief to Victims: Under the Public Liability Insurance Act, 1991, MoEF has published the list of chemicals and threshold qualities beyond which the occupier or owner must take third-party PLI for providing relief to accident victims as per the direction of the collector. The Act also provides for an Environment Relief Fund (ERF) and enables payment of relief over and above the insured amount. The occupier or owner should pay the PLI premium to the ERF and deposit the funds with the insurer. APPCB ensures compliance with the PLI Act at the state level, while collectors and regional officers are accountable at the district level. This statute allows prompt access to relief money to verify and strengthen compliance with the statute. It is recommended that the maximum liability under the Act (currently Rs 5 cores) be significantly increased.
- B. Restoration and Regeneration of Ecosystem: Chemical mishaps have caused significant environmental harm, including at Seveso, Bhopal, Mexico City (LPG disaster), Chernobyl, and Alaska (Exxon Valdez). To remediate the impacted environment, it's crucial to examine the environmental damages, both quantitatively and qualitatively, and identify the most vulnerable components to chemical mishaps. Factors influencing this assessment include chemicals, pollutant concentrations, accident-related media, geography, and meteorological. After reviewing the damage, the government can select an appropriate recovery strategy.
- C. Handling leakages from damaged pipelines:
Following are signs of potential pipeline leak:
- ✚ Discolouration of vegetation, dead vegetation pool, of liquid on the ground near the pipeline, dirt being blown into the air, fire dense white cloud or fog or frozen ground near the pipeline.
 - ✚ Hissing or roaring sound in ROW.
 - ✚ Any one of the above or combinations indicate the presence of leak from the pipeline and needs to be informed promptly to the pipeline owner on the telephone numbers as mentioned in the warning boards provided in the

pipeline route or toll-free number given in the emergency contact number tab.

Actions in Case of Suspected Leak:

- ✚ Immediately leave the area in an upwind direction and inform others to stay away from the area.
- ✚ In case of a school nearby, students, teachers, entire school staff to be evacuated and act as per the emergency response plan of the school. Other public gatherings also need to be evacuated immediately.
- ✚ Do not light a match, start an engine, use a cell phone or turn on/off any electrical appliances, in the vicinity of leakage.
- ✚ Area to avoid potential ignition sources which may cause an explosion or fire.
- ✚ Area to avoid potential ignition sources which may cause an explosion or fire.
- ✚ After moving to a safe distance away from the potential leak, inform the pipeline owner regarding the incident.
- ✚ Do not drive into an area where you suspect a leak, and do not touch or operate pipeline valves.
- ✚ Avoid making contact with escaping liquids or vapours. Touching the liquid or vapour may cause any eye, skin or respiratory irritation and possible fire as the product may be highly inflammable.

6.10 Calling of Emergency:

The District Collector shall call off the emergency via Annexure 9.2. The calling off of emergency shall restore life to normalcy and curtail the spread of misinformation, rumours giving opportunism for exploitation of the situation. The emergency camps set up shall continue to function after calling off of emergency till they provide all the needed support to the aggrieved.

CHAPTER 7
MOCK DRILL

DRAFT

7 MOCK DRILL

7.1 Mock drill objectives

Mock Drills have two basic functions, namely “training” and “testing”. The objectives of Mock Drills are as under:

- ✚ To identify deficiencies in resources (both in manpower and equipment).
- ✚ To clarify each individual’s role and areas of responsibility.
- ✚ To reveal weaknesses in the plans and procedures, before emergencies occur
- ✚ To improve the level of co-ordination among various response personnel, departments and agencies.

The following two types of Mock Drills are recommended,

7.2 Communication Exercise Drills

In these, communication between various authorities and agencies is put to trial and test. A simple goal such as confinement of residents of a particular building is drawn. The chain of communication beginning from first observer of source-site up to the residents closing their windows and confining themselves in their houses is exercised. The communication delays are noted and causes are analysed and appropriately addressed. The communication drills shall be carried out once in 6 months.

7.3 Full-Scale Drills

In these, the communications as well as the response action measures by various authorities and agencies are put to test. The response time for reaching of fire-brigade vehicles, ambulances to the site is tested. The efficacy of the police to divert traffic is also put to test. Evacuation of members in a particular building is carried out and pertinent observations are noted. Members of expert group are present at various points such as police station, fire department, hospitals, office of transportation services to make and note their observations. Their observations are compiled and lessons are drawn from the mock-drill for incorporation and inclusion in the off-site plan. The full-scale drills shall be carried out at least once in a year. The reports of the mock drills shall be filed in Off-site Emergency Plan via Annexure 9.4 of the Template

CHAPTER 7
RECOMMENDATIONS

DRAFT

Recommendations.

8 MOCK DRILL

1. During this visit, industries in the Kurnool area have been inspected for offsite emergency preparedness. It is essential to establish Emergency Control Centres (ECCs) outside the consequence contours or vulnerable zones. In the future, if additional industries are evaluated the results should be validated and DECC is to be located accordingly
2. The statutory authority should regularly conduct mock exercises involving industries in various combinations, based on the developed off-site emergency plan.
3. The statutory authority must ensure that all personnel trained in their respective industries receive periodic refresher training, covering a range of scenario-based hazards to enhance their readiness for responding to off-site emergencies.
4. The statutory authority should conduct frequent meetings with representatives from each industry to review and enhance the off-site emergency plan, ensuring its continuous improvement.
5. A communication chart containing emergency contact information, including the Emergency Response and Disaster Management System (ERDS) and Mutual Aid Group numbers, should be prominently displayed at all Major Accident Hazard (MAH) Emergency Control Centres (ECCs).

ANNEXURE 9

DRAFT

9 ANNEXURE**9.1 Declaration of Off-site Emergency**

I declare Off-site Emergency in the district of [NAME OF THE DISTRICT] starting at this _____ hour on this day of _____.

DC or DEA: [NAME, SIGNATURE AND SEAL]

Date: [DATE]

Information to the following be made via phone followed by written communication,

authority details

Authority	Name of Persons	Contact Numbers	Address
Police			
Fire Brigade			
Medical Department			
Factories Inspectorate			
Mutual Aid Group			
Pollution Control Board			
Media			
Others			

9.2 Calling off the Declared Off-site Emergency

I call off the declared Off-site Emergency in the district of [NAME OF THE DISTRICT] starting at this _____ hour on this day of _____.

DEA: [NAME, SIGNATURE AND SEAL]

Date: [DATE]

Information to the following be made via phone followed by written communication,

Authority	Name of Persons	Contact Numbers	Address
Police			
Fire Brigade			
Medical Department			
Factories Inspectorate			
Mutual Aid Group			
Pollution Control Board			
Media			
Others			

9.3 Investigation Reporting

Investigation Report No:

- I. Name of Event
- II. Accident Description
- III. Cause of Accident
- IV. Effects of Accident
 - a. No. of people dead
 - b. No. of people injured
 - c. Property damage(s)
 - d. Pollution (short-term)
 - e. Pollution (long-term)
- V. Lessons to be drawn from the event
 - Resource Gap:
 - Communication Gap:
 - Others:
- VI. Response measures taken

Agency	Responses	Remarks

9.4 Mock Drill Reporting

Mock Drill No:

Mock Drill Scenario Description:

Observations:

Response Agency	Response	Observation and Comments	Remarks

Lessons to be drawn from the event

- Resource Gap:
- Communication Gap:
- Others:

Response measures taken

Agency	Responses	Remarks

9.5 ERDS for Chlorine

Emergency Response Data Sheet (ERDS) for Chlorine:

I. Identification:

- Synonyms: None
- Formula: Cl₂

Yellow/Green Colour, Gas, Pungent Odour, Corrosive (Chlorine gas is heavier than air and dispersion is slow)

II. General Response Actions

- ON-SITE: Stop Chlorine leakage, if possible, safely.
- Wear Self Contained Breathing Apparatus (SCBA) and use Chlorine Emergency Kit.
- INFORM people to stay confined indoors with doors and windows tightly shut and ventilators and ACs off.
- SHELTER AND CONFINE unsheltered people to an indoor area outside likely cloud travel path
- Use water spray/fog to disperse and dilute vapours.
- Collect runoff for disposal as potentially hazardous waste

III. Evacuation Distance

Mass/Vol Release	Appx. Vulnerable Distance (m) (in the direction of wind)	Appx. Time to reach Max. Vulnerable dist.(min)
1 Ton	5247	43

IV. Fire

- Chlorine is non-flammable, so the cascading effect in case of fire explosion is absent. Hence, no Domino Effect.
- However, it may ignite or explode on contact with combustible materials.

Suggested Actions:

- Use water, spray/fog as extinguishing medium.

- Do not use dry chemicals, carbon dioxide or halogenated extinguishing agents.
 - For large fires-Flood with fine water spray.
-

V. Medical

Dangers

- Poisonous if inhaled. Fatality may be caused due to inhalation when concentration in air is greater than 10 ppm (IDLH)
 - Low level exposures to Chlorine in air will cause eye/skin/airway irritation, sore throat and cough.
 - At higher levels of exposure, signs and symptoms may progress to chest tightness, wheezing, dyspnoea, and bronchospasm.
 - Low level exposures to Chlorine gas will cause eye and skin irritation. Higher exposures may result in severe chemical burns or ulcerations. Exposure to compressed liquid Chlorine may cause frostbite of the skin and eyes.
-

Suggested Actions:

- Inhalational Chlorine poisoning can be treated with supportive care and can include administration of humidified oxygen, bronchodilators and airway management.
 - Pulmonary oedema may be delayed and, therefore, patients should be monitored for up to 24 hours following severe inhalation exposures.
-

Antidotes: NA

VI. Pollution

- A leak of Chlorine vapour poses a significant air pollution hazard.
- Chlorine is heavier than air and dispersion is slow. Hence, state of emergency will last longer.

VII. Chemical Information

A. Chemical Reactivity:

- **Reactivity with Water:** Chlorine is sparingly soluble in water. The water solubility of Chlorine is 0.7% @ 20°C.
- **Reactivity with Common Materials:** Chlorine is aggressive to certain non-metallic material like natural rubber and many plastics; therefore, equipment and hoses must be suitable for Chlorine. Chlorine is chemically stable. It is incompatible with strong oxidizers. It does not react with common materials but may react with oxidizing materials. Olefinic impurities may lead to narcotic effect or it may act like a simple Asphyxiate.

B. Polymerization: Hazardous polymerization will not occur.

C. Combustion Products: Not applicable since Chlorine is not flammable

D. Properties

Physical State at 15°C and 1 ATM	Gas
TLV	1 ppm
IDLH	10 ppm
ERPG - 2	3 ppm
Molecular Weight	70.906
Boiling	-34°C
Freezing Point	-101°C
Vapor Pressure	5168 mmHg @ 21°C
Vapor Density	2.49
Liquid Density	1.56 @ -34°C
Flammable	No
Flash Point	Not applicable
LEL - UEL	Not applicable
Toxic	Yes

9.6 Emergency Resources

Firefighting robot:

Range of applications: Roads, Production areas, Petrol stations, closed buildings, parking houses, Oil Installations, Pharmaceuticals, Petrochemical complexes, Fertilizer Plants, Congested Areas, Power Plants

Design: Firefighting robot to be durable and heat-resistant capable of withstanding very high temperatures, flames and debris.

Sensors: Infrared sensors to be made available to detect the fire location and intensity of it. Gas sensors to detect and analyse the composition of gases in the environment.

High resolution camera: Equipped with both the standard and the thermal imaging camera to provide real-time visual information during an emergency.

Water and foam delivery system: Water Cannons/Nozzles: High-pressure water delivery system for extinguishing the flames.

Foam Systems: firefighting foam in addition to water for certain types of fires.

Communication Systems: Wireless Connectivity: Proper communication systems for maintaining and allowing for real-time data and video transmission to the firefighting operators.

Power Source: Battery - A high-capacity battery, to ensure effective operation during the firefighting.

Navigation and Mapping: Mapping Sensors: Sensors to be installed for creating a digital map of the environment to aid the navigation.

Fire Fighting Drone:

Applications: Surveillance, Control, Detection, Search, Recognition, Collection and Analysis of data in real-time.

Thermal Imaging Camera: High-Resolution Thermal Camera: The drone is to be equipped with a high-resolution thermal imaging camera capable of detecting heat signatures and temperature variations.

Temperature Measurement: Thermal drones should feature temperature measurement capabilities, allowing firefighters to identify hotspots and assess the intensity of the fire.

Live Video Transmission: Real-time Streaming and monitoring: Should be able to provide a live video to operators on the ground, allowing them to monitor the fire and view thermal imagery in real-time.

Flight Control Systems: GPS Navigation: Should be able to utilize the GPS for accurate positioning, and enabling precise mapping of the fire and the locations of firefighters.

Obstacle Avoidance: Obstacle Avoidance Sensors: Thermal drone to be equipped with obstacle avoidance sensors to navigate through smoke, debris, or any obstacle.

Heat Resistance: Heat-Resistant Components: To be constructed with materials that can withstand exposure to very high temperatures during fire emergencies.

Communication Systems: Reliable communication systems, such as long-range radio or encrypted data transmission, to ensure continuous connectivity between the drone and operators.

Battery Life: Should be designed with sufficient battery capacity to provide extended flight times, allowing for prolonged monitoring and assessment during firefighting operations.

Search and Rescue Capabilities: Person Detection: Thermal drones can be used to search and rescue missions by detecting heat signatures, and be helpful to locate the individuals in smoke-filled or obscured environments.

Integration with Firefighting Operations: Thermal drones can be integrated with firefighting equipment, such as water delivery systems or communication devices and share the data with ground crews, incident commanders, and other emergency responders for collaborative decision-making during the emergency.

Mapping and Documentation: Mapping Software Integration: The drone is to be integrated with mapping software to create thermal maps of the fire incident area, which will be used to aid in the strategic planning. **Recording and Documentation:** The drone should be Capable of recording thermal

footage and capturing the images for post-incident analysis and documentation.

Fire Fighting Robot



Fire Fighting Drone



DRAFT

9.7 Material Safety Data Sheet (MSDS)

Material Safety Data Sheet		
1. CHEMICAL IDENTITY		
CHEMICAL NAME: Liquefied petroleum gas		
CHEMICAL CLASSIFICATION: Mixture of butane and propane		
SYNONYMES:		
TRADE NAME: Liquefied petroleum gas		
FORMULA: Mixture of C ₃ H ₈ & C ₄ H ₁₀ .	C.A.S. NO.	
U.N. NO: 1075	HAZCHEM CODE: 2WE	
REGULATED IDENTIFICATION: NA		
SHIPPING NAME CODES/ LABEL: Liquefied petroleum gas		
HAZARDOUS WASTE I.D. NO.: NA		
HAZARDOUS INGREDIENTS:	C.A.S. No.:	
1. Propane	106-97-8	
2. Butane	74-98-6	
3. Pentane	109-66-0	
2. PHYSICAL AND CHEMICAL DATA		
BOILING POINT (°C): >-40	PHYSICAL STATE: Liquefied gas	APPEARANCE: Colorless
MELTING / FREEZING POINT(°C): N/A	VAPOUR PRESSURE @ 35 °C, 1311.56 mm hg @-20	Odor: Odorless Gas.
VAPOUR DENSITY (AIR= 1): 1.5	SOLUBILITY IN H ₂ O @ 30 °C: Slight at 30 °C	
SPECIFIC GRAVITY (H ₂ O=1): 0.51 to 0.58 at 50 °C	PH: NA	
3. FIRE AND EXPLOSION HAZARD DATA		
FLAMMABILITY: Yes	LEL: 1.8 %	UEL: 12.8%
TDG FLAMMABILITY:	FLASH POINT (°C): -76 to -156 F °	AUTO IGNITION: TEMP (°o.): 320 to 405 deg C
EXPLOSION SENSITIVITY TO IMPACT: NA	EXPLOSION SENSITIVITY TO STATIC ELECTRICITY: NA	HAZARDOUS COMBUSTION PRODUCTS: Carbon monoxide and carbon dioxide
HAZARDOUS POLIMERISATION: NA	EXPLOSIVE MATERIAL: NA	CORROSSIVE MATERIAL: NA
FLAMMABLE MATERIAL: NA	OXIDISER: NA	OTHERS: NA

PYROPHORIC: NA		ORGANIC PEROXIDE: NA		
4. REACTIVITY DATA				
CHEMICAL STABILITY: Stable				
INCOMPATABILITY WITH OTHER MATERIAL: With oxidizing materials				
REACTIVITY: Yes				
HAZARDOUS REACTION PRODUCTS: Carbon dioxide, Carbon monoxide				
5. HEALTH HAZARD DATA				
ROUTES OF ENTRY: Skin Absorption: NA. Skin Contact: Yes (liquid) Eye Contact: Yes Inhalation: Acute: Yes Chronic: NA. Ingestion: No				
EFFECTS OF EXPOSURE / SYMPTOMS: Inhalation can cause headache, disorientation, dizziness, drowsiness and possibly Unconsciousness at concentrations that cause oxygen deficiency and asphyxiation. Rapidly expanding gas or vaporized liquid may cause frostbite to skin and eyes				
EMERGENCY TREATMENT: Flush eyes and skin with plenty of water and get medical aid.				
TLV (ACGIH): 100 PPM, 1800 mg/m ³		STEL:	PPM mg/m ³	
PERMISSIBLE EXPOSURE LIMITS:		ODOUR THRESHOLD		
		LD50: 5000ppm to 20000 ppm		
LD 50:	PPM mg/m ³			
NFPA HAZARD RATING	HEALTH: NA	FLAMABILITY	STABILITY:	SPECIAL: NA
		: Yes	Stable	
6. PREVENTIVE MEASURES				
PERSONAL PROTECTIVE EQUIPMENTS: Respiratory protective equipment required. Eye & Face: Safety goggles. Hand & Arm: Hand gloves (PVC synthetic only) Other clothing and equipment: Gum boots, PVC apron.				
HANDLING AND STORAGE PRECAUTION: Store the container in a cool, dry and well-ventilated specified place, away from heat, spark and flame.				
7. EMERGENCY AND FIRST- AID MESURES				
FIRE	FIRE EXTINGUISHING MEDIA: Dry chemical powder,			
	carbon dioxide and water spray.			
	SPECIAL PROCEDURE: NA			

	UNUSUAL HAZARDS: Air vapor mixture highly explosive.
EXPOSURE	FIRST AID MEASURES: Skin: If freeze burn occurs, gently bathe affected area in warm water (38 – 43) deg.C. Do not rub. Get
	Medical attention.
	Eye: Immediately flush with large amounts of Luke warm water for 15 minutes, lifting upper and lower lids at intervals. Seek medical attention if irritation persists.
	Inhalation: Remove to fresh air. Give oxygen, artificial respiration, or CPR if needed. Seek medical attention.
	Ingestion: Usually no effect by this route.
	ANTIDOTES / DOSAGES: NA
	SPILLS
Do not enter in the gas area without protective wears.	
Get the area evacuated.	
Stop flow of gas if without risk.	
Spray water to keep the container cool	
WASTE DISPOSAL METHOD: Collect the spillage & wash the affected area with plenty of water. Allow gas to burn under control	

9.8 MSDS for Chlorine

Material Safety Data Sheet	
1. Identification	
<p>GHS product identifier: Chlorine Chemical name: chlorine Other means of identification: Molecular chlorine; CHLORINE GAS; active chlorine released from chlorine; Dichloride; Dichlor; Diatomic chlorine; Chlorine molecule; Chlorine, liquefied; Liquid chlorine.</p> <p>Product type: Gas</p>	
2. Hazards identification	
<p>Prevention: Wear protective gloves. Wear protective clothing. Wear eye or face protection. In case of inadequate ventilation wear respiratory protection. Keep away from clothing and other combustible materials. Keep reduction valves, valves and fittings free from oil and grease. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Do not breathe gas.</p> <p>Response: Collect spillage. In case of fire: Stop leak if safe to do so. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.</p> <p>Storage: Store locked up. Protect from sunlight. Store in a well-ventilated place.</p> <p>Disposal: Dispose of contents and container in accordance with all local, regional, national and international regulations</p>	
3. Composition/information on ingredients	
CAS number : 7782-50-5	
4. First aid measures	
<p>Eye Contact: Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician</p>	

Inhalation: Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband

Skin contact: Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse

Potential acute health effects:

Eye contact: Causes serious eye damage. Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation: Fatal if inhaled.

Skin contact: Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite: Try to warm up the frozen tissues and seek medical attention.

5. Fire-fighting measures

Suitable extinguishing media: Use an extinguishing agent suitable for the surrounding fire

Specific hazards arising from the chemical: Contains gas under pressure. Oxidizing material. This material increases the risk of fire and may aid combustion. Contact with combustible material may cause fire. In a fire or if heated, a pressure increase will occur and the container may burst or explode. This material is very toxic to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain

Hazardous thermal decomposition products: Decomposition products may include the following materials- halogenated compounds.

Special protective actions for fire-fighters: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk.

Special protective equipment for fire-fighters: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6. Accidental release measures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

7. Physical and chemical properties

Physical state: Gas. [GREENISH-YELLOW GAS WITH SUFFOCATING ODOR]

Color: Colorless. Green. Yellow.

Odor: Pungent.

Odor threshold: Not available.

pH: Not available.

Melting point: -101°C (-149.8°F)

Boiling point: -34°C (-29.2°F)

Critical temperature: 143.85°C (290.9°F)

Flammability (solid, gas): Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials, organic materials and alkalis

Vapor pressure: 85.3 (psig)

Vapor density: 2.5 (Air = 1)

Gas Density (lb/ft³): 0.185

Solubility in water: 7.41 g/l

Molecular weight: 70.9 g/mole

9.9 Consequence Results

Consequence analysis helps in understanding the behaviour of a chemical during LOC and the extent of the impact. Accidental release of flammable or toxic fluids can result in severe consequences. Immediate ignition of the pressurized chemical will result in a jet flame. Delayed ignition of flammable vapors can result in blast overpressures covering large areas. The release also impacts beyond respective facility boundary and affects the surrounding environment.

To develop an efficient offsite emergency and rescue plan, it is important to analyse the extent of damage from these chemicals. The existing QRA reports provides the details of extent of damage from various LOC scenarios. Various offsite scenarios from industries of Kurnool District were identified and a cluster contour depicting the various offsite scenarios from all the industries was developed. This will help to communicate hazards and subsequent mitigation measures to the public.

TYPES OF OUTCOME EVENTS:

Depending on the considered LOC scenarios the following outcomes are expected:

- Jet fire
- Pool fire
- Flash Fire (Flammable gas dispersion)
- Vapor Cloud Explosion
- Toxic Dispersion

Jet fires

Jet fire occurs when a pressurized release (of a flammable gas or vapor) is ignited by any source. They tend to be localized in effect and are mainly of concern in establishing the potential for escalation effects and employee safety zones rather than for community risks.

The jet fire model is based on the radiant fraction of total combustion energy, which is assumed to arise from a point slowly along the jet flame path. The jet dispersion model gives the jet flame length.

Pool fires

This represents a situation when flammable liquid spillage forms a pool over a liquid or solid surface and gets ignited. Flammable liquids can be involved in pool fires where they are stored and transported in bulk quantities. Pool fires are associated with the difference between release of material and complete combustion of the material simultaneously. They are common when large quantity of flammable material is released within short time.

Flammable Gas Dispersion

Flammable vapours, after loss of containment, will normally spread in the direction of the wind. If it finds an ignition source before being dispersed to below its Lower Flammability Limit (LFL), a flash fire is likely to result and the flame may travel back to source of the release. Any person caught in a flash fire is likely to suffer fatal burn injuries.

Typically, the burning zone is defined as 0.5 LFL and LFL limit back to the release point, even though the vapor concentration might be above UFL. However, existing QRA reports may also consider 0.6LFL instead of 0.5LFL.

Vapor Cloud Explosion (VCE)

Vapor cloud explosion is the result of flammable materials in the atmosphere, a subsequent dispersion phase, and after some delay an ignition of the vapor cloud. Turbulence is the governing factor in blast generation, which could intensify combustion to the level that will result in an explosion. Obstacles in the path of vapor cloud or when the cloud finds a confined area, e.g., as under the bullets, often create turbulence. The VCE will result in overpressures.

Toxic Dispersion

Accidental release of toxic material into atmosphere may result in dispersion. The extent of dispersion depends on properties of released toxic material and weather parameters and topographical conditions. However, it is to be noted that

- ✓ All the identified scenarios of TGV SRAAC Limited, contributing to toxic impact are re-modelled using PHAST v.8.9 for generating contours of ERPG-2 concentration of interest.
- ✓ Additional (01) scenario associated with 25mm leak from Chlorine Tonner - TGV SRAAC Limited is newly modelled to evaluate the offsite impact.
- ✓ For Toxic Dispersion - TGV SRAAC Limited, leak of 25mm is considered as credible case amongst all the four leak sizes i.e, 5mm, 25mm, 100mm, FBR/CR). Hence, 25mm leak is considered for the purpose of development of offsite ERP

The offsite scenarios that are extracted from the existing QRA reports of both BPCL LPG Bottling Plant and TGV SRAAC Limited of Kurnool district are listed below.

BPCL LPG Bottling Plant, Kurnool

Scenarios Identified:

Flash Fire

S. No	Scenario No	Description	Flammable Gas Dispersion Impact Distance (m)	
			10% LEL (1800 ppm)	60% LFL (10800 ppm)
1	2	125 MT Above ground Bullet SRV Release	618	212
2	6	600 MT Mounded Storage due to SRV Pop up	319	98
3	12	Road Tanker 18 MT SRV Release	337	105

Pool Fire

S. No	Scenario No	Description	Pool Fire Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	4	125 MT Above Ground Bullet Rupture	89	62	47
2	11	Road Tanker Rupture 18MT	89	57	44

Jet Fire

S. No	Scenario No	Description	Jet Fire Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	5	Leak (2 inch) from 125 MT Above ground Bullet Body	120	76	52
2	8	Leak (2 inch) from Road Tanker 18MT Body	123	80	57
3	22	FBR (6 inch) of liquid pipeline	162	105	74

BLEVE

S. No	Scenario No	Description	BLEVE - Thermal Radiation Damage Distance (m)		
			2 kW/m ²	5 kW/m ²	10 kW/m ²
1	10	ROAD TANKER 18MT TANK UNDER BLEVE	697	448	317

Overpressure

S. No	Scenario No	Description	Overpressure - Damage Distance (m)		
			1 psi	3.5 psi	8 psi
1	1	125 MT – Above ground Bullet SRV Release	232	121	NR
2	13	ROAD TANKER 18MT Unloading arm failure	119	79	NR



Below figure depicts **thermal radiation Contour of 5 kW/m²** due to Scenario #10 i.e., Road Tanker 18MT under BLEVE, impacting upto the distance of 448m.

TGV SRAAC Limited, Kurnool**Scenarios Identified**

In line with the QRA Study of TGV SRAAC Limited, it is understood that no scenarios are identified to have thermal radiation & overpressure impact beyond the facility i.e., offsite.

S. No	Scenario No	Description	Toxic Gas Dispersion Impact Distance (m) Corresponding to ERPG-2	
			1.5F Weather	5D Weather
1	ISO-03-1	25mm leak from Chlorine gas line from electrolyser up to PV-1151A/B	1927	424
2	ISO-03-2A	25mm leak from Chlorine Drying Tower	1420	222
3	ISO-3-3A	25mm leak from Chlorine Compressor (K-701A)	1490	1167
4	ISO-3-5	25mm leak from Chlorine Liquefier No. 1	1804	1229
5	ISO-03-6	25mm leak from Chlorine Tank - A	1174	880.8
6	ISO-4-1C	25mm leak from HCl Anhydrous Vapour line from Thermal Chlorination (ERPG-2 is 20ppm)	723.6	774.7
7	ISO-5-1	25mm leak from Chlorine Vaporizer	1230	1310
8	ISO-09	25mm leak from Carbon Tetra Chloride Storage (CCl ₄) ERPG-2 is 200 ppm	1441.5	401.09
9	IS-New	25mm leak from Leak from one (01) Cl ₂ Tonner (900 kgs, 12 barg) at Cl ₂ filling & storage area	3941.56	3820.56

TGV SRAAC Limited, Kurnool

Below figure depicts **toxic dispersion contour of ERPG-2 concentration (3 ppm) due to chlorine leak of 25mm from any of the chlorine tonners in Cl₂ handling / storage areas**, impacting upto the distance of 3.95kms corresponding to 1.5F weather conditions.



DRAFT