Annexure 3: Risk Assessment Document.

7 ADDITIONAL STUDIES

7.1 Public Consultation

As per ToR Letter no. J-11011/139/2016-IA II (I) dated 23/09/2016 issued by MoEFCC, New Delhi, attached as Annexure 1, Public Consultation is exempted for this project since the proposed project site is located within the notified area.

7.2 Hazard Identification and Consequence Analysis

The risk assessment process is intended to identify existing and probable hazards in all operations and work environment, to quantify the hazards and to access the risk levels of those hazards in order to prioritize those that need an immediate attention.

7.2.1 Methodology of Risk Assessment

The methodology includes,

1. Hazard identification,
2. Selection of potential loss scenarios,
3. Simulation of release source model on DNV's PHAST 7.1,
4. Plotting the damage contour on site map

These steps undertaken to carry out risk assessment for this project are described in following sections.

7.2.2 Hazard Identification

The project description, and other project related data provided by the client have been comprehensively reviewed to identify the hazardous operations. Also the information on the hazardous properties (MSDS) of all the chemicals handled at the site has been reviewed to identify the hazards associated with the same.

At present Kemone is going to set up CPVC manufacturing plant. This involves transfer of chlorine and hydrogen gas by pipeline from adjacent existing plant which can lead to uncontrolled release of hazardous material causing hazard. On the basis of this, the important hazards that can lead to accident in the proposed project are described in ***Table 7-1.***

Table 7-1: Important Hazardous Events

Type of Event	Explanation
BLEVE	Boiling Liquid Evaporating Vapor Explosion; may happen due to catastrophic failure of refrigerated or pressurized gases or liquids stored above their boiling points, followed by early ignition of the same, typically leading to a fire ball
Deflagration	Is the same as detonation but with reaction occurring at less than sonic velocity and initiation of the reaction at lower energy levels
Detonation	A propagating chemical reaction of a substance in which the reaction front advances in the unreacted substance at or greater than sonic velocity in the unreacted material
Explosion	A release of large amount of energy that form a blast wave
Fire	Fire
Fireball	The burning of a flammable gas cloud on being immediately ignited at the edge before forming a flammable/explosive mixture.
Flash Fire	A flammable gas release gets ignited at the farthest edge resulting in flash-back fire

Type of Event	Explanation
Jet Fire	A jet fire occurs when flammable gas releases from the pipeline (or hole) and the released gas ignites immediately. Damage distance depends on the operating pressure and the diameter of the hole or opening flow rate.
Pool Fire	Pool fire is a turbulent diffusion fire burning above a horizontal pool of vaporizing hydrocarbon fuel, where the fuel has zero or low initial momentum
Spill Release	'Loss of containment'. Release of fluid or gas to the surroundings from unit's own equipment / tanks causing (potential) pollution and / or risk of explosion and / or fire
Structural Damage	Breakage or fatigue failures (mostly failures caused by weather but not necessarily) of structural support and direct structural failures
Vapor Cloud Explosion	Explosion resulting from vapor clouds formed from flashing liquids or non-flashing liquids and gases

Hazard and Damage Assessment

Toxic, flammable and explosive substances released from sources of storage as a result of failures or catastrophes, can cause losses in the surrounding area in the form of:

- Toxic gas dispersion, resulting in toxic levels in ambient air,
- Fires, fireballs, and flash back fires, resulting in a heat wave (radiation), or
- Explosions (Vapors Cloud Explosions) resulting in blast waves (overpressure).

Consequences of Fire/Heat Wave

The effect of thermal radiation on people is mainly a function of intensity of radiation and exposure time. The effect is expressed in term of the probability of death and different degree of burn. The consequence effects studied to assess the impact of the events on the receptors are provided in ***Table 7-2***.

Table 7-2 : Damage due to Radiation Intensity

Radiation (kW/m2)	Damage to Equipment	Damage to People
4.0	-	Causes pain if duration is longer than 20 sec. But blistering is unlikely.
12.5	Minimum energy to ignite wood with a flame; melts plastic tubing.	1% lethality in one minute. First degree burns in 10 sec.
37.5	Severe damage to plant	100% lethality in 1 min. 50% lethality in 20 sec. 1% lethality in 10 sec.

Consequences of Overpressure

The effects of the shock wave vary depending on the characteristics of the material, the quantity involved and the degree of confinement of the vapor cloud. The peak pressures in an explosion therefore vary between a slight over-pressure and a few hundred kilopascals (kPa). Whereas dwelling are demolished and windows and doors broken at overpressures as low as 0.03- 0.1 bar. Direct injury to people occurs at greater pressures. The pressure of the shock wave decreases rapidly with the increase in distance from the source of the explosion. The overpressure damage is shown in ***Table 7-3.***

Table 7-3: Overpressure Damage

Overpressure (bar)	Damage
0.02068	Limited minor structural damage

Overpressure (bar)	Damage
0.068 to 0.136	Corrugated asbestos shattered; corrugated steel or aluminum panels, fastenings fail, followed by buckling, wood panels (standard housing) fastenings fail, panels blown in
0.204 to 0.272	Frameless, self -framing steel panel building demolished; rupture of oil storage tanks

Source: CCPS Consequence Analysis of Chemical Release

Consequences of Toxic Release

The effect of exposure to toxic substance depends upon the duration of exposure and the concentration of the toxic substance.

Short-term exposures to high concentration give Acute Effects while long term exposures to low concentrations result in Chronic Effects.

Only acute effects are considered under hazard analysis, since they are likely credible scenarios. These effects are:

- Irritation (respiratory system, skin, eyes)
- Narcosis (nervous system)
- Asphyxiation (oxygen deficiency)
- System damage (blood organs)

Following are some of the common terms used to express toxicity of materials.

- Threshold Limit Value (TLV): It is the permitted level of exposure for a given period on a weighted average basis(usually 8 hr/day, 40h/week)
- Short Time Exposure Limit (STEL): It is the permitted short term exposure limit usually for a 15 minutes exposure.
- Immediately Dangerous to life and health (IDLH): It represents the maximum concentration of a chemical from which is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.
- Lethal Concentration Low (LCLo): It is the lowest concentration of a material in air, other than LC50, which has been reported to cause a death in human or animals.
- Toxic Concentration Low (TCLo): It is the lowest concentration of a material in air, to which humans or animals have been exposed for any given period of time that has produced a toxic effects in humans or produced carcinogenic, neoplastigenic or tetratogenic effect in humans or animals.
- Emergency Response Planning Guidelines1 (EPRG1): The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour (without a respirator) without experiencing other than mild transient adverse health effects or without perceiving a clearly defined objectionable odor.
- Emergency Response Planning Guidelines2 (ERPG2): The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.
- Emergency Response Planning Guidelines3 (ERPG3): The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

7.2.3 Selection of Maximum Credible Loss Scenarios (MCLs')

Following important points should be considered for the selection of release scenarios.

- Flammability and the flash point of the material
- Phase of material i.e. liquid or gas
- Threshold quantity of the chemicals as prescribed in MSHIC Rule
- Operating temperature and pressure of the material
- Total inventory of the material

On the basis of study of chemical properties (MSDS) of the chemicals those are selected for simulation are presented in ***Table 7-4.***

Table 7-4: Chemicals selected for Simulation

S. No.	Raw Material	State	Flash Point (°C)	IDLH (ppm)	Hazard	UEL%	LEL%
1.	Chlorine	Gas	N/A	10	Poisonous, Corrosive	-	-
2.	Hydrogen	Gas			Highly Flammable	4	76

On the basis of the information provided in ***Table 7-4,*** and as discussed over failures sceneries given in publications like World Bank Technical Paper 55 and TNO Purple Book and the experience of the consultant, MCLs' which may take place are presented in ***Table 7-5.***

Table 7-5: Scenarios Selected for Simulation

S. No.	Storage Tanks of	Hazard involved	Mass Inventory, kg	Operating Condition		Types of Failure Possible	Consequences Studied
				Temperature (°C)	Pressure (bar)		
1	Chlorine	Poisonous, Corrosive	70	30	5.01	5 mm Leak	Toxic release
2	Hydrogen	Highly Flammable	3.60	30	5.01	5 mm Leak	Jet Fire & Late Ignition
						25 mm Leak	Jet Fire & Late Ignition

Also, the risk assessment is considered using certain internationally recognized yardsticks for measuring risk. These first need to be explained, and this is done as ***Table 7-6.***

Table 7-6: Broadly Accepted Frequency

Annual Fatality risk level per year	Conclusion
10-3	Unacceptable to everyone. Immediate action shall be taken to reduce the hazards
10-4	Willing to spend public money to control hazards, such as traffic signs, fire departments etc.
10-5	People still recognize. Safety slogans have precautionary rings. Such as never swim alone, never point a gun, avoid air travels
10-6	Not of great concern to everyone. People are aware of these hazards but feel that they cannot happen to them. Such as Lightning Never Strikes twice an Act of God.

7.2.4 Simulation of Release and Development of Contours

As the MCLS' were developed for the selected set of chemicals, the next step is to carry out the consequence analysis. The consequence analysis results along with their contours are presented in the following sections.

Chlorine

Toxic effect distance due to the release of Chlorine are presented in following table;

Table 7-7: Toxic Effect Distance due to Release of Chlorine from Pipeline

Chemical (Pipeline)	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (10 ppm)
Chlorine	5 mm leak	2.5/B	207
		2.0/F	1491
		4.0/D	349

Hydrogen

Radiation level and effect distance due to the release of Hydrogen are presented in ***Table 7-8,*** the overpressure effect distance are presented in ***Table 7-9.***

Table 7-8: Radiation Level and Effect Distance due to Release of Hydrogen

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Hydrogen	5 mm leak	Jet Fire	2.5/B	NR	NR	NR
			2.0/F	NR	NR	NR
			4.0/D	NR	NR	NR
	25 mm leak	Jet Fire	2.5/B	4	1	NR
			2.0/F	4	1	NR
			4.0/D	4	7	NR

Table 7-9: Overpressure Effect Distance due to Release of Hydrogen

Chemical (Storage Tank)	Failure Scenario	Consequence	Met Data	Overpressure Distances in Meters		
				0.02 bar	0.21 bar	1.0 bar
Hydrogen	5 mm leak	Late Ignition	2.5/B	19	12	10
			2.0/F	-	-	-
			4.0/D	19	12	11
	25 mm leak	Late Ignition	2.5/B	35	15	12
			2.0/F	-	-	-
			4.0/D	65	37	33

7.3 Precautions during Storage

Chlorine

Personnel Protective Equipments

- Cartridge type gas masks provided individually to employees working in chlorine handling area.
- Canister type gas masks provided to key personnel and are also available in control room.

- Online breathing apparatus with long hoses are installed at strategic locations within the plant

Disaster Control Planning is an essential part of the loss prevention strategy. This is a preplan to handle any emergency situation effectively. Its objective is to reduce the probability of serious loss / damage to public, terminal, machinery, equipment, important document, etc. The loss can be measured in both human and monetary terms. If the effective action is taken in time, the full potential loss can be avoided. The action can be effective only when there is an existence of preplanned and practiced procedure for handling major emergencies utilizing the combined resources of the industrial concern and the outside services like Government Agencies, Fire Brigade, Medical, Police etc.

Thus "The Disaster Management Plan is prepared with the objective of defining the functions and responsibilities of all concerned – Managerial, Operational and Support Services Department Personnel with respect to detection of possible emergencies and effective implementation of the action plan. The ultimate goal is the effective containment of the situation by proper mitigative action at the place of occurrence, cautioning people in adjoining affected localities, prompt rescue and medical aid to affected persons and communication to civil authorities for rushing in help from outside. All concerned are hereby requested to carefully study and thoroughly familiarize themselves with it, in order to ensure its effectiveness in times of emergency." The plan is divided into two parts

- Onsite Emergency Plan
- Offsite Emergency Plan

7.4 Onsite Emergency Plan

Chemicals occupy an important position and contribute significantly to economy besides being the source of large benefits to the society. In recent years there had been a significant rise in the number, variety and complexity of these chemicals, which are toxic, reactive or flammable and are classified as hazardous chemicals. Such chemicals do possess potential to cause harm to human beings, properties and environment. In order to avoid accidents, these chemicals have to be handled very carefully during manufacture, processing and storing.

The Government has enacted various laws and regulations. The Government has also identified statutory authorities and charged them with responsibility of monitoring compliance. In spite of these regulatory measures, accidents do happen and the analysis has established that human errors, failure of mechanical, electrical or instrument system have been responsible for these accidents.

It is very essential that the Industries, Government and local people are kept fully prepared to meet any such accidents, control them and mitigate the harm effects.

It is common knowledge that a well-prepared plan of action will largely help in timely and orderly response and in this context preparation of Emergency Preparedness Plan becomes important. This document details the measures to be taken to contain and control the incident, minimization of the effects due to fire, explosion or toxic release and also specify the responsibilities of every person engaged in this exercise.

7.4.1 Aims & Objectives

The objectives of the present On-site Emergency plan (OSEP) is to present the hazards associated with handling, storage and use of hazardous chemicals and indicate Kemone Chemplast Pvt. Ltd.'s

(KOCL) risk reduction vision and strategy for risk control, prevention of loss of life or injuries, damage to property or environment and consequential loss/impact as a result of the risks identified.

Being a good and responsible corporate citizen, KOPL will always sought to minimize the risk associated with transfer and use of hazardous materials at their site and safety of their workers through provision of inbuilt safety systems, equipment, safe operating procedures, preventive & predictive maintenance and regular training to their staff and employees. The on-site emergency plan is a step in this direction to plan and respond to emergencies in a structured manner. The outcome of the study will not only provide the roadmap for emergency planning and response but also help achieve compliance to the local EHS regulations.

7.4.2 Methodology

The methodology adopted to achieve the desired objectives is given below:

- Collection of relevant data and information from the Safety, Operations, Maintenance and Process Engineering team.
- Evaluation of the site vis-à-vis neighboring facilities and surrounding areas.
- Collection of data related to products and processes handled at site including process, storage details, firefighting arrangements, safety and alarm systems, electrical and instrumentation details, etc.
- Data compilation and analysis followed by identification of hazards
- Consequence analysis to assess the damage/effect of short-listed accident scenarios by using Cirrus/Aloha software.
- Development of recommendations for risk prevention or mitigation
- Preparation of on-site emergency plan document and its submission

Guidelines provided in Schedule 11 of MSIHC Rules 1989, of the Ministry of Environment & Forests has been used as a basis for preparation of this document.

7.4.3 Plant and Site Description

Introduction of the Facility

Details for plant and site is given in Chapter 1.

Location

Location is described in Chapter 2.

Raw Material and Products

Details are given in Chapter 2.

Manufacturing Process

Manufacturing process is given in Chapter 2.

Safety System

Emergency Handling Facilities Available at C-PVC Plant

Self-contained breathing apparatus will be available at site to handle any chlorine emergencies. In addition to that compressed air chlorine mask will be made available to handle any prolonged leak of chlorine. However, the probabilities of occurrence is very low based on the control

measures that will be put in place. It is also planned as part of EMP, to monitor chlorine, using 5 No's of Chlorine monitors, which would enable an early signal such that corrective action can be taken immediately.
In order to overcome any fire emergencies because of hydrogen adequate fire extinguishers will be located at strategic places.

Fire Hydrant System

Details of fire hydrant system is given in Table 7-10.

Table 7-10: Fire Hydrant System

S. No.	Description	Capacity	Numbers	Remark
1	Fire Water Storage Tank	500 m^3	1	
2	Electrically driven Fire Water Pump	125 m^3/hr	2	One working and one standby
3	Jockey Pump	25 m^3/hr	2	One working and one standby
4	Diesel Driven Pump	125 m^3/hr	2	Backup for electrical driven pump

7.4.4 Climatological Details

Detail of climatology as per IMD is given in Chapter 3.

7.4.5 Demographic Profile

Demographic profile is given in Chapter 3.

7.4.6 Hazard Identification

Details of hazard identification and consequence analysis is given in the beginning of the Chapter 7.

7.4.7 Hazard Identification for Natural & Other Man Made Disasters

Chemicals disasters could also occur as an outfall of natural disasters such as earthquakes, floods and cloud bursts, cyclones, Lightning Tsunami, aircraft strike and sabotage/war. Floods and earthquakes could result in large-scale damage to life and property even without the exposure to chemicals. The presence of chemicals in the affected area could only complicate the emergency and would have to be dealt with special precautions. In order to make informed decisions, it is essential to understand the hazard potential due to such natural calamities also.

Cyclones

The coastal region like Karaikal is extremely vulnerable to cyclones. Cyclones are intense low-pressure areas with pressure increasing outwards. Cyclones can be hazardous as Cyclones are normally associated with strong winds.

Measures during cyclones

Plant will be designed taking into consideration strong winds associated with cyclones.

Tsunami

Karaikal district is more prone to Tsunami. In December 2004, Karaikal faced its worst tragedy. Tsunami waves are the tidal waves that hit this coastal town and more than 500 people, mostly fishermen and their families, were washed away by the killer waves.

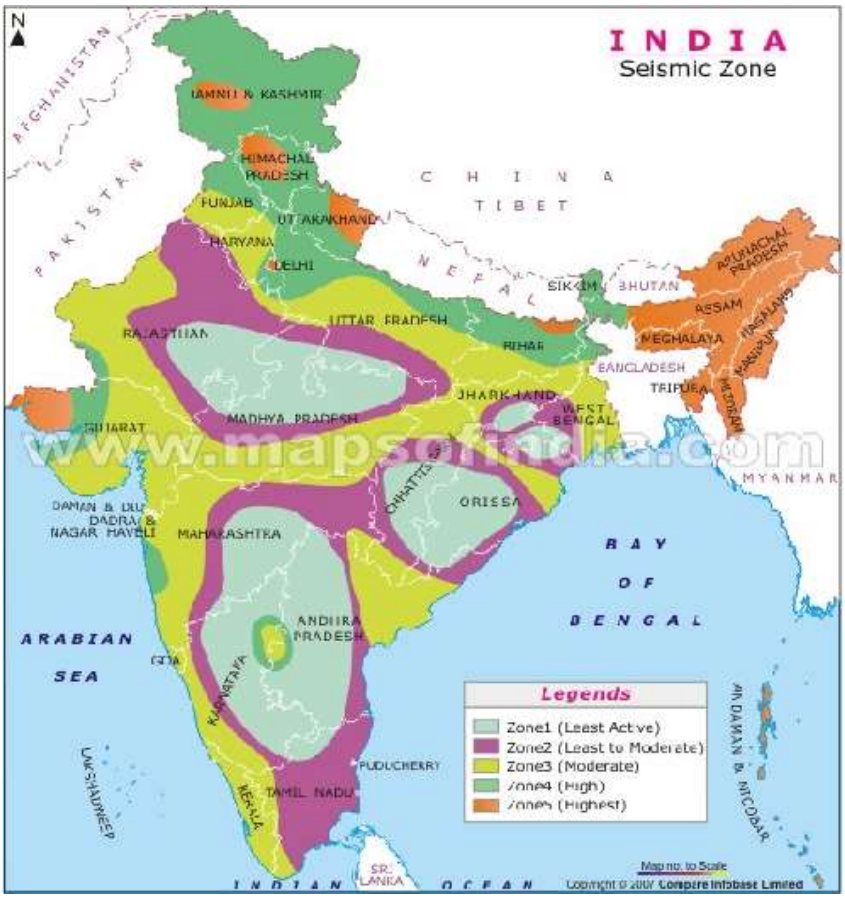
Measures during Tsunami

Inbuilt design, bunding and adequate drainage facilities to quickly drain the water without affecting the plant facilities. It is pertinent to note that the water level did not come upto the project site during 2004 Tsunami.

Earthquake

From the adjacent figure it can be seen that Karaikal lies in Zone II. This corresponds to moderate earthquake related damage potential.

Figure 7-1: Map Showing Earthquake Zone of India



Measures for Earthquake

Structure will be built as per IS codes applicable for the seismic zone.

7.4.8 Consequence Analysis

Detailed consequence analysis is given in the beginning of the Chapter 7.

7.4.9 Emergency Preparedness

Objectives & Coverage

The plan is formulated for the specific objective of minimizing the potential of damage through proper planning of activities and material at KOCL. It is designed to cope up with all types of emergencies and is flexible enough to meet different situations like fire, explosion, chemical spills, toxic release, etc.

In preparation of the On-site Emergency Plan, the following elements have been considered to make it effective.

- Leadership and administration for emergency management
- Prompt activation of Emergency Management Plan to minimize loss
- Communication arrangements for warning/notification and requisitioning external help
- Lighting and stand-by power for various combat operations
- Setting up of an Emergency Control Center to act as a command and control point during an emergency
- Defining escape routes and deciding upon methods that will be employed for evacuation of people
- Provision for Medical care to the injured and response personnel
- Protection of vital records
- Formulation of public relations/functions including interaction with media, press, officials and neighboring population
- Preparation and use of checklists for various emergency management functions for pre, post and in emergency activities.
- Formulation of procedure for systematic shut-down of the operations
- Formulation of re-entry and recommissioning procedures
- Conducting regular training programs for all level of employees, and
- Conducting Mock Drills for assessment of the level of preparedness of men and material at the works.

7.4.10 Pre Emergency Activities

The following activities have been undertaken to efficiently manage emergency situation, if it arises:

- Formation of an Emergency Control Organization (ECO), which involves identification of Works Main Controller (WMC), Works Incident Controller (WIC) and key persons who will take charge of the situation during an emergency.
- Assigning specific duties to the identified members of the ECO.
- Identification of major hazardous storages, carrying out risk assessment, calculation of damage distances and identification of vulnerable areas.
- Preparation and updating of an on-site emergency plan.

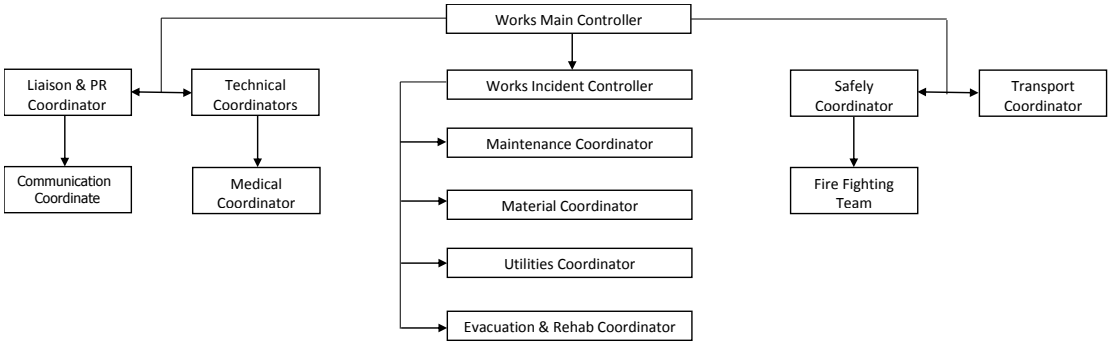
In addition to the above, following activities are regularly taken up for enhancing the emergency preparedness:

- Inspection of the plant by competent personnel to locate any abnormalities.
- Training of staff and workers in plant safety, safe work procedures, first aid, rescue, firefighting, etc.
- Formulation of Work Permit System for various activities such as construction, hot work, excavation, maintenance in hazardous areas, loading/unloading of hazardous materials, etc.
- Carrying out Mock drills to be in readiness to cope with any emergent situation
- Getting Safety Audit conducted at least once a year by competent external agency
- Updating on-site emergency plans on the basis of safety audit and mock drills

7.4.11 Emergency Organization

The first step in Emergency Response Planning is to build a team of responsible and dedicated persons who match the emergency response functions and can handle with ease the responsibility assigned to them during emergency. For this, the responsibility has been assigned to responders keeping in mind their normal area of work and expertise. The emergency organization chart of KOCL is depicted below;

Figure 7-2: Organization Chart for Emergency



7.4.12 Key Persons & Responsibilities

A good team having representation from all relevant departmental functions has been prepared to effectively deal with any type of emergency situation. The responsibilities of key emergency personnel is given below;

Works Main Controller (WMC)- Plant Head

He will report to the Emergency Control Center and will assume overall responsibility of the works and its personnel. Main duties are:

- Ensure that the key personnel are called in promptly
- To assess the magnitude of the situation and decide whether a major emergency exists or is likely to develop, requiring external assistance. To inform District Emergency Authority (i.e. District Collector).
- Maintain a continuous review of possible developments and assess these to determine most probable course of events.
- To exercise direct operational control over areas in the complex rather than those affected.
- Assess the magnitude of the situation and decide if staff needs to be evacuated from the assembly points to identified safe places.
- To continuously review and direct shutting down of plants or sections of the plant in consultation with the other key personnel.
- Liaison with senior officials of police, fire brigade, medical and Factories Directorate and pass on information on possible effects on the surrounding areas, outside the factory premises.
- Liaison with various coordinators to ensure casualties are receiving adequate attention, arrange for additional help if required. Ensure that relatives are informed.
- Ensure traffic control movement within the work is well regulated.
- To arrange for a log of the emergency to be maintained in the Emergency Control Center (ECC).
- To release authorized information to press through the media coordinator.
- To control rehabilitation of the affected persons and the affected areas after the emergency.
- Ensure attention is directed towards preservation of evidence

- Where the emergency is prolonged, arrange for the relief of personnel and provision for catering and other services.

Works Incident Controller

The Works Incident controller would be the Head of Production / Shift in charge. Main duties are:

- On declaration of major emergency, ensure that key persons and outside emergency services are called in, and, where required, near-by firms are also informed.
- Exercise direct operational control of the affected area.
- Direct the shutting down and evacuation of the installation in consultation with the works Main Controller
- Ensure the accounting for personnel and arrange non-essential workers be sent to assembly points.
- Based on discrepancy in head count, if any, arrange for a thorough search for casualties
- Coordinate rescue and firefighting operations until the arrival of fire brigade personnel
- Arrange for a chronological record of the emergency to be maintained.
- Contact the meteorological office for latest trends and predictions on the weather, lest it affect the rescue/ relief efforts.
- Mobilize the team from maintenance department to assist fire and safety efforts.
- Ensure availability of materials required by the site incident controller.
- Liaison with chief officers of the fire and police departments, experts on fire and safety, health etc. and provide advice on possible off site effects.
- Arrange emergency procurements from local dealers or from neighboring industries.
- Establish communication link with the ECC (through phone or messenger) and keep the WMC informed about the developments at the incident site

Safety Coordinator – Safety Head

- On receiving the information on the impeding emergency, rush to the incident scene
- Take stock of the situation and accordingly inform the WMC for calling external help, if required
- Based on the intensity of the emergency, initiate evacuation of the affected area and direct all non-essential workers to assembly points.
- Ensure safe stoppage of the operations, switching off main instruments, shut off valves on product lines and isolation of affected area.
- Demarcate danger and safe zones by putting RED and GREEN flags/ barriers/ cordon tape.
- Mobilize the firefighting crew and direct Fire Fighting operations.
- Effectively deploy manpower, both internal and external.
- Arrange the replacements of various firefighting squads with the Mutual and External aid members on need basis.
- Ensure / maintain sufficient level of water in the storage tank / reservoir and plan replenishment.
- Monitor the requirements of Fire equipment and coordinate for procurement of spares.
- Arrange for flood lighting of the affected areas and dewatering of the firefighting area, if required.
- Advise the security personnel to barricade storm water drain and ensure treatment of firewater before discharge.
- Arrange for safety equipment (breathing apparatus, fire suits etc. as required)
- Arrange to remove and park the tank Lorries to a safer place, as necessary.
- Preserve records/evidence for root cause analysis of the accident

Medical Coordinator – Factory Medical Officer

- Rush to the scene of emergency on receipt of information.
- Ensure that casualties are receiving adequate help. If required, arrange for additional help. Ensure that relatives of the affected workers are advised
- Assume complete responsibility of providing Medical Attendance, treatment and guidance to the injured.
- To prepare plan for rendering first-aid on the spot or at the medical room
- Assign doctors, nurses, technicians and trained first aiders as may be required
- To requisition immediate medical help and shift those effected to nearby Hospital
- Ensure availability of essential medical supplies
- To assess the nature of injury and health hazard for follow-up action
- To keep the WMC informed of the steps taken and seek advice for further mobilization of medical resources from within and outside the plant
- Fix up a list of hospitals to treat the injured and emergency cases and keep them informed regarding the nature of injuries/emergencies likely to occur from different cases.

Task Force Coordinator – Maintenance Head

- As soon as information is received he shall reach the site of emergency.
- He shall provide assistance as per the demand of works Incident Controller(s) / Safety Officer.
- He shall be responsible for electrical supply cut-off / restoration of other mechanical and workshop help.
- He shall have his own at least two massagers to communicate to the other maintenance / Utility personnel.
- He shall ensure the Electrical / Water supply to Fire Pump House.
- He shall provide Fabrication / Construction manpower for any demolition / Construction as per the emergent situation.
- He shall provide temporary barricade to the affected location.

Communication Coordinator

- They shall be responsible for arranging assembly of the employees working in the affected section and take their attendance.
- They shall identify the victims of emergency and inform their relatives.
- They shall collect the complete record of victims and informed to Site Main Controller / Public Relation Officer.

Evacuation Team

Manager Human Resources will perform the duties of Evacuation & Rehabilitation coordinator wherein he will be responsible for:

- Ensuring that all non-essential persons are advised to gather at the appropriate `Assembly Point'
- Carrying out the head count and initiating operations to locate the missing workers/ visitors
- Getting all non-essential workers safely evacuated to the designated rehabilitation centers, if necessary, by stopping work not required during the emergency
- Arrange refreshments and revitalizers for personnel engaged in combat and rescue operations
- Provision to escort visitors, if any, to safe area promptly
- Immediate needs of casualties like shelter, food, clothing, medical aid, etc. are channeled/ mobilized.

Liaison & Public Relations Coordinator

Public Relations Officer will hold the responsibility of liaison and PR coordinator wherein he will:

- Report at the ECC and take charge of the functions
- Liaise with local police/ law enforcing authority, Dist. Collector, Chief Medical Officer, District Fire Officer, etc. for possible help, if needed.
- Preparation of Call-in-Lists by identifying employees and their area of residence.
- Plan to see that the press reporters and photographers get the accurate coverage and the information is given only by the person authorized by WMC
- Prepare plan, for maintaining industrial relations/ public relations; to stop rumors / panics among the employees and their families in the plant and rendering welfare measures which may be needed.

Rescue Coordinator

- Rescue team will go to OHC.
- With ambulance they will come to incident spot.
- They will carry the victim to OHC.
- They will assist the Medical Coordinator.

7.4.13 Emergency Control Centre

Emergency Control Center is the location from where all the emergency activities are coordinated. A specific room has been designated as the emergency control center. The control room has been selected as the Emergency Control Center as it is easily accessible as well as away from the scene of emergency. The control room is equipped with:

- Factory layout plan
- Telephone Nos of emergency responders and Government authorities.
- Intercom, external phones and hot lines.
- Number/ List of people working and likely to be present in the affected zone.
- Emergency Lighting
- Details about vulnerable zones
- Required set of tools and safety equipment
- Meteorological data
- Public address system

7.4.14 Emergency Response Equipment & Facilities

Fire Fighting

KOCL will have a full-fledged fire fighting department with the following facilities:

Table 7-11: Fire Fighting Arrangements

S. No.	Item	Tentative Quantity
1	Fire water reservoir (capacity m3)	500 KL
2	Fixed Water Monitors	10
3	Water Hoses	20
4	Single point header	5
Portable Fire Extinguishers		
1	CO_2	20
2	DCP	20

S. No.	Item	Tentative Quantity
3	Water	5

Portable fire extinguishers of suitable types and fire buckets will be installed at various locations all over the plant premises.

A well laid fire hydrant system, hose reel system and fire alarm system will be installed in the plant premises to deal with any type of fire eventuality.

Servicing and repairs of all fire extinguishers will be done periodically under the supervision of Engineering and Fire safety personnel.

Survey of locations and availability of fire extinguishers and fire buckets will be conducted by Fire Officer. Necessary additions, changes will be made accordingly. New equipment will procured if necessary.

All fire extinguishers will be numbered serially according to the location.

A drawing of factory layout will made available at each department on which locations of all fire extinguishers and exit ways will be marked.

All security guards will be trained in firefighting.

Personal Protective Equipment

Personal Protective Equipment (PPEs) will be the key to safe working in factory area. KOCL will provide appropriate PPEs to the workers for safety in the workplace. Different types of PPEs provided at KOCL include canister masks, face shields, safety shoes, various types of hand gloves, safety goggles, ear muffs, welding glasses, face mask, helmets, etc. Details of Major PPEs is given below:

Table 7-12: Details of PPEs

S. No.	Item	Tentative Quantity
1	Self-Contained Breathing Apparatus (including usage time)	5 No. each 20 min.
2	Air-line breathing apparatus	2
3	PVC Suit with hood for full body protection	5
4	Industrial type canister masks	30

Medical & First Aid Facilities

Adequate number of first aid boxes will be installed and maintained all over the plant. Chemplast has an existing fully equipped OHC, KOCL will use same facility as this is adequately equipped. Hence, no new OHC is considered. An ambulance van will available for all 24 hours at the OHC of Chemplast that will be available for KOCL. Major health centre activities at KOCL will be given below:

- Providing Round the clock Medical Services with Ambulance facility.
- Handling medical emergencies at the site of accidents, fire & food poising etc.
- Procurement & Management of medicines using FIFO system.
- Monthly checking of expiry date of medicine.
- Preventive Health Awareness advice.
- Do's & Don'ts for epidemics and prolong diseases.
- Information by e-mail, display at notice board & awareness poster fixing.
- Life-saving first aid workshop from external source.
- First aid training internal by company doctor for employees, food handlers & security personnel.

- As against the legal obligation of providing 1 first aid box for every 150 employees, KOCL provides one First Aid Box for every 20 employees.

Alarm and Communication

The factory will have public address system in each and every department. For internal and external communication, KOCL will have intercom facility all over the factory.

Mobile phones will be available with all the senior and middle management employees. Mobile phones will have also been provided to the fire department for use during emergency.

A fire alarm system will be installed for information and detection of fire. The alarm system will have several points at fire prone areas and if an associate detects fire he will immediately breaks the nearby fire alarm glass. As a result there will be alarm at that particular zone as well as at reception area. The main panel also indicates the zone where fire will have been detected.

The factory will have an emergency siren with dedicated siren code and is tested every week.

Assembly Points and Evacuation Routes

The following assembling points will be identified and escape routes will be clearly marked with arrows.

Assembly Points:

1. Near Main gate

2. Near Utility area

3. Near HCl storage tank

Escape Routes/Emergency Assembling Points:

1. Near Main gate

2. Near Utility area

3. Near HCl storage tank

7.4.15 External Emergency Response Agencies

Fire Services

Table 7-13: Name and Address of External Fire Services

S. No	Name & Address	STD Code	Phone
1	Station Fire Officer, Karaikal	04368	220101,230112
2	Fire Station, IBP, Panangudi	04365	256413
3	Fire Station, Nagapattinam	04365	242101
4	Fire Station, CPCL , Panangudi	04365	256416
5	Fire Officer, Residence CPCL	04365	256421
6	Project Manager, Fire ONGC, Neravy, Karaikal	04368	222577
7	Asst. Fire Officer-ONGC Neravy Karaikal	04368	222161

List of major Hospitals

Table 7-14: Details of Major Hospitals nearby Area

Hospital Name	Vinayaka Mission's Medical College & Hospital	Govt general Hospital Karaikal	Sugam Priya Hospitals	Puduthurai Clinic
Address	Karaikal	Karaikal	Karaikal	Karaikal
Phone no	04365-222474	04365-221362	04365-224040	04368-220426
No of beds	800	200	20	20
Burn ward	Yes	Yes	No	No
Chemical poisoning	Yes	Yes	No	No
No of Ambulances	3	3	0	0

7.4.16 Emergency Response Procedure

Action Plan for Tackling Chlorine Leak from Pipeline

When the leak is noticed from the pipeline or from joint of pipeline valve, the incident controller i.e. The Shift-In charge rushes to the leaky spot and assesses the situation. If the leak could be controlled by his crew, he will proceed as follows using the emergency kit.

- To stop chlorine supply by shutting off the valves at both ends.
- Evacuate the line to alkaline scrubber
- Depending upon the leak select a suitable mask (Airline respirator, Canister with face shield, Self-Contained Breathing Apparatus). Alert the operatives also, to wear a suitable mask.
- The Incident Controller i.e., the Shift In-charge is of the opinion that he could not handle the situation then he will RAISE THE ALARM FOR CHLORINE LEAK.

Hydrogen on Fire

Hydrogen is supplied through pipelines to Plant. Hydrogen leak from pipeline joint has comparatively a higher frequency rate. Being a highly flammable gas could pose a potential fire hazard on site.

Action plan for hydrogen gas leak from pipeline is as below:

The Incident Controller i.e., Shift In charge attends to control the fire as follows:

- Alert the Concerned Area Officers / Task force Members from Mechanical Department about the fire and he should arrange to inform the Communications team for communicating to Key Personnel as per the guidelines of the On Site Emergency Plan.
- Cut off supply of both power and Hydrogen from the source to the supply line.
- Put off the fire with Carbon –di-oxide gas
- Cool down the pipe with water spray.
- Flush the line with Nitrogen.
- Works Main Controller will arrange for additional Fire Service, if necessary from Pondicherry Fire Services etc.,

7.4.17 Action Plan in Case of Natural Calamities

Storm / Tsunami

Plant Head or Maintenance Head will declare this situation on the basis of the information from Meteorological department / Local Authorities / Cable TV / External Sources.

Action by HR Department;

- Transport facilities.

- Emergency evacuation.
- Head count.
- Communicating the persons outside the plant if needed.
- Canteen arrangements.
- Welfare arrangements.

Acton by Production Department;

- Quick shutdown of the plant and sequence of shutdown of plants will be decided the works Main controller (WMC) as per the procedures depending on the nature of the situation prevailing at that time.
- Additional manpower if required may be brought in from in other department as per the decision of works main controller.
- Product equipments from low-lying areas with the help of the maintenance crew. Move to other areas for safety.

7.4.18 Post Emergency Activities

- The cessation of Emergency will be declared, only after ensuring that there is absolutely no threat either to personnel or property.
- The WMC will announce the end of emergency by arranging to provide notification by the public address system.
- This will be followed by head count of all the individuals at the assembly point.
- A committee will be constituted to investigate the cause of disaster, which will submit a detailed report of the findings.
- Based on the findings and lessons learned during emergency, the on-site plan will be suitably modified to make it more effective.
- Mock-drills will be carried out on the on-site plan to check its effectiveness and for identification of areas for improvement.
- Regular training programs through audio-visual aides will be conducted to enhance the preparedness of all workers, especially the emergency combat personnel.