OFF-SITE EMERGENCY PLAN

DISTRICT WEST, DELHI

(Prepared under Rule 14 of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989)

Developed & prepared by:
DIRECTORATE OF INDUSTRIAL SAFETY & HEALTH
(LABOUR DEPARTMENT)
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Message from Chairperson

Disasters cause human tragedy, crippling economic losses and hamper development, particularly in developing countries, where human dwellings are vulnerable to natural and industrial disasters. Sometimes a small incident, if not controlled or mitigated in time, can turn into a major chemical disaster and can have serious consequences.

Emergency planning becomes a necessary element to mitigate the effect of uncontrolled situations and to minimize loss of property, life and damage to the environment. Ministry of Environment, Forests & Climate Change, Government of India, as part of its programme to avoid major accidents like Bhopal and restrict the loss of human beings, has mandated to prepare off-site emergency plan

To deal with any emergency, it is very important that the necessary equipment and supplies are readily available and that various government/private authorities/agencies know their roles well in advance. These procedures must be documented and all stakeholders should have the opportunity to practice their emergency response skills regularly through mock-drills.

Keeping in view the nature of hazards in district West, this off-site emergency plan brings together the agencies and resources to ensure an effective emergency preparedness and response. It envisages the roles and responsibilities, function of the authorities and control measures including evacuation procedures.

I hope this plan will help the district authorities and industries to deal with any undesired emergency situation that necessitates swift and effective response.

(NEHA BANSAL, IAS)
DISTRICT MAGISTRATE/CHAIRPERSON
DISTRICT DISASTER MANAGEMENT AUTHORITY
DISTRICT WEST, DELHI

Acknowledgements

The formulation of District Crisis Group (DCG) and preparation of of off-site Emergency Plan is an important part in compliance of the mandate given to the Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules,1996 framed under the Environment Protection Act 1986.

This plan is developed basically for the agencies under the Government to make them understand their roles in case of an emergencies arising in Major Hazard Installations (MAH). Also the crisis groups and the industries are expected to be clear in their roles and responsibilities while dealing with any disaster due to fire, explosion or toxic release. Entire west district is covered under this plan. I would like to appreciate the guidance the Directorate of Industrial Safety and Health (DISH) and the members of the District Crisis Group (DCG).

I would also like to appreciate the praiseworthy efforts of Sh Kausik Sadhukhan Asstt Director (ISH) and Sh. Mohit Sharma, District Project Officer, for executing our envisioning and guiding principles and developing this Off Site Emergency Plan for District West.
I am extremely pleased with the deep involvement, support and co-operation of various stakeholders from community, line departments and other important members in the preparation of the Off Site Emergency Plan of (i) Hindustan Petroleum Corp. Ltd., Tikri Kalan, (ii) 40 MGD, Water Treatment Plan, Kamruddin Nagar situated in District West.

I am hopeful that the off-site Emergency Plan of District West and its process guidelines would inspire to follow the multi stakeholder participatory approach and proactive approach towards any chemical disaster related to the plants in the district, which will make our district more safe.

(DHARMENDRA KUMAR)
ADM (W)/CEO-DDMA(W)
DISTRICT WEST, DELHI

Acknowledgement

The Off-site Emegency Plan for district West of NCT of Delhi has been prepared keeping in view of the Major Accident Hazards Installations in the district. All MAH installations in the district have prepared on-site emergency plans to deal with any eventuality within the premises. In spite of taking best safety precautions in the plant, an off-site emergency due to fire, explosion or toxic release cannot be ruled out. This off-site emergency plan shall come into force, once the emergency is not restricted to the boundaries of the installation. Since this document is dynamic in nature, certains amendments as required from time to time shall ensure its viability and practical use. This forms the core and essence of this plan.

District Crisis Group (DCG) for the district was formed as required under the Chemical Accidents (Emergency Planning, Preparedness & Response) Rules, 1996 and the members of the group provided their valuable suggestions during the process of preparation of this Plan. Various meetings of DCG and deliberations resulted in framing and shaping of contents and details of the plan. The officers of district administration were kind enough to provide data and information, so that the plan can be a self-sustained document covering all aspect including geographical locations, manpower, strategic areas, etc. apart from technical inputs provided by the Directorate of Industrial Safety & Health.

Various departments like fire, police, health, DPCC and safety experts provided their inputs to complete this document. I am thankful to my colleagues, DCG members and stakeholders, without them such outcome would not have been possible. I am specially thankful to the district administration for their support and logistics.

(S. P. Rana)
Dy. Director (ISH)/ Member-Secretary (DCG)
Labour Department, GNCT Delhi

The journey...

The Directorate of Industrial Safety & Health, Labour Department, Govt. of NCT of Delhi headed by Mr. S. Pandia Rajan, Director (ISH) is mandated to enforce laws governing occupational, safety & health and one of the duties of the Directorate is to prepare "Off-site Emergency Plans" in consultation with respective District Magistrates.

Under the guidance of Ms. Neha Bansal, DM (West) and to convert the concept into reality, Mr. Dharmendra Kumar, ADM (West) took personal interest and put his efforts to see that consistent progress is made in the matter and the plan for the district takes shape. His motivation and resolve helped the members of the "District Crisis Group" to speed up the work and provide necessary information and input as required for inclusion in the plan.

Mr. S. P. Rana, Dy. Director (ISH) took up the challenge to prepare the Off-site Emergency Plan for "West district" in consultation with other stakeholders. Being "Ex-Labour Inspection Specialist" in International Labour Organisation (ILO) and having vast experience in conducting safety audits/surveys, HAZOP and MCLS studies, etc. it was prudent to utilize his expertise in preparing the plan. His understanding of consequence analysis and dispersion modeling of hazardous chemicals helped in visualizing different worst case scenarios for tackling any emergency. Experience gained by him during his stint with DGFASLI, Ministry of Labour, Govt. of India, Mumbai and International Training Centre, Turin, Italy was instrumental in framing prevention and protection strategies in line with national/international standards & guidelines for development of plan. Areas of critical importance were incorporated by him to achieve possible outcome.

Mr. Kausik Sadhukhan, Asstt. Director (ISH) assisted in framing & shaping the plan. He communicated to the government departments and other stakeholders persistently to gather information and data needed to incorporate in the plan. His experience in the field of OSH helped in defining roles and responsibilities of stakeholders. His suggestions/remedial measures for MAH installations were considered while developing the plan.

The officers of DDMA were kind enough to share data and material that was needed to develop the plan. Members of DCG were consulted including technical experts on OSH and deliberations were made at different levels to discuss the contents of the document.

While developing the plan, all aspects were looked into and consideration included making sure the material is easily understood, accessible and gender sensitive.

prepared on 18.11.2020

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1.0 INTRODUCTION

1.1 BACKGROUND

Chemicals are a vital component of everyday life and occupy an important position in our economy. There has been a rapid increase in recent times in their use in industry and household. Many of these chemicals are toxic, highly reactive, explosive or flammable, or have combination of these characteristics. Due to these properties, they have potential to cause damage to human beings, other living creatures, plant, property and the general environment. Disaster can have devastating effect on the economy. They can cause huge human and economic losses, which directly affect the development efforts of a region or a state. It is therefore, necessary to take utmost care, while handling such chemicals at all stages of manufacture, processing, treatment, storage, transportation, use, or sale.

The potential for major accidents caused by the increasing production, storage and use of hazardous substances implies that a well-defined systematic approach is required, if major disasters are to be avoided. Although such an emergency may be caused by a number of factors; e.g. plant failure, human error, earth quake, vehicle crash or sabotage, it will normally manifest itself in any of three basic forms viz. fire, explosion or toxic release.

Unlike natural disasters, which cannot be prevented, proper planning and preparedness can minimize the occurrence of emergencies caused through chemical accidents. Such a planning can be successful, only if those responsible for handling hazardous substances are aware about hazards and have a concern about it. This has to be supported by the local authorities, state governments and the central government.

The leakage of deadly Methyl Iso Cyanate (MIC) gas in Bhopal Disaster in Dec 2-3/1984 can never be forgotten. The highly toxic gas made its way into and around the colonies located near the plant. The killer cloud of gas that leaked abruptly and in an uncontrolled manner left more than 3500 people dead and thousands were injured. It is considered among the world's worst industrial disasters.

In most of the cases, the accident takes place due to chain of undesired and unplanned events, which get unnoticed and may lead to disaster. The situation is more severe in case of accidents in chemical industries where potentially hazardous conditions are always prevailing. Therefore, emergency planning becomes a necessary element to mitigate the effect of uncontrolled situations and to minimise loss of property, life and damage to environment. Ministry of Environment, Forests & Climate Change, Government of India as the nodal ministry for management of chemical disasters, as part of a programme to

avoid major accidents like Bhopal and restrict the loss of human beings, has mandated to prepare off-site emergency plan. Keeping in view the nature of hazards, off-site emergency plan is prepared to assess, minimize and eliminate risks to the possible extent.

It is imperative that the legislation alone cannot fulfil the objectives but complete cooperation and involvement of industries, district administration and the public is needed. In this context, the Directorate of Industrial Safety & Health of Labour Department of GNCT of Delhi in consultation with west district administration took the initiative in preparing a comprehensive off-site emergency plan for west district to manage the eventualities arising from MAH installations and other Hazardous industries located in the district.

1.2 PREAMBLE

An offsite emergency arising out due to chemical is one, which has the potential to cause serious damage or loss of life beyond the plant boundary. The snowballing of a small incident into a major chemical disaster and the subsequent effects on the life and property can be mitigated, if there is a readily implementable emergency preparedness plan available with the concerned district authorities. 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.

1.3 OBJECTIVES

The main objectives of the Off-site Emergency Plan are:

- to provide resources and methods for effective control of emergencies arising out due to fire, explosion or toxic release involving hazardous chemicals;
- to prevent emergency that may turn into disaster;
- to minimize damage to the property, people and the environment;
- effective rescue operation of public and treatment of the injured;
- synchronized action from all the coordinating agencies with least possible delay;
- to bring back normal situation in the least possible time;
- to provide authoritative information to the news media and government agencies;
- to train the people and the concerned to act efficiently and with confidence in an emergency.

1.4 PURPOSE

An off-site emergency plan is an important element of overall OSH Programme but also it is an important tool to mitigate emergency situations arising out due to chemical accidents. The lack of an emergency plan could lead to severe losses such as financial collapse of the area or even casualties. Since emergencies will occur, preplanning is necessary to prevent possible disaster. An urgent need for rapid decisions, shortage of time, and lack of resources and trained personnel can lead to chaos during an emergency. Time and circumstances in an emergency mean that normal channels of authority and communication cannot be relied upon to function routinely.

Being prepare for emergencies means making sure that the necessary equipment and supplies are readily available and that various government/private authorities/agencies know what to do when something unplanned happens such as a release, spill, fire or explosion. These procedures must be documented and all stakeholders should have the opportunity to practice their emergency response skills regularly.

The purpose of this plan is to describe the activities to be carried out in case of a major emergency or a disaster, assist concerned agencies in planning for hazardous materials incidents and to serve as a guide & training aid. This plan is developed for the Govt. agencies and the industries to help them in understanding their roles in case of an emergency.

The purpose of this plan is also to outline the procedures for immediate action, if major off-site emergencies occur involving major hazard installations in the district. Every Major Accident Hazards installation has its Onsite Emergency Plan to deal with an emergency inside the premises of the factory. If an emergency arises beyond the resources of the factory, they have an obligation to seek assistance from the Government.

1.5 SCOPE

This plan is developed basically for the agencies under the Govt. to make them understand their roles in case of an emergency. Also the crisis groups and the industries are expected to be clear in their roles and responsibilities while dealing with any disaster due to fire, explosion or toxic release.

Entire west district is covered under this plan. The plan will apply to the following emergency scenario:

- Release of toxic/ flammable chemical, both liquid & gases that are not restricted to the boundaries of the Major Accident Hazards Installation;
- Any emergency situation that is uncontrolled by any MAH installation or any factory involving hazardous chemicals located in the west district.

2.0 GEOGRAPHICAL FEATURES OF WEST DISTRICT

2.1 District Profile

2.1.1 Historical background

Boundaries: West District is one of the 11 districts of the NCT of Delhi that has been reorganized from 19th September, 2012 when Delhi was divided into Eleven Revenue Districts. Prior to that, there used to be only nine districts for the whole of Delhi with its district head quarter at 5, Sham Nath Marg.The District has common boundaries with the Northwest, North, Central and the Southwest District. It shares its West Boundary with the Jhajjar District of state Haryana. Rohtak Road and the Northern Railway Line marks the Northern Boundary, Najafgarh Drain being the southwestern edge of the District. The Northern Railway Line also marks the eastern boundary of the District.

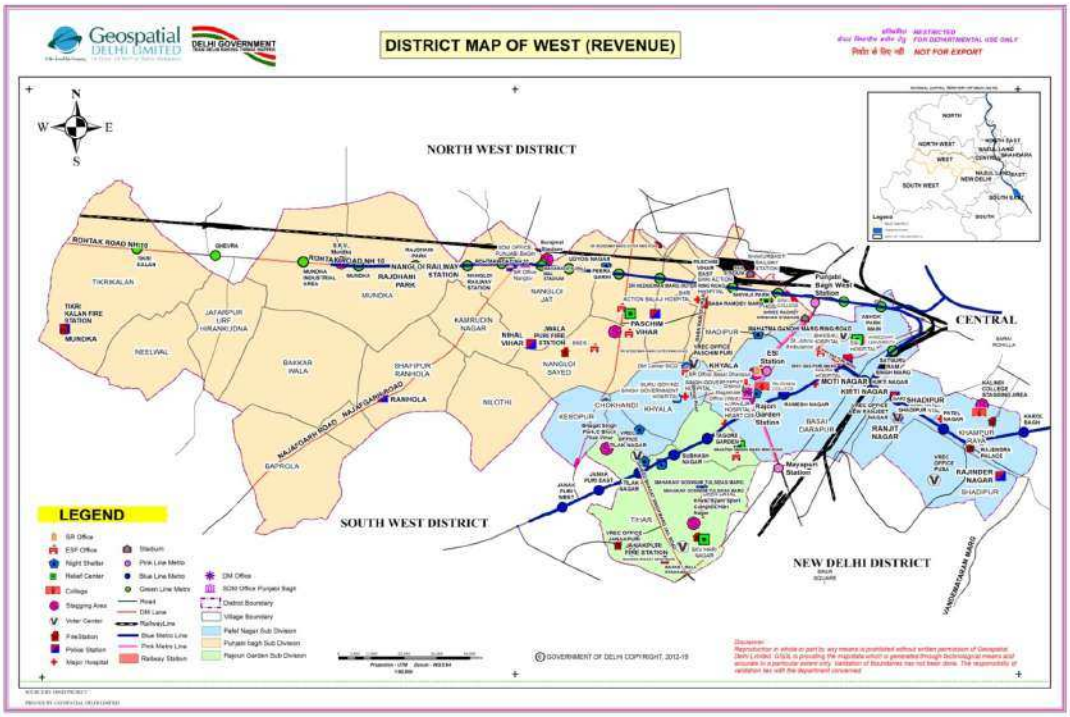
2.1.2 Demography

West District has 3 subdivisions, 20 villages, 19 police stations. West District is having population 1173902 persons (8% of entire Delhi's population) and Population density of 10,000 per square kilometre as per census 2011. Literacy Rate of district is 88.01 % highest in state. West is predominantly an urban area. Sex ratio of West district depicts 815 females per 1000 males. Per Capita income of Delhi for 2012-13 is 201083 whereas for India it is 68757 (Source - DELHI STATISTICAL HAND BOOK 2013).

The total population of the District is 25, 43,243 lakhs (According to census 2011),with an overall density of 19,563 persons per sq.km. In comparison to the other Districts, West district has moderate to high density. Sub-Division Wise Population Distribution: Maximum population resides in the Patel Nagar sub – division, which has population of 12, 63,010 with the density of 28,094 persons per sq. km. The Rajouri Garden sub division has the population 4, 80,970. The overall population of Punjabi Bagh is around 7, 87,603.

2.1.3 Location

The latitudinal and longitudinal location of Delhi are 28.6417 degree north and 77.1225 degree east. West District lies in Zone D according to Master Plan of Delhi 2001(DDA Zone). This area lies in the west part of the city. It is surrounded by Central, New Delhi, Southwest and Northwest districts.



2.1.4 Area

The District is mainly divided into three sub-divisions/ tehsils named as Rajouri Garden, Patel Nagar and Punjabi Bagh. Punjabi Bagh is the largest Sub division of the District. It has a number of rural settlements – Mundka, Ranhola, Baprola, Tikri Kalan, etc; urban settlements like Punjabi Bagh, Paschim Vihar, etc. Patel Nagar subdivision has only one rural settlement – Khampur Raya. The overall character of the subdivision is urban with areas like Patel Nagar, Tilak Nagar and Moti Nagar etc. Rajouri Garden subdivision has no rural settlements. It has areas like Rajouri Garden, Subhash Nagar, Hari Nagar, and Mansarover Garden.

2.1.5 Climate

The climate of the Delhi region is semiarid type, with three well defined seasons. The cold season begins at the end of November and extends to February, rainy season starts in early July and continues up to September. The hot summer extends from the end of March to the end of June.

2.1.6 Rainfall

Rains always come to Delhi a little later than predicted. There are bouts of rain during early July or maybe very late June. The monsoon finally catches on in the end of July. Depends from year to year, but rainfall is sufficient, torrential sometimes. The monsoon are around till about middle August generally and till about early September for a year with good monsoon.

3.0 GEOGRAPHICAL FEATURES OF MAH INSTALLATIONS

The West district has two MAH installations namely;

- M/S Hindustan Petroleum Corporation Ltd, Tikri Kalan Delhi-41.
- M/S 40 MGD Water Treatment Plant, Delhi Jal Board, Kamruddin Nagar Nangloi, Delhi 110041.

3.1 LOCATION OF HPCL

3.1.1 Location

Hindustan Petroleum Corporation Ltd. is Public Sector Undertaking that is located on the Delhi Rohtak Road (National Highway No. 10) near Haryana border.
The site is surrounded by the agricultural fields. The nearest habitation at Tikri Kalan is around 0.73 km in southwest. JJ colony Sawda at 1.32 km in north, and PVC market at 2.55 km in south direction. IOCL Bottling plants at 1.5 km in east direction.

3.1.2 Major Facilities at HPCL, Tikri Kalan Terminal:

HPCL Delhi Terminal, Tikri Kalan has storage tanks to receive Petroleum products through pipelines from the Mundra-Delhi pipeline and dispatch it to HPCL retail outlets through Tank trucks. Two 12 kms spur lines (i.e.10" dia & 8" dia.), one each for HSD/SKO & MS, from Bahadurgarh to HPCL Marketing installation at Tikri Kalan in Delhi for transporting MS, HSD & SKO products.

The terminal is having TT loading facilities. It also has storage and injection facilities for dosage of Ethanol and various other additives like Blue dye, Power, Turbojet etc.

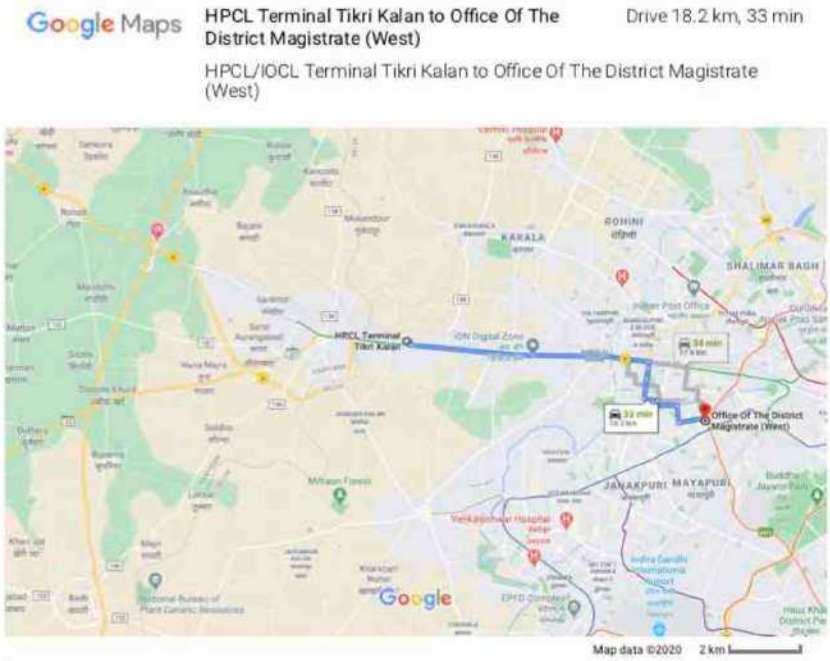
3.1.3 Storages at HPCL, Tikri Kalan Terminal:

Delhi Terminal has the storage capacity of 13180 KL of MS, 2860 KL of ethanol, 140 KL of kerosene, 17012 KL of HSD, 2840 KL of MTO and 280 KL of bio diesel for supply to the Delhi retail pumps. This MAH Installation is well equipped with firefighting facilities such as water storage tank of 11000 KL, auto fire hydrant system, monitors, and dry chemical powder extinguishers to combat in case of fire/ emergency. The details of tank farm area are as follows:

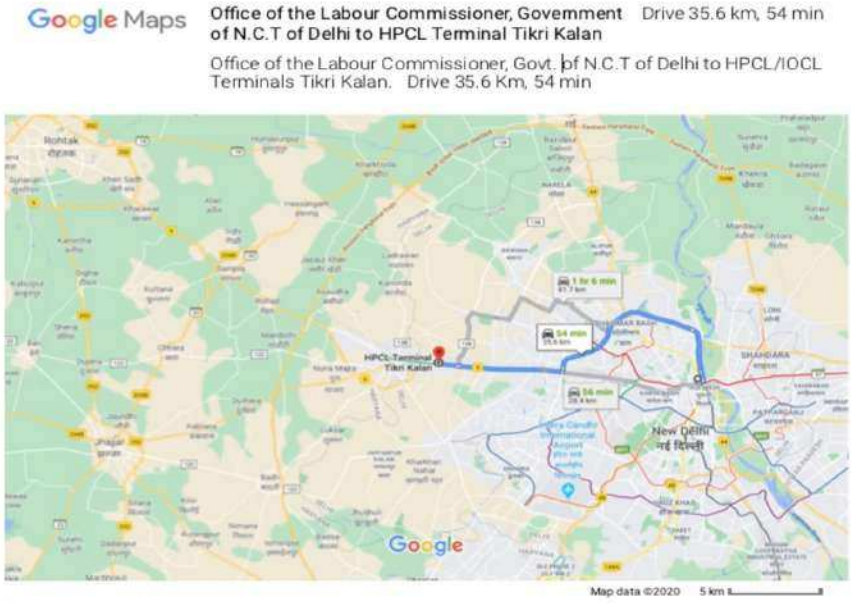
Particulars	**Unit**	**Description**
Land Area	Sq. meter	122215
Licensed Area	Sq. meter	73329
Administrative Block	Sq. Meter	336
Tankage (Above ground vertical cone roof with floating suction) under Jet A-1 service	10 Nos	3 X 4370 KL(MS) 3 X 5640 KL(HSD) 2X1395 KL(Ethanol) 2X1385 KL(MTO)
Tankage (U/G tanks with floating suction) under Jet A-1 service	3 Nos.	1 X 200 KL 1 X 115 KL 1X 10 KL (without floating suction) 1X 45 KL (without floating suction for downgraded fuel).
Tankage (U/G) under HSD service	14 No.	2X70 KL(MS) 2X70 KL(HSD) 2X70 KL(Ethanol) 2X70 KL(Solvent) 1X70 KL(MTO) 2X18 KL(Sump) 4X70 KL (Bio Diesel)

3.1.4 How to Reach

1. From DM Office/ERC -The travel time to the HPCL plant (MAH installation) from District Magistrate office, West would be around half an hour(20 KM). The route map is as follows:



2. From DISH- The travel time to reach the HPCL plant (MAH installation) from DISH office located at 5 Sham Nath Marg would be around one and half hour. The route map is as follows:



3.1.5 TOPOGRAPHY

The site is surrounded by the agricultural fields. The nearest habitation at Tikri Kalan is around 0.73 km in Southwest. JJ colony Sawda at 1.32 km in North, and PVC market at 2.55 km in south direction. Two MAH installations namely IOCL Terminal and IOCL Bottling plants are located in east direction at 2.0 km away from the HPCL site.

The HPCL site lies in Latitude 28°41'22.51"Nand Longitude 76°58'28.19"E.

3.1.6 Water Resources

There are no surface water resources under 5 km radius to the facility. The ground water and water storage tanks are main source for water for the facility.

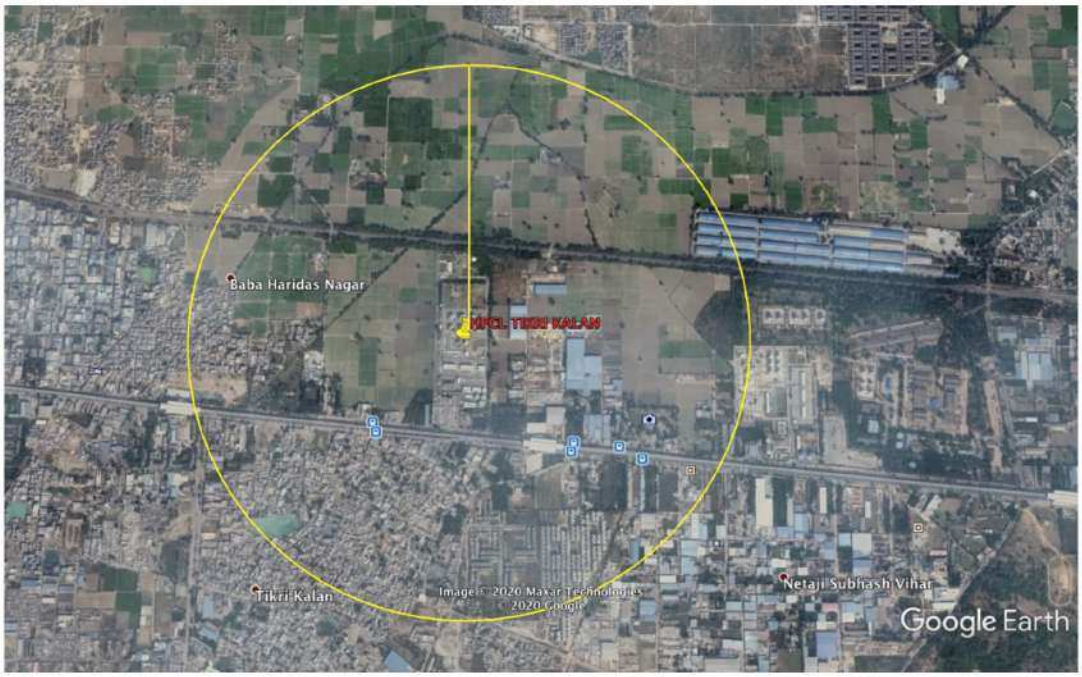
3.1.7 Land Use

Terrain in the MAH Installation is mostly barren, apart from tree line at the boundary walls of installation. There is a local railway station at Tikri Border.

3.1.8 DEMOGRAPHIC DETAILS

There is Tikri Kalan village in the vicinity of HPCL. The Different demographic establishments that fall within 5 km from both the facilities are as follows: -

Sl. No.	Name of strategic area	Address of establishment
01.	Delhi metro	Tikri Kalan Metro Station
02.	NH – 10	Delhi Rohatak Road
03.	Indian Railway	Ghewra Railway Station
04.	Police	Mundka Police Station
05.	District Fire Brigade	Mundka Fire Station
06	Delhi Metro	Tikri-Border Metro Station
07	Delhi Metro	Tikri Kalan Ghevra mod Metro Station



The ariel view of the sites is taken from google earth (yellow circle shows 1 km radius).

3.2 LOCATION OF 40 MGD WATER TREATMENT PLANT

The 40 MGD Water Treatment Plant of Delhi Jal Board is located at Kamruddin Nagar Nangloi, Delhi 110041, which is near to Nangloi. The nearest metro stations are "Nangloi railway Station" & "Nangloi".

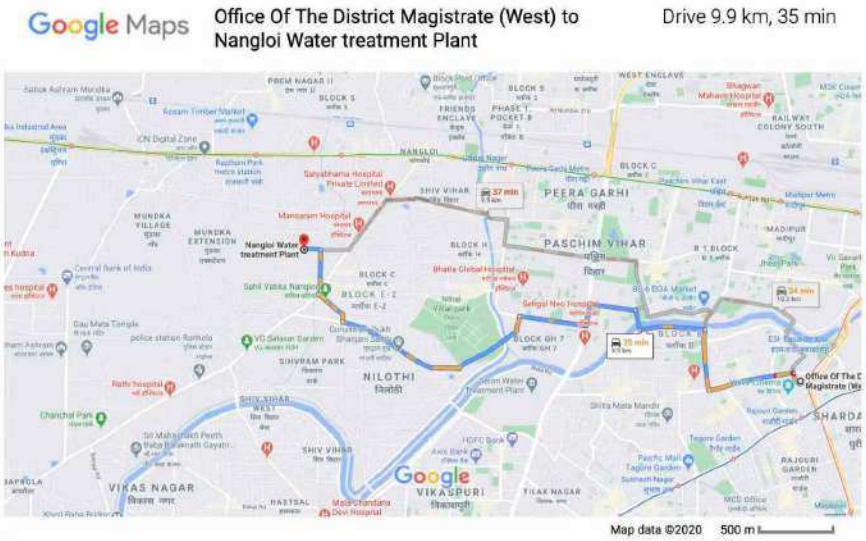
3.2.1 Water treatment plant facilities:

Particulars	**Unit**	**Description**
Land Area	Sq. meter	196004
Licensed Area	Sq. meter	196004
Administrative Block	Sq. Meter	503.4
Tankage (U/G tanks with floating suction)	6 Nos.	3 X 3 MG 3 X 3 MG

The WTP consists of one bifurcation channel 4 coagulation tanks and 16 constant head filters and other utilities for chemical addition, and storage. The sludge from sludge tanks goes to waste water channel. The treated water is disinfected and stored in the clear water reservoirs until it is distributed. There is a total of 10 pumps distributing the treated water into four transmission mains.
Liquid chlorine filled containers called tonners are brought to the Nangloi water service from the various organizations (from where it is purchased) in their own transport. The Tonners are placed on its seat. The tonner is to be used for water treatment and thus connected to the manifold system for use. Total licenced capacity of chlorine storage is 12 tons.

3.2.2 How to reach at treatment plant

From DM Office/ERC-The travel time to treatment plant (MAH installation) from District Magistrate office, West would be around half an hour. The route map is as follows:



- **From DISH**- The travel time to reach the plant (MAH installation) from DISH office located at 5 Sham Nath Marg would be around one hour. The route map is as follows:

3.2.3 TOPOGRAPHY

The site is surrounded with two villages; Amar Colony to north and Laxmi Park Colony to the southwest respectively. The site is surrounded by densely populated villages/colonies.

The site lies in Latitude 28°40'16.32"N and Longitude 77° 2'55.86"E

3.2.4 Water Resources

There are no surface water resources within 5 km radius to this facility. But the site contains and deals with a lot of water for treatment and supply purpose.

3.2.5 Land Use

Terrain in the MAH Installation is mostly fertile having trees and bushes in and around the site. There is a local railway station called Nangloi Railway Station to north.

3.2.6 DEMOGRAPHIC DETAILS

3.2.7 Demography:

The area is densely populated after 10 meters from facility boundary towards all directions comprising of villages and colonies.
The strategic locations within 1 Km radius of M/s 40 MGD water treatment plant of Delhi Jal Board:

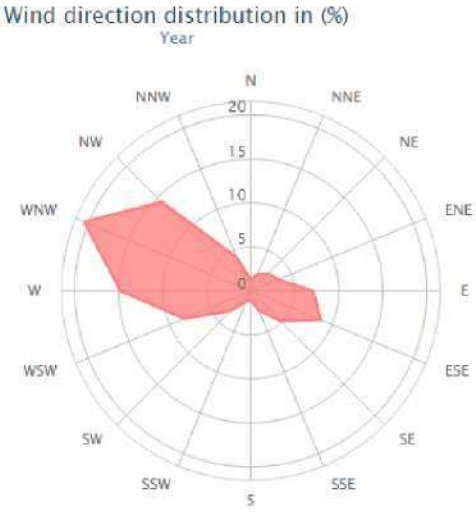
The ariel view of the site is taken from google earth.

3.3 METEROLOGICAL DATA:

3.3.1 Meteorological Data:

Maximum Temperature --- 35° C,
Minimum Temperature --- 20° C
Solar Radiation flux --- 0.5 kw/m^2 for day time
Average Relative Humidity --- 68.8 %
Wind Speed: Maximum Mean --- 5 m/s, Minimum Mean --- 3 m/s
Predominant wind Direction - From North-West

3.3.2 Wind Velocity/Directions:



4.0 HAZARD IDENTIFICATION IN WEST DISTRICT

Hazard identification in any occupational activity or area is the process of finding and identifying hazardous agents (situations, products etc) that could contribute to provoking an occupational accident or/and disease as well as the groups of workers potentially exposed to these hazards. Hazard identification is one component of the larger process of safety and health management. The extent of the consequences arising from the petroleum oil terminal would depend upon quantity of the oil present, mode of containment, and external factors like location, density of population etc. In many cases, realization of hazard and its potential also depend on prevailing meteorological conditions and availability of ignition source.
A number of major objectives may be identified:

- to establish what dangerous situations exist within a plant or a process operation;
- to establish how these dangerous situations may come about; and,
- to assist in the risk assessment and to make decisions on hazard control.

One of the major hazards posed in west district is due to Fuel/Oil stored and handled in M/s HPCL terminal located at Tikri Kalan. Motor Spirit (MS), High Speed Diesel (HSD), Mineral Turbine Oil (MTO) and other products stored in the Depots are inflammable in its basic character. Products are dangerous because of their intrinsic properties i.e. flash point, heat of combustion, flammability limits, etc. In addition to such intrinsic properties, extrinsic factors like storage & operating conditions and large storage quantity are also considered for hazard identification.

Apart from above, another hazard is posed by chlorine that is being used in water treatment plant, Kamruddin Nagar for disinfection in water treatment process, which is toxic in nature. Leakage of chlorine (toxic gas) from tonners & associated pipelines, equipment while transporting, storing or handling / using is considered a major hazard.

The extent of the consequences arising from the petroleum oil terminals and water treatment plant would depend upon quantity of the oil/chlorine present, mode of containment, and external factors like location, density of population etc. In many cases, realization of hazard and its potential also depend on prevailing meteorological conditions and availability of ignition source.

The major hazard installations in west district at a glance are as follows:

S. No.	MAH Installation, Address	Manufacturing Activity being carried out	Hazardous chemical being stored/ handled	Emergency considered
1.	Hindustan Petroleum Corporation Installation, Tikri Kalan Delhi	Storage and supply of Fuel/Oil.	MS, HSD, K Oil, MTO,	Fire Explosion
2.	40 MGD Water Treatment Plant, DJB, Kamruddin Nagar	Water treatment	Chlorine	Toxic release

IOCL, Terminal and Bottling Plants at Tikri Kalan, both MAH installations engaged in storage and handling of fuel oil & filling of LPG cylinders respectively are located within 2 km distance of HPCL installation. Besides this, the district does not have any major industry within the vicinity of 5 km excepts petrol pumps.

Thus, most serious consequences would arise from a large inventory of petroleum products stored and handled in HPCL installation. Petroleum requires interaction with air or oxygen for its hazard to be realized. Under certain circumstances vapours of the liquid when mixed with air may be explosive specially in confined spaces. Another serious consequence would arise from leakage of Chlorine from tonner used in water treatment plant of DJB, Kamruddin Nagar that is surrounded by a densely populated area.

4.1 MAJOR HAZARDS CONSIDERED

The following hazards were considered that pose serious threat to the installations and the vicinity in district west:

- Fire
- Explosion
- Release of Toxic of gas
- Spillage of flammable liquid/ toxic gas
- Natural Calamities : Lightening, storm, earth quake
- Overturning of tanker containing flammable/toxic substances during transportation.

4.1.1 Pool fire

There are likely chances of rupture of tank containing flammable liquid and formation of pool in the dyke wall and if ignited, burn as a pool fire. The worst scenario as per Quantitative Risk Assessment will be catastrophe rupture of MS/Ethanol/HSD tank and

flooding from dyke. Since in petroleum installations, the possibility of ignition source cannot be ruled out, though all the equipment are flame proof. In such scenario, pool fire is possible.

4.1.2 Explosion

The vapours emanating from a pool of released liquid may tend to form a thick hydrocarbon vapour cloud. Upon finding a source of ignition, a vapour cloud explosion may take place. The damage due to this vapour cloud explosion may be by fire engulfing people/materials inside the cloud. People inside such a cloud will have little chance of survival. A substantial part of the well-ventilated structure inside the vapour cloud may remain undamaged. Outside the vapour cloud in unconfined space, no fatality or injury may result as a direct consequence of the pressure wave caused by the explosion. Explosion of a vapour cloud in confined / semi confined spaces may lead to the development of a blast wave due to overpressure. Vapour generated from the spill mixed with air can make an explosive mixture leading to unconfined vapour cloud explosion (UVCE).

4.1.3 BLEVE (Boiling Liquid Expanding Vapour Explosion)

Very unlikely. When a tank containing a liquefied gas fails completely, a BLEVE can occur. Some of the released chemical will burn in a fireball while the remainder will form a pool fire. The amount of the chemical involved in the fireball and/or the pool fire will depend on the conditions at the time of release.

The primary hazards associated with a BLEVE are thermal radiation, overpressure, hazardous fragments, smoke, and toxic by-products from the fire. Since all the petroleum products (MS, MTO, HSD, etc)are stored as liquid in storage tanks at atmospheric pressure and below its boiling point, BLEVE is very unlikely and hence not considered for possible credible scenario.

4.1.4 Toxic release

Chlorines a toxic gas, which owing to its physical and chemical properties is capable of producing Major Accident Hazards. The permissible limit of exposure (PLV) for chlorine are as follows:

ACGIH TLV: 0.5 ppm (1.5 mg/m^3) TWA, 1 ppm (2.9 mg/m^3) STEL
As per the Factories Act, 1948, TLV: 1 ppm (3 mg/m^3) TWA, 3 ppm (9 mg/m^3) STEL

Other human data: Exposures to 30 ppm have been reported to cause intense coughing fits and exposure to 40 to 60 ppm for 30 to 60 minutes or more may cause serious damage . A concentration of 34 to 51 ppm has been reported to be lethal in 1 to 1.5 hours while 14 to 21 ppm has been suggested as being dangerous within 0.5 to 1 hour.

There are likely chances of breakage of pipe connecting the nozzle of tonner or the nozzle itself. It may lead to leakage of chlorine gas or liquid into the atmosphere causing emergency situation. Its acute toxicity and harmful nature warrants quick control measures and evacuation procedures.

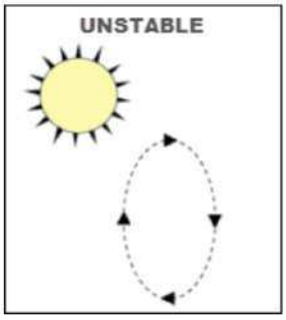
4.2 ATMOSPHERIC AND PHYSIOLOGICAL FACTORS

It is generally accepted that the "WORST CASE" scenario has the remotest of occurrence. Therefore, we need to direct resource towards the control of incidents, which could realistically occur. Accordingly, Maximum Credible Loss scenarios (MCLS) can effectively tell us in advance about the risk posed by the fire, explosion or toxic release due to any disaster.

Consequence analysis was carried out for the identified failure scenarios using computer software ALOHA (Areal Locations of Hazardous Atmospheres), which is designed to model chemical releases for emergency responders and planners. It is developed jointly by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA).

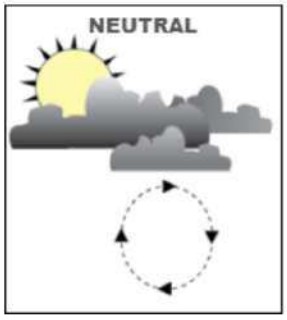
4.2.1 Background on Atmospheric Stability Classes

The atmosphere may be more or less turbulent at any given time, depending on the amount of incoming solar radiation as well as other factors. Meteorologists have defined six atmospheric stability classes (A-F), each representing a different degree of turbulence in the atmosphere.



When moderate-to-strong incoming solar radiation heats air near the ground—causing it to rise and generating large eddies—the atmosphere is considered unstable (relatively turbulent).

- Very Unstable (Stability Class A)
- Unstable (Stability Class B)
- Slightly Unstable (Stability Class C)

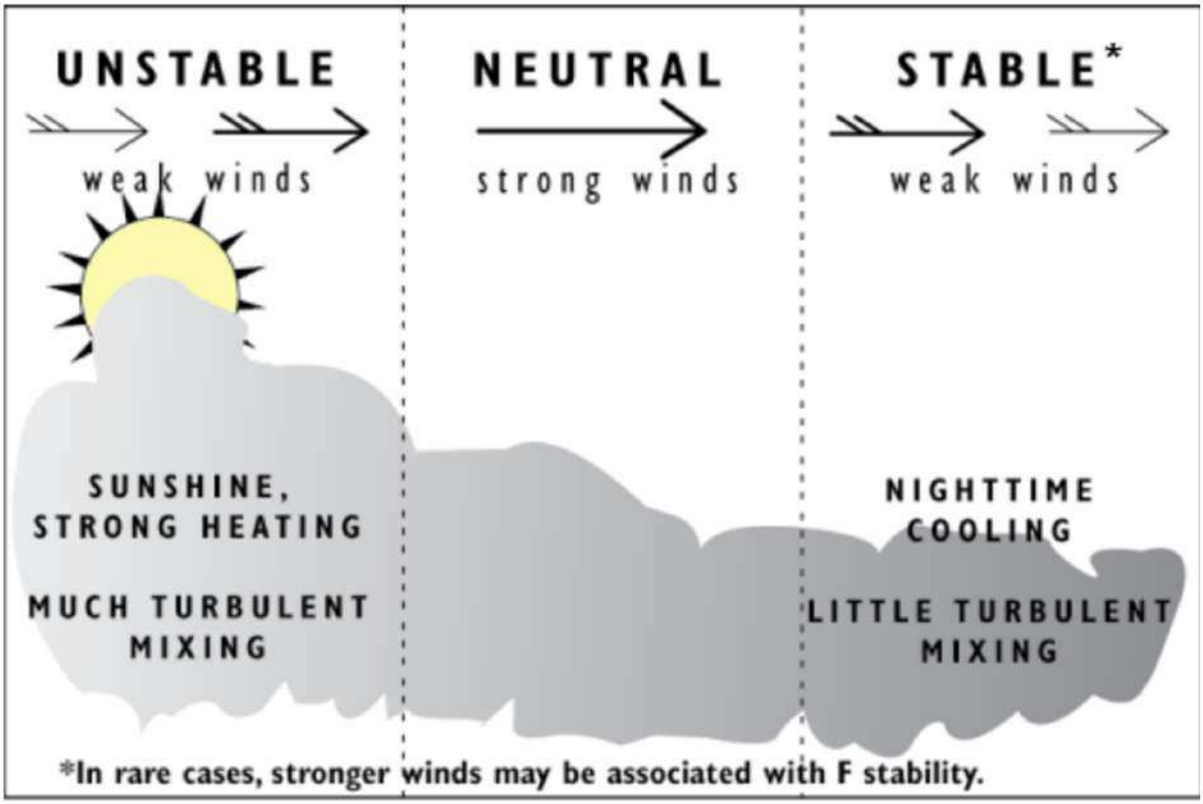


Relatively strong wind speeds and moderate solar radiation are associated with neutral stability (moderate turbulence).

- Neutral (Stability Class D)

When solar radiation is relatively weak or absent, air near the surface has a reduced tendency to rise, and less turbulence develops. The atmosphere is considered stable (less turbulent) and the wind is weak.

- Slightly Stable (Stability Class E)
- Stable (Stability Class F)



Stability class has a big effect on ALOHA's prediction of the threat zone size for dispersion scenarios. Under unstable conditions, a dispersing gas mixes rapidly with the air around it.

ALOHA expects that the cloud will not extend as far downwind as it would under more stable conditions, because the pollutant is soon diluted below our Level of Concern (LOC), and ALOHA will display a shorter threat zone than it would for more stable conditions.

4.2.2 Estimating Wind Speed and Direction

ALOHA uses the table below (Turner 1994) and information that is entered about time of day, wind speed, and cloud cover to automatically choose a stability class.

In this particular study, the average wind speed was taken 4 m/s, which is prevailing during summers in Delhi, India.

This table is an illustration of the wind speed and specifications as per the international standards.

Wind Speed			Day: Incoming Solar Radiation			Night: Cloud Cover	
Miles per Hour	Knots	Meters per Second	Strong	Moderate	Slight	More than 50%	Less than 50%
Less than 4.5	Less than 3.9	Less than 2	A	A–B	B	E	F
4.5 – 6.7	3.9 – 5.8	2 – 3	A–B	B	C	E	F
6.7 – 11.2	5.8 – 9.7	3 – 5	B	B–C	C	D	E
11.2 – 13.4	9.7 – 11.7	5 – 6	C	C–D	D	D	D
More than 13.4	More than 11.7	More than 6	C	D	D	D	D
• Table adapted from Turner, D. Bruce. 1994. Workbook of Atmospheric Dispersion Estimates: An Introduction to Dispersion Modeling. Second edition. Boca Raton, Florida: Lewis Publishers.							

ALOHA assumes that wind speed and direction are constant throughout the area downwind of a chemical release. ALOHA also expects the ground below a dispersing cloud to be flat. In reality, though, the wind typically shifts speed and direction as it flows up or down slopes, between hills or down into valleys, turning where terrain features turn.

LIMITATIONS: ALOHA's concentration estimates can be less accurate when any condition exists that reduces mixing in the atmosphere. For example:

- Very low wind speeds. At very low wind speeds (less than 3 miles per hour) the pollutant cloud does not mix quickly with the surrounding air. The concentration of the gas in the chemical cloud may remain higher than ALOHA predicts, especially near the source.
- Very stable atmospheric conditions. Very stable atmospheric conditions (stability classes E and F) generally occur at night or in the early morning, and may be indicated by conditions such as low-lying fog. Under these atmospheric conditions, gas concentrations within a pollutant cloud can remain high far from the source.

The following illustration is given for better understanding of the wind speed and characteristic which is widely accepted internationally:

Meters per second	**Knots**	**International description**	**Specifications**
< 1	< 1	Calm	Calm; smoke rises vertically.
<1 - 2	1 - 3	Light air	Direction of wind shown by smoke drift but not by wind vanes.
2 - 3	4 - 6	Light breeze	Wind felt on face; leaves rustle; Ordinary vanes moved by wind.
3 - 5	7 - 10	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.
5 - 8	11 - 16	Moderate	Raises dust and loose paper; small branches are moved.
8 - 11	17 - 21	Fresh	Small trees in leaf begin to sway; crested wavelets form on inland water.
11 - 14	22 - 27	Strong	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
14 - 17	28 - 33	Near Gale	Whole trees in motion; inconvenience felt walking against wind.
17 - 21	34 - 40	Gale	Breaks twigs off trees; generally impedes progress.

1 knot = 1.2 miles per hour

Notes:

- For completely overcast conditions during day or night, the stability class is D.
- This table is for releases over land. If the release occurs over water, the stability class will be either D or E.
- Wind speed is measured from a wind reference height of 10 meters.
- Strong incoming solar radiation corresponds to clear skies with the sun high in the sky (solar angle greater than 60 degrees).
- Slight incoming solar radiation corresponds to clear skies with the sun low in the sky (solar angle between 15 and 35 degrees).

4.2.3 Level of Concern (LOC):

A Thermal Radiation Level of Concern (LOC) is a threshold level of thermal radiation, usually the level above that a hazard may exist. For each LOC, ALOHA estimates a threat zone where the thermal radiation is predicted to exceed that LOC at some time after a release begins. These zones are displayed on a single Threat Zone plot. If three LOCs are chosen, ALOHA will display the threat zones in red, orange, and yellow. The red zone represents the worst hazard. ALOHA uses three threshold values (measured in kilowatts per square meter) to create the default threat zones:

Red: 10 kW/(sq. m) -- potentially lethal within 60 sec;
Orange: 5 kW/(sq. m) -- second-degree burns within 60 sec; and
Yellow: 2 kW/(sq. m) -- pain within 60 sec.

The thermal radiation effects that people experience depend upon the length of time they are exposed to a specific thermal radiation level. Longer exposure durations, even at a lower thermal radiation level, can produce serious physiological effects. The threat zones displayed by ALOHA represent thermal radiation levels; the accompanying text indicates the effects on people who are exposed to those thermal radiation levels but are able to seek shelter within one minute.

Below are some effects at specific thermal radiation levels and durations (on bare skin):

2 kW/(sq. m) -- people will feel pain after 45 seconds and receive second-degree burns after 3 minutes;
5 kW/(sq. m) -- people will feel pain after 13 seconds and receive second-degree burns after 40 seconds; and
10 kW/(sq. m) -- people will feel pain after 5 seconds and receive second-degree burns after 14 seconds.

4.2.4 Toxic LOCs

A toxic LOC tells us what level (threshold concentration) of exposure to a chemical could hurt people if they breathe it in for a defined length of time (exposure duration). Generally, the lower the toxic LOC value for a substance, the more toxic the substance is by inhalation. Toxic LOCs also may be referred to as exposure limits, exposure guidelines, or toxic endpoints.
There are some key differences between the different types of exposure guidelines; however, at a very general level, the tiers are similar: the first tier (e.g., AEGL-1) is a mild effects threshold, the second tier (e.g., AEGL-2) is an escape-impairment threshold, and the third tier (e.g., AEGL-3) is a life-threatening effects threshold.

5.0 CREDIBLE LOSS SCENARIO STUDIES

5.1 SCENARIOS FOR HPCL

5.1.1 SCENARIO 1 (Burning puddle- Pool fire- HPCL installation):

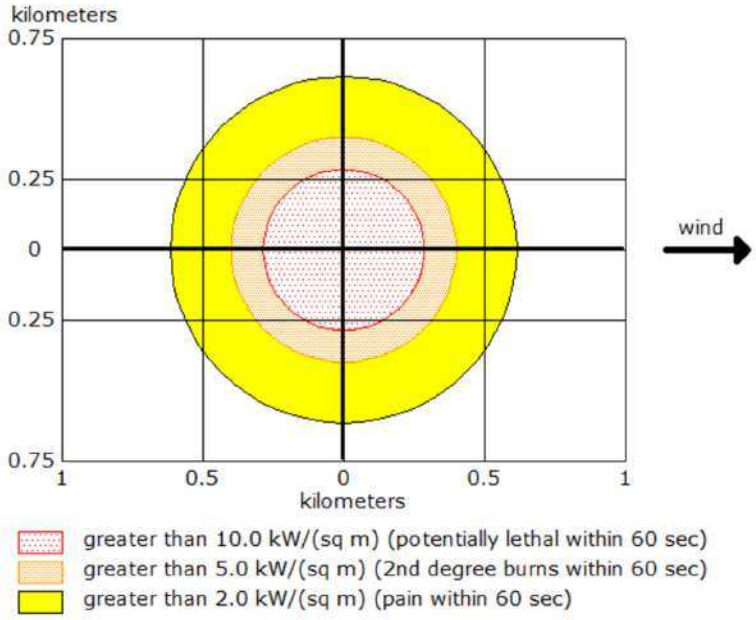
SITE DATA:
Location: DELHI, INDIA
Building Air Exchanges Per Hour: 0.80 (unsheltered single storied)
Time: November 8, 2020 1855 hours ST (using computer's clock)

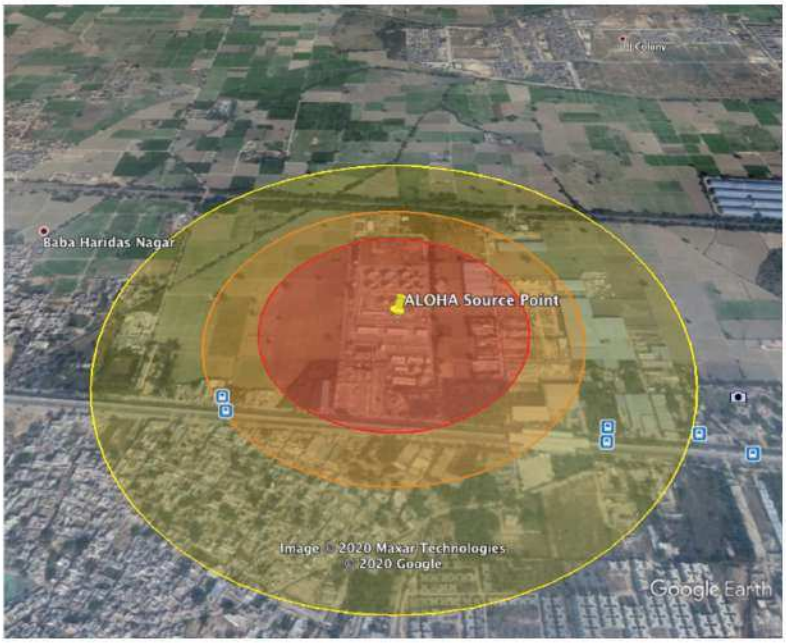
CHEMICAL DATA:
Chemical Name: GASOLINE (MOTOR SPIRIT)
CAS Number: 8006-61-9 Molecular Weight: 72.15 g/mol
PAC-1: 3000 ppm PAC-2: 33000 ppm PAC-3: 200000 ppm
IDLH: 1500 ppm LEL: 14000 ppm UEL: 78000 ppm
Ambient Boiling Point: 35.3° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 3 meters/second from NW at 3 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 45° C Stability Class: E
No Inversion Height Relative Humidity: 50%

SOURCE STRENGTH:
Burning Puddle / Pool Fire
Puddle Area: 10074 square meters Average Puddle Depth: .43 meters
Initial Puddle Temperature: 30° C
Flame Length: 138 meters Burn Duration: 36 minutes
Burn Rate: 73,500 kilograms/min
Total Amount Burned: 2,671,324 kilograms

THREAT ZONE:
Threat Modeled: Thermal radiation from pool fire
Red : 285 meters --- (10.0 kW/(sq. m) = potentially lethal within 60 sec)
Orange: 399 meters --- (5.0 kW/(sq. m) = 2nd degree burns within 60 sec)
Yellow: 615 meters --- (2.0 kW/(sq. m) = pain within 60 sec)


kilometers
0.75
0.25
0
0.25
0.75
1
0.5
0
0.5
1
kilometers
wind
greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)


Baba Haridas Nagar
ALOHA Source Point
Image © 2020 Maxar Technologies
© 2020 Google
Google Earth

5.1.2 SCENARIO 2 (Leaking Tank – Burning- HPCL):

SITE DATA:
Location: DELHI, INDIA
Building Air Exchanges Per Hour: 0.80 (unsheltered single storied)
Time: November 8, 2020 1855 hours ST (using computer's clock)

CHEMICAL DATA:
Chemical Name: GASOLINE (MOTOR SPIRIT)
CAS Number: 8006-61-9 Molecular Weight: 72.15 g/mol
PAC-1: 3000 ppm PAC-2: 33000 ppm PAC-3: 200000 ppm
IDLH: 1500 ppm LEL: 14000 ppm UEL: 78000 ppm
Ambient Boiling Point: 35.3° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 3 meters/second from NW at 3 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 45° C Stability Class: E
No Inversion Height Relative Humidity: 50%

SOURCE STRENGTH:
Leak from hole in vertical cylindrical tank
Flammable chemical is burning as it escapes from tank
Tank Diameter: 22 meters Tank Length: 13 meters
Tank Volume: 4,942 cubic meters
Tank contains liquid Internal Temperature: 30° C
Chemical Mass in Tank: 2,696,251 kilograms
Tank is 88% full
Circular Opening Diameter: 20 inches
Opening is .7 meters from tank bottom
Max Flame Length: 138 meters
Burn Duration: ALOHA limited the duration to 1 hour
Max Burn Rate: 73,500 kilograms/min
Total Amount Burned: 1,832,681 kilograms
Note: The chemical escaped as a liquid and formed a burning puddle.
The puddle spread to a diameter of 113 meters.

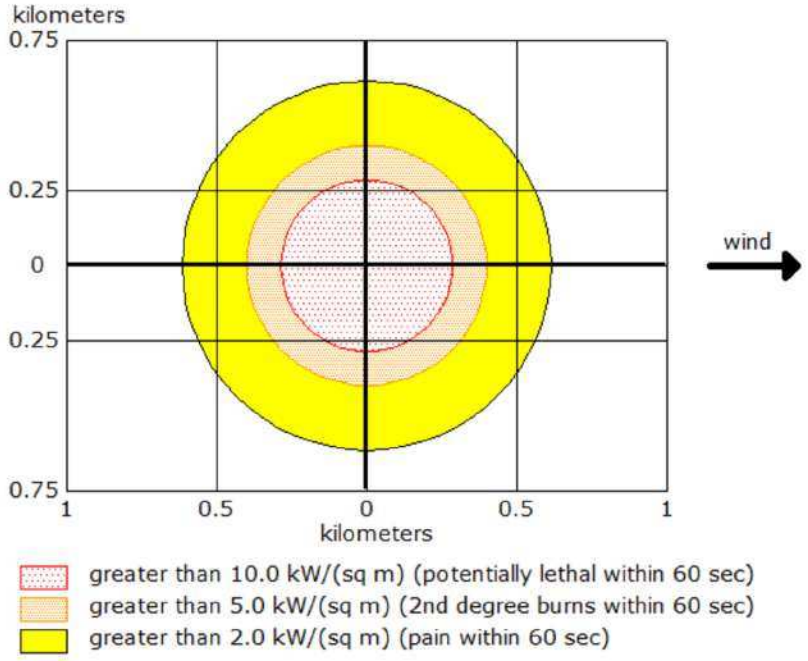
THREAT ZONE:

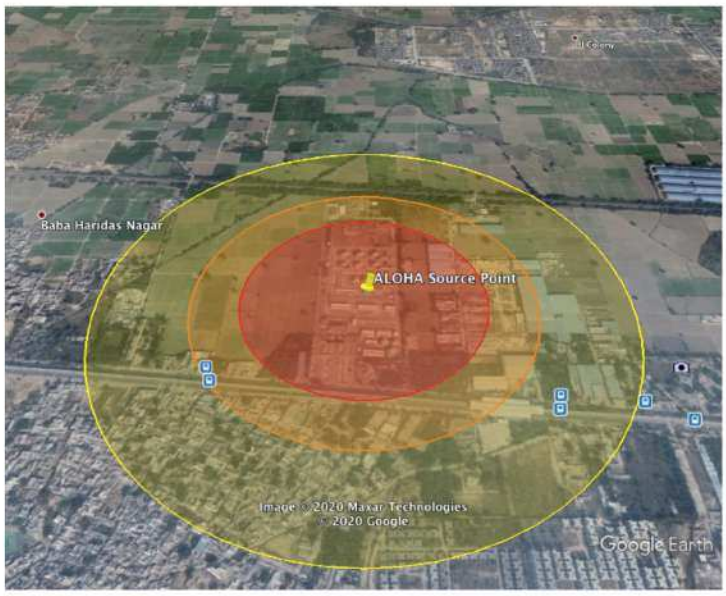
Threat Modeled: Thermal radiation from pool fire

Red : 285 meters --- (10.0 kW/(sq. m) = potentially lethal within 60 sec)

Orange: 399 meters --- (5.0 kW/(sq. m) = 2nd degree burns within 60 sec)

Yellow: 615 meters --- (2.0 kW/(sq. m) = pain within 60 sec)





5.2 SCENARIO FOR TOXIC RELEASE

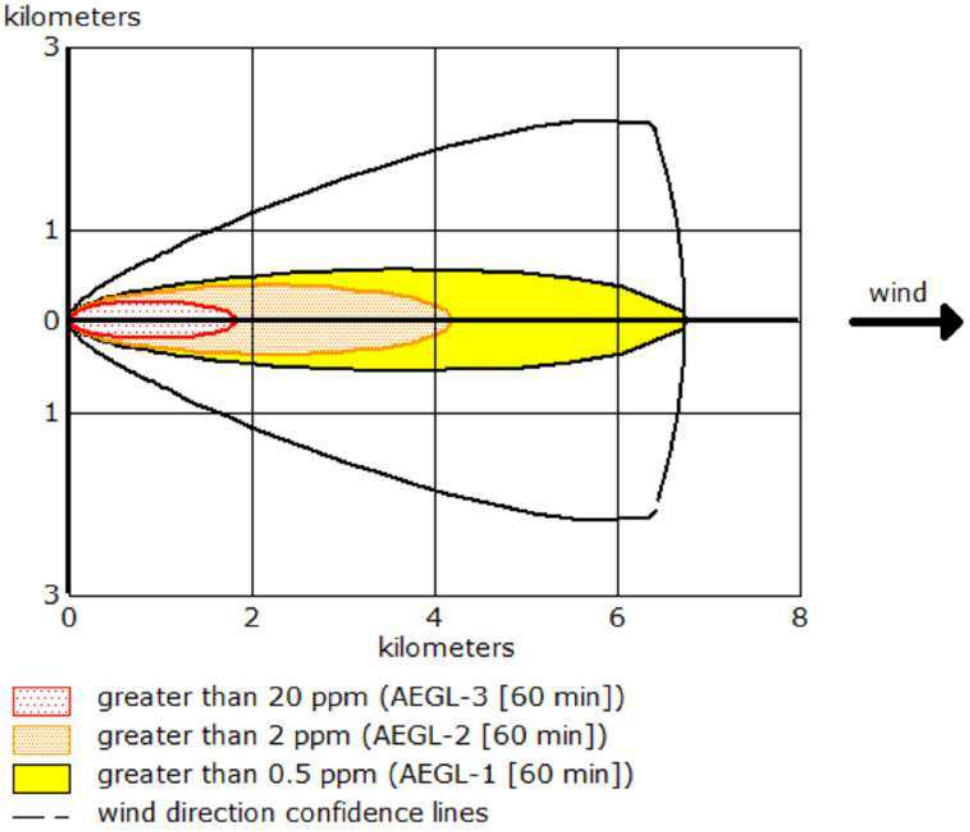
SITE DATA:
Location: DELHI, INDIA
Building Air Exchanges Per Hour: 0.77 (unsheltered single storied)
Time: November 7, 2020 1141 hours ST (using computer's clock)

CHEMICAL DATA:
Chemical Name: CHLORINE
CAS Number: 7782-50-5 Molecular Weight: 70.91 g/mol
AEGL-1 (60 min): 0.5 ppm AEGL-2 (60 min): 2 ppm AEGL-3 (60 min): 20 ppm
IDLH: 10 ppm
Ambient Boiling Point: -34.6° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 3 meters/second from nw at 3 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 40° C Stability Class: C
No Inversion Height Relative Humidity: 50%

SOURCE STRENGTH:
Leak from hole in horizontal cylindrical tank
Non-flammable chemical is escaping from tank
Tank Diameter: .76 meters Tank Length: 2.085 meters
Tank Volume: 0.95 cubic meters
Tank contains liquid Internal Temperature: 40° C
Chemical Mass in Tank: 900 kilograms
Tank is 70% full
Circular Opening Diameter: 1 inches
Opening is 0.27 meters from tank bottom
Note: RAILCAR predicts a stationary cloud or 'mist pool' will form.
Model Run: traditional ALOHA tank
Release Duration: 5 minutes
Max Average Sustained Release Rate: 551 kilograms/min
(averaged over a minute or more)
Total Amount Released: 606 kilograms
Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
Model Run: Heavy Gas
Red : 1.9 kilometres --- (20 ppm = AEGL-3 [60 min])
Orange: 4.2 kilometres --- (2 ppm = AEGL-2 [60 min])
Yellow: 6.8 kilometres --- (0.5 ppm = AEGL-1 [60 min])



Google earth is used for mapping threat zones at the site.

From scenario 2, It is clear from the graphic representation that the toxic release from the water treatment plant will affect the people up to approx. 2 km towards southeast direction as toxic release up to that zone (red) is around 20 ppm, which is much higher than Immediately Dangerous to Life or Health (IDLH) limit i.e. 10 ppm. After that severity of the chlorine gas dilutes gradually as predicted by the dispersion modal of chlorine release. The area has to be evacuated as per the plan procedure up to 2 km towards southeast direction from the water treatment plant immediately after the off-site emergency is declared; provided the wind direction is from northwest. The area is to be evacuated accordingly depending upon the wind direction.

6.0 KEY PERSONNEL & ERC

6.1 DISTRICT CRISIS GROUP (DCG)

Rule 8 of Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 mandates to constitute a "District Crisis Group" in each district. Accordingly, District Crisis Group for district West has been constituted.

The District Crisis Group shall be the apex body in the district to deal with major chemical accidents and to provide expert guidance for handling chemical accidents.
The District Crisis Group shall —

(a) assist in the preparation of the district off-site emergency plan;
(b) review all the on-site emergency plans prepared by the occupier of Major Accident Hazards installation for the preparation of the district off-site emergency plan;
(c) assist the district administration in the management of chemical accidents at a site lying within the district;
(d) continuously monitor every chemical accident;
(e) ensure continuous information flow from the district to the Central and State Crisis Groups regarding accident situation and mitigation efforts;
(f) forward a report of the chemical accident within fifteen days to the State Crisis Group;
(g) conduct at least one full-scale mock-drill of a chemical accident at a site each year and forward a report of the strength and the weakness of the plan to the State Crisis Group.

6.2 NAME AND DETAIL OF DCG MEMBERS:

S. No.	Name with designation	DCG status	Office Address	Telephone	E-mail
1.	Ms. Neha Bansal, DM (W)	**Chairperson/ COEC**	Plot No 3 Shivaji Place Raja Garden Rajouri Garden Delhi-110027	01125107118	dcwest@nic.in
2.	Mr. Dharmendra Kumar, ADM (W)	DOEC	Plot No 3 Shivaji Place Raja Garden Rajouri Garden Delhi-110027	01125107117	westadm@nic.in
3.	Mr. S. P. Rana, Dy. Director (ISH)/Dy. CIF	**Member-Secretary**	Labour Department, D Block 2nd Floor 5 Sham Nath Marg Delhi 54	9717295551	somendra.rana@gmail.com
4.	Mr. Kausik Sadhukhan, Asstt. Director (ISH)/Inspector of Factories	-do-	-do-	9910166984	kaushik.sadhu@gmail.com
5.	Dr. S.K. Singh Controller of Explosives	Member	Hall No. 505 & 507, Level -5, Block B, Old CGO Complex NH1v, Faridabad (Haryana) - 121001	8447639102	jtccefaridabad@explosives.gov.in
6.	Dr. A. Koan (DCP-Outer)	Member	Police line Pitampura, near Bhagwan Mahavir Hospital Delhi-110034	01127034874 01127034877	dcp-outer-dl@nic.in
7.	Mr. Sunil Chaudhary, Dy. CFO	Member	Fire Station (HQ), Connaught Place, New Delhi - 110001	01125158083 01123846352 9811338552	dcfondz.dlfire@nic.in
8.	Dr. Sunita Prasad Chief Medical Officer	Member	Dispensary Building A-2 Paschim Vihar	01125255021 8745011323	cdmowest@gmail.com
9.	Dr. Anwar Ali khan Sr. Environmental Engineer (DPCC)	Member	2nd Floor, C-Block Vikas Bhagwan-II, Civil Lines, Delhi-110054	8417048888	envanwar@gamail.com
10.	Ms. Sangeeta Bansal	Member	Deputy Commissioner, NDMC, Narela Zone, MCD Office, Opp. Narela Police Station, Narela	27283262 8826690501	dcnarela2013@gmail.com
11.	Mr. V.K. Sharma, Ex-CIF DISH, GNCTD	Member	D 170 Kamla Nagar, Delhi-110007	9871668253	vksd170@gmail.com
12.	Mr. R. N. Dahiya, Ex-CIF, LabourDeptt GNCTD	Member	A2/178, Prateek Apartment, Paschim Vihar, Delhi-110063	9990092712	rndahiyasafety1@gmail.com

13.	Mr. Piyush Sharma, Ex-JLC, LabourDeptt GNCTD	Member	D 37, Rajouri Garden, New Delhi 110027	9810370304	piyushsharma_del@yahoo.com
14.	Ms. Rachna Dawar, Consultant, ISC Delhi	Member	229, Raja Garden, New Delhi -110015	9811124609	rachnadawar@gmail.com
15.	Mr. Pradeep Rana /(Sh. Parshuram Bhatt) Nodal Officer (CATS)	Member	Centralized Accident and Trauma Services, Yamuna Pusta, Bela Road, Near Vijay Ghat, Delhi – 110006.	99115146479 / 8130496360	catsambulance@yahoo.com
17.	Mr. Brij Mohan Member from Civil Defence	Member	O/o DM (West) Room No 105, Plot No 3 Shivaji Place Raja Garden Rajouri Garden Delhi-110027	01125170147 8368009796	dcdowestdistrict@gmail.com
18.	Sh. Jagdish Giri Trade Union Representative	Member	CB-6, Ring Road Naraina, Delhi-110028.	9811486877	jagdishgiri102@gmail.com

The DCG members shall be provided with "Identity Card" issued by DDMA/SDM(HQ) so that they can perform their duties and functions at the time of emergency. As the accident site becomes controlled access, the DCG members can be recognized through identity card and allowed to function conveniently.

6.3 EMERGENCY RESPONSE CENTRE (ERC)

The "Emergency Response Centre" for the purpose of this plan shall be the "Emergency Control Centre" earmarked for the purpose of "District Disaster Management Plan" prepared by District Disaster Management Authority. The ERC shall be located at 3, Shivaji Place, Raja Garden, Delhi-27.

ERC shall be equipped with detailed location maps of the district. It shall also have the maps of strategic locations; viz MAH installations, fire stations, hospitals, roads, rail lines etc. The telephone numbers of Police, Fire, Medical Officer, Transport department, nearby hospitals, etc shall be depicted at a conspicuous place at the centre. MSDS of petroleum products and chlorine shall be displayed.

During any Disaster, all activities of Off-site emergency management shall be coordinated from the Emergency Response Centre.

The ERC shall :

(i) act as a focal point of emergency management.
(ii) keep records of all messages.
(iii) inform 'District Crisis Group" members and different government agencies/stakeholders on receipt of first information relating to accident.
(iv) monitor implementation of mutual aid.
(v) serve as the centre for meeting of the DCG members.
(vi) be equipped with proper communication system, data processing network and should be a storehouse of information to combat emergencies.
(vii) be a place for meeting of DCG members to discuss the onsite/offsite plans and chemical accidents.

6.4 DISTRIBUTION OF THE PLAN

This plan shall be distributed to the concerned government agencies, members of the District Crisis Group and other stakeholders. Few copies of the plan shall be made available at "Emergency Response Centre".

6.5 AMENDMENTS IN PLAN

The plan is dynamic in nature and amendment in plan shall be carried out from time to time. Any changes required to be incorporated shall be considered by the stakeholders and discussed in the meetings of District Crisis Group The amendments in plan can be made in following circumstances:

- Any inclusion/exclusion of MAH installation in the district;
- Any addition/deletion of hazardous chemical being manufactured/stored/ handled/ manipulated or used in the MAH installations that needs attention in plan.
- Any geographic/demographic or other change that needs attention in plan.

The suggested changes shall be incorporated in the manual upon approval of DCG headed by District Magistrate, who is also the chairperson of the DCG.

7. ROLES & RESPONSIBILITIES

7.1 ROLES & RESPONSIBILITIES OF THE DISTRICT MAGISTRATE/ COEC

1. The District Magistrate is overall in-charge of all emergency operations to deal with disaster arising anywhere in the district.
2. He is the chairperson of the District Crisis Group.
3. Assessment of possible major hazards in the district with special focus on major hazard industry/ installations, major railway/ road accidents, air raids and the natural calamities e.g. Earth quake, flood, lighting etc.
4. Make the assessment of facilities and equipment available with all departments, organizations and to suggest improvement for the up-gradation of facilities and equipment for dealing with an emergency.
5. Facilitate Directorate of Industrial Safety & Health, labour Department of GNCT Delhi to prepare and amend Off-site Emergency Plan, in order to mitigate the effects of disaster so as to minimize the loss of life, property & environment. Nominate his/her subordinate to take charge of ERC in case of disaster.
6. To make arrangements to establish the "Emergency Response Centre" with suitably skilled person for taking action in case of emergency and to equip it with necessary information, documents, route map, MSDS, composition and sufficient & effective means of communication.
7. Issue instructions, standing orders to all departments, organisations, MAH Installations and services to prepare and act in accordance with the Off-site Emergency plan.
8. Be familiar with the Major Accident Hazards Installations as well as possible effects on MAH installations due to natural calamities.
9. Ensure the training of all the members of Off-site Emergency Plan.
10. Ensure awareness in respect of the public emergency preparedness through News Paper, Radio, T.V. etc.
11. Hold periodical mock/training exercise to ensure optimum operational preparedness. Evaluate and review the mock drill reports.
12. Review the efficiency of the Off-site Emergency Plan.

During Emergency:

1. The responsibility and the power of declaring the off-site emergency in the district vests with the DM. In his/her absence, the responsibility and power vests with the authority appointed in lieu of the DM.On getting information of the incident, the District Magistrate will contact the Works Incident Controller or other sources of information for detailed information regarding the emergency.

2. If the emergency is not controlled within the installation/site, the emergency services shall be pressed into service as per procedure laid down in the Off-site Emergency Plan.
3. On reaching the accident site he/she will assess the gravity of the emergency.
4. He/she will ensure the arrival of all the emergency services at the site.
5. Direct and co-ordinate the activities of various agencies involved in the emergency operation like firefighting, rescue operation, evacuation of employees and general public, shifting of injured to hospitals and management of causalities.
6. Keep in constant touch with Emergency Response Centre.
7. Take latest information of the situation.
8. Direct the rescue operation.
9. Direct the local chief of State Transport Corporation (DTC/DMRC) to arrange for transport of victims and evacuation of people trapped within the hazard zone, if necessary
10. Direct the Electricity Board officials to give uninterrupted power supply.
11. Direct the official in-charge to provide uninterrupted water supply as required.
12. 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.
13. Co-ordinate with the media. Arrange for release and provide necessary funds at various stages of disaster mitigation
14. Direct railways to stop train, if required.
15. Seek help from State crisis group and Central Crisis group, adjoining districts and central government, if required.

After the emergency/ incident :

1. Calling-off the emergency.
2. Arrange for the rehabilitation of evacuated public.
3. Ensure essential amenities for the public.
4. Keep watch on any disease/ epidemic due to and after effects of the emergency.
5. Arrange for the treatment rehabilitation of effected employees and public.
6. Provide relief under Public Liability Insurance Act, 1991.
7. Constitute an investigating committee, if required, to investigate the cause of accident/ major emergency.
8. Arrange for the implementation of remedial action to prevent the recurring of emergency based on investigation.
9. Keep records of weakness/ shortfalls/ lapses and causes of failure of Off-site Emergency Plan during emergency operation and suggest measures for improvement.

7.2 ROLES & RESPONSIBILITIES OF DEPUTY DIRECTOR (INDUSTRIAL SAFETY & HEALTH), LABOUR DEPARTMENT

1. He is the Member-Secretary of the District Crisis Group
2. Conduct inspection of Major Accident Hazards (MAH) factories to ensure the adequacy of the safety and health arrangements by directing the occupiers where any deficiency is observed.
3. Examine the adequacy of emergency arrangements during the regular inspections of the MAH installations under the provisions of the Factories Act, 1948 and Rules framed there under.
4. Direct the occupier of the MAH Installations to prepare and submit their On-site Emergency Plans. Ensure that enough information is disseminated to the public staying in the vicinity of the installation.
5. Direct the Occupier of the MAH Installations for the hazard assessment of their Installations by conducting safety audit, HAZOP study, hazard analysis, etc.
6. Get sufficient information of hazard identification and control measures from each MAH Installation.
7. Arrange the meeting of District Crisis Group.
8. Preparation of District Off-site Emergency Plan in consultation with DM.
9. Ensure the conduct of periodic mock drill of the onsite emergency plan of MAH Installations by directing their occupiers.
10. To assist in conduct of mock drill of the District Offsite Emergency Plan.
11. Investigation of the incident / accident at the earliest.
12. To keep the list of MAH Installations updated.
13. Suggest remedial measures in case of incident / accident to prevent reoccurrence.
14. Direct the management in whose unit any incident / accident happens to implement adequate safety measures pointed out in the investigation of the incident/ accident.

During the incident :

1. After getting the information, quickly rush to the scene of emergency.
2. Assess the level of emergency and keep in touch with DM/district administration to brief them about the type of emergency.
3. Suggest the immediate remedial measures to control/mitigate the hazard.
4. Co-ordinate with Works Incident Controller and gather more information regarding the hazardous chemical involved in the emergency.
5. Suggest prevention and protective strategies to minimise the damage and loss to human lives.

After the incident :

1. Direct the Works Incident Controller to ensure that safe working conditions have been maintained in MAH installation before re-start of the plant.
2. Assess the site and building for its structural stability and ask the site to take remedial measures accordingly.
3. Once the situation is normal, investigate the accident site, try to find out root cause of accident and suggest improvements accordingly.
4. Direct the site to carryout safety study viz, HAZOP or safety audit, etc, if required.
5. Send a report of accident investigation to the Ministry of Environment, Forests and Climate Change, Govt of India.
6. Share the findings with the DCG members.

7.3 ROLES & RESPONSIBILITIES OF THE DY CHIEF FIRE OFFICER

1. To be aware of the location of Major Accident Hazards Installation and potentially hazardous installations as well as the level of possible emergency.
2. To be familiar with works incident controller and key personal of each Installation and their Roles.
3. To be familiar to deal with the leakage of flammable toxic substances.
4. To keep a list of adverse effects of chemicals and methods to deal with emergency involving each chemical in each unit.
5. Prepare the team to attend the emergency on each particular location.
6. Review the adequacy of existing facilities available with fire service Deptt., concerned to Major Accident Hazards Installations and suggest/ arrange to procure the additional equipment /facilities.
7. Review the adequacy of fire prevention arrangements in Major Accident Hazards Installations and suggest to make adequate fire prevention arrangements.
8. Participate in mutual aid programme/ scheme with Major Accident Hazards Installations and suggest for improvement in the existing plan.
9. Involve in On-Site Emergency Plan Mock drills.
10. Prepare the rescue plan for each Major Accident Hazards Installation in consultation with the management and review the arrangements for rescue operation suggest to procure or arrange to procure essential equipment for rescue operation.
11. Identify roads/ routs of access and escape.
12. Impart training to the firefighting staff including the employees of Major Accident Hazards Installations.

During the incident :

1. After getting the information, quickly rush to the scene of emergency.
2. Assess the level of emergency and inform district administration to take further action for evacuation.
3. Evacuate the employees inside the building/ plant.
4. Co-ordinate firefighting activities of mutual aid group and the concerned Major Accident Hazards Installation.
5. Co-ordinate the operation to stop leakage or release of flammable / toxic substance.
6. Keep in touch with Works Incident Controller of the Major Accident Hazards installation and district administration.
7. Advise the District administration for the development of additional firefighting personnel/ requirement of additional equipment etc.
8. Seek help of police/ civil defence in firefighting operation.
9. Safe guard the adjacent property/ population from fire by confining the fire spread.
10. Search for injured/ trapped/ buried persons and causalities and take them out for first aid/ medical aid.

After the incident :

1. Ensure that there is no chance of re-ignition of fire/leak /release at site before leaving the site.
2. Search for injured / casualties etc.
3. Make record of damages/ casualties / losses.
4. Make record of firefighting facilities used.
5. Record the lapses/ promptness in action during firefighting operation.
6. Check the conditions of drains/ Storm drain for the presence of harmful substances.
7. Investigate into the cause of fire in collaboration with investigating officer and suggest remedial measures for future.

7.4 ROLES & RESPONSIBILITIES OF THE ASSISTANT COMMISSIONER OF POLICE

1. To help the planning team in the preparation of Off-site emergency plan.
2. To be aware of nature, causes and consequences of emergencies.
3. To be familiar with Major Accident Hazards Installations with personal visit.
4. To set up and maintain the Emergency Response Centre.
5. To stop/ control of dwelling in the vicinity of Major Accident Hazards Installations.
6. To control the encroachment/ congestion on the roadways leading to Major Accident Hazards Installations.

7. Constitute teams to deal with emergency in different area on call and assign duties to SHO's of the area concerned.
8. Arrange for the participation in rehearsal/Mock drill.
9. Arrange for public address system and siren.
10. Explain evacuation procedure to general public.
11. Make arrangement for evacuation and dealing with Injured/ casualties.
12. Plan for traffic control for different areas.

During the incident :

1. Rush to the scene of emergency.
2. Be in regular contact of Emergency Response Centre and District Magistrate/COEC.
3. Resource mobilisation for firefighting, rescue and evacuation operation.
4. Keep in touch with Works Incident controller of affected Major Accident Hazards installations.
5. Arrange to send the injured/ affected persons to hospitals.
6. Arrange to control the traffic.
7. Arrange to cordoned off/ barricade the affected area.
8. Maintain the law and order in the area.
9. Declare and arrange for the evacuation of general public to a predetermined safe place. Communicate with general public.
10. Arrange to guard the public property in the evacuated area.
11. Search the affected area for injured/affected persons and causalities inside and outside of the Major Accident Hazards Installations.
12. Report all significant development and activities to DM/COEC.
13. Take/ preserve evidences.
14. Arrange to deal with casualties.

After the incident :

1. Arrange for the rehabilitation of evacuated person.
2. Arrange to put the traffic to normal.
3. Communicate the situation to general public.
4. Arrange to give information of Injured/ affected personals and casualties to their relatives.
5. Keep the record of injured / casualties.
6. Set up communication centre to give information to the relatives of affected persons.
7. Keep watch on law and order situation.

7.5 ROLES & RESPONSIBILITIES OF THE CONTROLLER OF EXPLOSIVES

1. Conduct inspection of Major Accident Hazards (MAH) factories to ensure the safe storage and handling of petroleum products, liquified pressurised gases and other hazardous chemicals by directing the occupiers where any deficiency is observed.
2. Examine the adequacy of emergency arrangements during the regular inspections of the MAH installations under the provisions of
   (i) The Explosives Act, 1884 (4 of 1884) and the rules made thereunder, namely: -
      a. The Gas Cylinders Rules, 1981;
      b. The Static and Mobile Pressure Vessel (Unified) Rules, 1981;
      c. The Explosive Rules, 1984
   (ii) The petroleum Act, 1934 (30 of 1934) and the Rules made thereunder, namely;
      a. The Petroleum Rules, 1976;
      b. The Calcium Carbide Rules, 1987
3. Direct the occupier of the MAH Installations to prepare and submit their On-site Emergency Plans.
4. Direct the Occupier of the MAH Installations for the hazard assessment of their Installations by conducting safety audit, HAZOP study, hazard analysis, etc. and submit Safety report.
5. Get sufficient information of hazard identification and control measures from each MAH Installation.
6. Assist in preparation of District Off-site Emergency Plan in consultation with district magistrate.
7. Ensure the conduct of periodic mock drill of the onsite emergency plan of MAH Installations by directing their occupiers.
8. To assist in conduct of mock drill of the District Off-site Emergency Plan.
9. To keep the list of MAH Installations updated.
10. Suggest remedial measures in case of incident / accident to prevent reoccurrence.

During the incident :

1. Rush to the scene of emergency.
2. Be in regular contact of Emergency Response Centre and District Magistrate/COEC.
3. Keep in touch with Works Incident Controller of affected Major Accident.
4. Take/ preserve evidences.

After the incident :

1. Carryout investigation of MAH installation.

2. Be in touch with DCG members for finding out prevention strategies
3. Report the findings to DM/DOEC and Ministry of Environment, Forests & Climate Change, GOI.

7.6 ROLES & RESPONSIBILITIES OF THE DISTT MEDICAL OFFICER

1. Keep a list of Major Accident Hazards Installations in the concerned area and hazardous chemicals being imported/ stored/handled.
2. Prepare a list of antidote for each chemical.
3. Have the estimate of affected persons in case of emergency in each Major Accident Hazards Installation.
4. Make necessary arrangements for first aid and affected people in various hospital/nursing home.
5. Keep liaison with all nursing homes and hospitals in the vicinity of MAH installation and have the information of their capabilities along with services available.
6. Send notices to all the nursing homes/hospital to be prepared for emergency specifying the services to be rendered during emergency.
7. Plan for medical services area wise i.e. select/appoint the hospitals for each Major Accident Hazards Installation.
8. Arrange/nominate the medical crew to reach at site for medical aid.
9. Arrange for ambulance/mobile medical aid for affected site.
10. Arrange to plan adequate beds for affected persons.
11. Arrange to deal with casualties.
12. Plan for additional capacity in hospitals.
13. Arrange for rehearsal and training of medical staff.
14. Arrange for the buffer stock of medicine.
15. Establishment of information centre capable of providing relevant information in an emergency on the diagnosis, treatment and rehabilitation of persons injured by hazardous chemicals/ by fire.
16. Take part in exercise with the other relevant authorities involved in Off-Site Emergency plan.

During the incident :

1. On getting information rush to the first designated hospital which is earmarked for shifting the injured for treatment.
2. Arrange for relevant emergency medicine, blood and antidote in sufficient quantity.
3. Keep in constant touch with D.M./DCP/Dy. Director (ISH) to know the scale of emergency and no. of people affected.
4. Send the medical crew and ambulances to the affected site for onsite medical aid.

5. Ensure the arrival of all medical staff to their pre-assigned locations.
6. Inform the various hospital to arrange for immediate medical aid.
7. Direct the injured/affected people to different hospital as per premedical plan.
8. Arrange for the treatment for injured and affected person.
9. Take account of the persons attended in the hospitals and admitted for treatment.
10. Deal with causalities.
11. Inform any development or change to DM.

After the incident :

1. Take account of the affected/admitted persons.
2. Arrange for the treatment of the side effects (long term)
3. Research for any kind of chronic disease/epidemics after the incident due to long term effect of hazardous chemicals.
4. Attend the injured people in hospital.
5. Report all significant development to D.M.
6. Record all developments/ treatment given during emergency.
7. Advise the people and district authorities to take particular precaution related with health, in future i.e. preventive measures and medicine.
8. Ensure the availability of essential/ lifesaving drugs in affected area.

7.7 ROLES & RESPONSIBILITIES OF WORKS INCIDENT CONTROLLER (DCG MEMBER)

1. To prepare the feasible, practicable on-site emergency plan.
2. To create awareness among the general public pertaining to the possible emergency due to industrial activity.
3. To conduct the risk assessment in the concern unit.
4. To assist the local administration in establishing the good harmonious relation with general public and other emergency response agencies and provide awareness how to act in case of off-site emergency.
5. To create an Emergency Control Room in the MAH Installation.
6. To encourage the most dedicated & other employees in control of the emergency.
7. To monitor & ensure that all available facilities for emergency are in good working condition.
8. Up to date the on-site emergency plan/ emergency preparedness.
9. Prepare to respond or remove confusion to the general public.
10. Proper road & means of escape route should be earmarked.
11. According to risk assessment ensure the adequate quantity of water for firefighting.
12. To provide the training to the all concern.

During the incident:

1. To mobilise all the emergency resources into action as per plan i.e. control the fire or stop the toxic release if possible.
2. Works Incident Controller of MAH Installation shall immediately inform DM, when he/she foresee the likelihood of an off-site emergency situation.
3. Assess the gravity of emergency and declare emergency.
4. Receive outside aid at the control room.
5. Help the local administration for safe evacuation.
6. Explain the level of emergency to the local administration with facts.
7. Co-ordinate with other rescuers & combating operation team.
8. Provide the technical guidance to the various operation team & local administration.
9. Shut down the plant to confine the emergency.
10. Report the accident to DISH/Police and DM/DOEC in writing.

After the incident:

1. Clean the spot site as soon as possible and dispose of the harmful substances in safe manner.
2. Check critical areas of plant and evaluate the extent of damage.
3. Establish links with general public/ leaders and local administration.
4. Keep watch on the situation for any other new development and inform to local administration.
5. Help the rehabilitation & salvage team for quick aid.
6. Ensure safe working conditions in the plant before start-up.
7. Find out the root cause of accident through internal investigation.
8. Get the site/building checked by recognised structural engineer for its stability.
9. Implement the remedial measures suggested by DISH/DCG members.

7.8 ROLES & RESPONSIBILITIES OF MCD/NDMC (DCG MEMBER)

1. To be familiar with MAH Installations possible emergency situation their consequences etc.
2. Plan to provide the building/ guesthouses at different locations to establish control room. First aid, Medical centre or shelter at the time of emergency.
3. Review the equipment, vehicle, crane manpower etc. for rescue, demolition or salvage purposes in relation to the possible level of emergency.
4. Prepare a rescue demolition / salvage team to be rushed to the scene of emergency on call.

5. Be familiar with the routes of emergency scene and escape routes.
6. Procure the equipment's essential for dealing with emergency.
7. Insure the training of team in emergency operation.

During the incident :

1. Emergency team will rush to the scene of emergency immediately on call.
2. Help in rescue and firefighting by providing the suitable equipment like dumper dozer, crane earthmover etc.
3. Help in taking out the people trapped in the building, plant by removal of debris and other obstruction.
4. Help in taking out the dead bodies from debris.
5. Help to prevent the flow of flammable/ toxic materials into the common drain.
6. Help to drain out the pool of water / excessive water from the site.
7. Help in any construction / demolition activity required for dealing with emergency.

After emergency :

1. Help in removal of debris from the site.
2. To repair the damaged services like water, sewer line and road etc.
3. To clean all the sewer and a surrounding to protect the general public from disease.
4. To repair the damaged road.
5. Help in normalizing the general life.
6. Arrange for the corps and disposal service.

7.9 ROLES & RESPONSIBILITIES OF COMMANDANT CIVIL DEFENCE

1. To be familiar with major hazard units, chemicals used and other information regarding the emergency.
2. Arrange for shelter at different locations for general public with the help of MCD/NDMC and other departments in respect of probability of population to be affected.
3. Plan for food and water supplies in shelter camp with the help of NGO's and Govt.Deptt.
4. Create public awareness for emergency procedures i.e. preventive measure and evacuation procedures during emergency.
5. Plan for medical aid with the help of CMO.
6. Co-ordinate the activities of all NGO's and social organisation.

During the incident :

1. Help in evacuation operations.
2. Help the police in maintaining law and order and piece.
3. Help in controlling the traffic.
4. Involve in first aid / medical aid team.
5. Help in dealing with causalities and injured people.
6. Help in providing shelter, food, water and other essential amenities for general public.

After emergency :

1. Help in the rehabilitation of the general public in planned manner.
2. Help in providing the supplies of essential immunities in perfect condition.
3. Help in relief operation.

7.10 ROLES & RESPONSIBILITIES OF DPCC REPRESENTATIVE (DCG MEMBER)

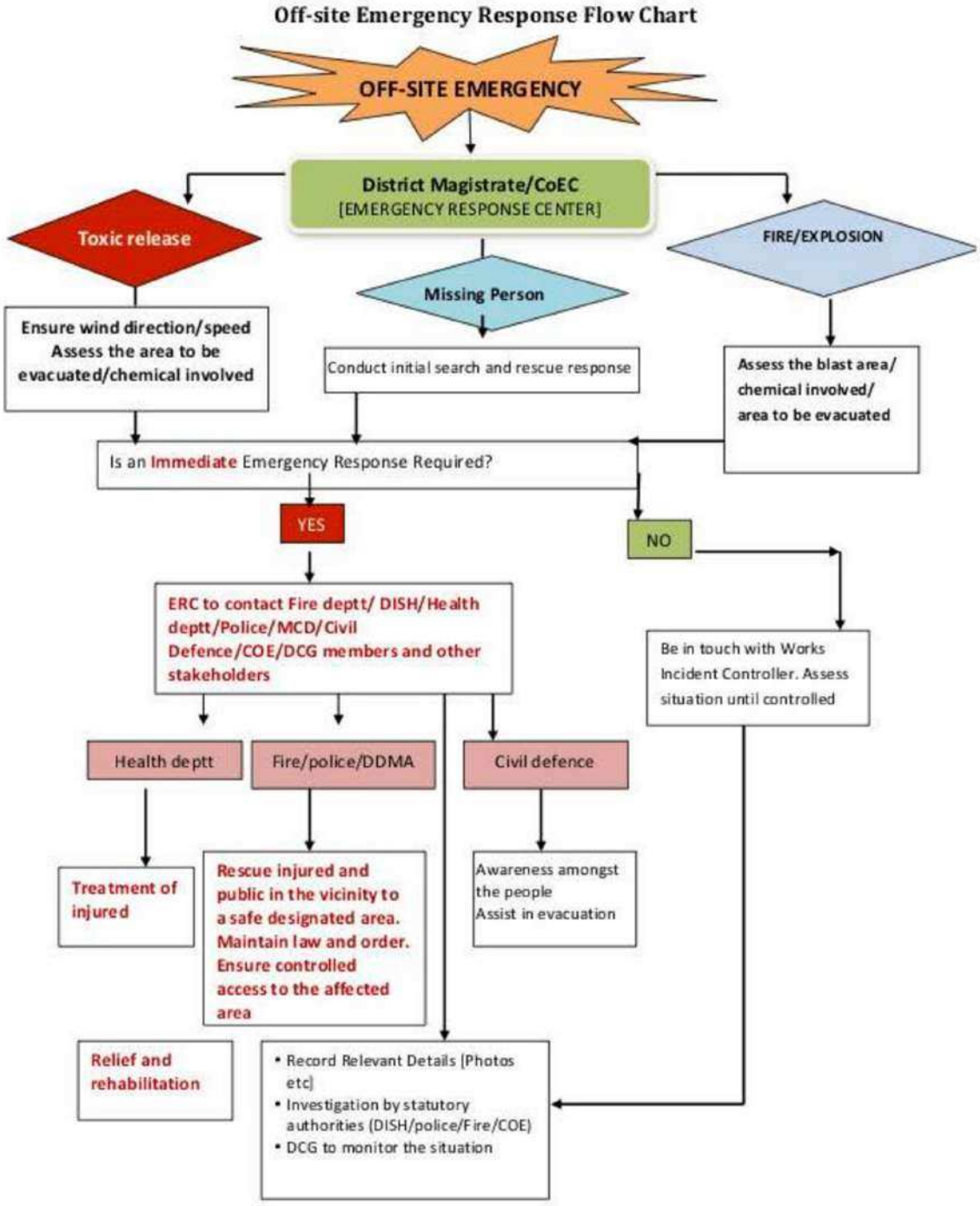
1. In the case of any contamination to the environment, to arrange, with the help of the industry and other agencies, decontamination of the area. Further to declare the area fit for re-entry after the decontamination is completed. Identify unidentified substances, chemical releases, if any.
2. Carry out pollution assessment at suspected location including soil, river, and air assessment.
3. Ensure the controlling of long term pollution damage
4. In case of an environmental disaster, the pollution control committee shall, based on the contaminant released into the environment, carry out, with the help of the Installation and other agencies, such investigations as may be necessary to establish the degree of contamination.
5. Arrange for suitable decontamination procedure using resources available in the area as well as with the committee.
6. Submit the report to the DM and a copy to Dy. Director (ISH), Labour Department.

7.11 OTHER AGENCIES - ROLES AND RESPONSIBILITIES DURING EMERGENCY:

Railways:
To stop railway traffic as directed by COEC.
Aviation Department:
Make available resources if required to combat emergency
Mobilize resources such as helicopters for knocking down Vapour clouds etc.

NGO bodies:
Aid and assist the responding agencies
Civil Supplies (Food and Water Supply) Department to Evacuees:
Arrangement of food, clothing etc. for evacuees
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.
Agriculture Department:
Arrange for protection of food grains and standing crops in the vulnerable zone.
Give instructions, to farmers, if any.
Mutual Aid Groups:
To quickly mobilize the resources required to emergency mitigation at the site or wherever required
Safety Experts:
Promptly respond to provide the necessary technical advice to MAH Installation, DM, Factory Inspectors, Fire Department, and Medical Department among others.
Provide on-phone help after properly understanding and assessing the situation.
Make visit to the site in co-ordination with DM, Factory Inspector(s) to provide appropriate technical assistance.
Telecommunication Department:
Ensure working of communication lines to enable effective communication between various responder agencies
Media (Television, Radio, Newspaper):
Disseminate vital information to public on direction of DOEC, Police and other Authorities. Act responsibly in disseminating vital information and dispel rumours, if any.
Other Members of DCG, if any: Assist and act as per directions of the District Magistrate.

7.12 EMERGENCY RESPONSE FLOW CHART



8.0 ACTIVATION OF THE PLAN

Facing OSH's complex problems requires a multidisciplinary approach and, therefore, the collaboration of different disciplines and specialists is a must. However, this collaboration has not been easy since the conceptual frameworks and the particular disciplinary approaches were different. The development of a common understanding of the basis, concepts, fundamentals and purposes of each OSH discipline for all OSH practitioners emerged as an important need to make this multidisciplinary approach effective.

It is not possible for a company to face a disaster single handed and calls for use of all available resources in the surrounding areas. It is impossible to predict the time when an accident occurs in an installation. It occurs unexpectedly, calling for emergencies/disasters.

An advance meticulous planning minimizes chaos and confusion which normally occur in such a situation and reduces the response time of disaster management organization. A well laid out procedure with proper chain of command, training, mock drills, arrangements for proper equipment and safety appliances, mutual aid with neighbouring industries and liaison with district collectorate, police, hospitals, Fire services etc help to take timely and appropriate action so that loss of property/human lives and damage to environment is minimum.

The District Magistrate, West will be the Chief Off-site Emergency Controller (COEC) for operating the Off-site Emergency Plan. Additional District Magistrate will be the Deputy Off-site Emergency Controller (DOEC). The COEC will be the overall in-charge of all off-site emergency activities in the district. The DM office, West shall function as "Emergency Response Centre".

Works Incident controller of the plant, where the incident takes place, shall perform the duties of Works Incident Controller and as a member of DCG for the purpose of this Off-site Emergency Plan. In case of any eventuality, the incident can be handled by the installation concerned in accordance with the "On-site plan". In the event of the emergency escalating into a major accident extending beyond the premises, the off-site emergency plan will come into effect. In such scenario, he/she will report to Chief Off-site Emergency Controller (COEC). He/ she will provide full details, nature and magnitude of the emergency and the area likely to be affected, etc. to COEC.

The plan comes into operation as soon as any stakeholder or person comes to know about the disaster that is beyond the control of any major hazard installation or factory involving such hazardous chemical that warrants invoking off-site emergency plan.

8.1 Notification of incident:

Incident notification has to be brief and precise. It has to take into account the fact that several of the variables may not be fully intimated at the time of notification. In case of the MAH Installation, Works Incident Controller or the person authorised by him shall immediately inform DM/COEC, Dy. Director (ISH) and the local police/fire stations when he/she foresees the likelihood of an off-site emergency situation. The following information is considered essential for notification:

- Name and designation of person notifying the emergency.
- Type of disaster/emergency; i.e. fire/explosion or toxic release.
- Place of occurrence and chemicals involved in accident.
- Likely magnitude of accident (release quantity).
- Prevailing wind direction and speed (if available)
- Any other important information (impact, toxicity etc.)
- Extent of damage, as a distance.

Since incidents could also be notified by anyone in the public (in the case of transport or other emergencies), the notification requirements must be simple. The notification should, further, enable the "Emergency Response Centre" to take action based on the minimal parameters notified.

8.2 Intimation of emergency:

Once the incident has been notified to the COEC/Dy. Director (ISH)/police/fire, the CoEC shall assess and declare emergency and invoke the Off-site Emergency Plan. ERC shall communicate and take necessary action as follows :

- The Emergency Response Centre shall initiate co-ordination process at the district level and inform other members of DCG who have been assigned roles and responsibilities during emergency/incident.
- ERC on its own shall be in touch with local police station, fire service and other stakeholders.
- Guide the DCG members regarding nature of emergency and the chemicals involved.

- Provide all such information and logistics as required to control the situation.
- Other support agencies should either be informed to keep themselves ready for action or for initiating the action.
- Neighbouring communities should be informed of an emergency situation in the area. Advise neighbouring communities to take preventive action based on the advice of the experts. Some of the common advises can be :
    - Keep calm and follow instruction.
    - Keep windows closed and remain inside the house.
    - Keep wet cloth or handkerchief over your nose and.
    - Evacuate area and proceed cross wind.

8.3 Communication Network System:

An efficient and reliable communication system is required for the success of the off-site emergency plan. The efficient communication system is required to alert :
(a) Off-site Emergency Authorities and services.
(b) Neighbouring public in the vulnerable zone.

A communication network of the following type may be helpful :
(i) Radio communication between Emergency Response Centre to Local control centres (Police Stations).
(ii) Data Processing Network/online access to the documents, etc. hooked to all Computers / PCs.

A Communication flow chart is to be prepared and kept in the Emergency Response Centre. An up-do-date telephone directory/list of key personnel/DCG members should be available at all times in ERC. In coordinating the communication system efficiently, there should be a Communication Officer in Emergency Response Centre to ensure that all the modes of communication are functional round the clock. All communication operators should maintain a log-book for the message received in/ out and actions taken. These activities should be incorporated in the data processing system.

8.4 Public Information System:

During a crisis following an accident, the people of the area and large number of media representatives would like to know about the situation from time to time and the response of the district authority to the crisis. It is important to give timely information to the public in order to prevent panic and rumour mongering. The emergency public information could be carried out in following phases:

During the Crisis:
Dissemination of information about the nature of the incidents, actions taken and instructions to the public about preventive and protective measures to be taken, evacuation, etc. are the important steps during this phase.

After the Crisis:
Attention should be focussed on information concerning restoration of essential services, road/rail travel etc.
The following steps should be taken to inform the general public:
(a) Quick dissemination of emergency instructions to the public.
(b) To receive all calls from media/ public regarding emergency situations and respond meticulously.
(c) Obtain current information from the Emergency Response Centre.
(d) Prepare news release.
(e) Brief visitors/ media.
(f) Maintain contact with hospital and get information about the causalities.

8.5 Evacuation plan:

In a disaster situation, evacuation is the movement of people from the place of danger to places of relative safety. It is most effective action to protect people. A comprehensive and coordinated planning is necessary to implement orderly evacuation of population.

The process of evacuation should be based on the nature of threat, possibility of spreading of toxic gases and weather conditions. In this case, the hazard analysis in maximum credible loss scenario would help in planning of evacuation. The people of the area should be advised to leave the threatened area and to take shelter in the nearest reception centres. The whole process is required to be completed within quickest possible time. The command and control of the evacuation should be under the supervision of the DM.

An early decision will be required in many cases on the advice to be given to people living "within range" of the accident - in particular whether they should be evacuated or told to go indoors. In the latter case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors :

(a) In the case of a major fire but without explosion risk (e.g. an oil storage tank), only house close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed accordingly.

(b) If a fire is escalating and in turn threatening a storage of hazardous chemical, it might be necessary to evacuate people nearby, but only if there is time. If there is insufficient time, people should be advised to stay indoors and shield themselves from the fire. This case particularly applies if the installation at risk could produce a fireball with very severe thermal radiation effects (e.g. LPG storage).

(c) For release or potential releases of toxic materials, limited evacuation may be appropriate downwind, if there is time. The decision would depend partly on the type of housing "at risk". Conventional housing of solid construction with windows closed offers substantial protection from the effects of a toxic cloud, while shanty houses which can exist close to factories, offer little or no protection.

(d) During the Crisis implementation of the plan should be done in the quickest possible time.

(e) Once the crisis is over, the affected people should be rehabilitated accordingly. The CoEC shall declare the termination of emergency.

8.6 Welfare Service:

In the event of major accident large number of people may be rendered homeless, without food or without adequate clothing. Grave social problem resulting from death, injury, loss of home and family disorganisation would be handled by the welfare service headed by the DM/ADM West assisted by the various departments.
The function of this service are:

(i) Information :
Supply of information regarding missing relatives, dead, etc nature of facilities and assistance available for affected.

(ii) Care of homeless :
Provisions of centres where homeless people may be given temporary shelter, food and clothing.

8.7 Post Emergency Management:

(a) Post emergency management of an incident requires a proper assessment of the after effect of accident. It is expected that DM, representative of the Directorate of ISH & Pollution Control Committee, Safety experts and other relevant agencies must reach the incident site. These persons together have to decide on post emergency actions regarding:

i. Review of mitigation measures being carried out and corresponding augmentation of all response related activities.
ii. Rescue related efforts.

iii. Restoration of normalcy in the area.
iv. Organising medical attention for the affected persons either locally or at other locations based on the nature of treatment required.
v. Victim identification, helping the kith and kins in formalities, financial relief, arranging funerals etc.
vi. Shelter for affected, if required.
vii. Decision to decontaminate the area and prepare the area for re-entry of evacuees.
viii. Order investigation of incident including assessment of damage to life, property and the environment.
ix. Make suitable release to the media/press conveying information on the accident. This should, normally, be authorised by the District Magistrate/COEC.

(b) Post emergency activities include the relief to the victims. The Public Liability Insurance Act -1991 provides for the owners who has control over handling hazardous substances to pay specified amount of money to the victims as interim relief by taking insurance policy for this purpose. The district collector has definite role in implementation of PLI 1991 as mentioned in hereunder.

i. Whenever it comes to the notice of the collector that an accident has occurred at any place within his jurisdiction, he shall take action, among other things, to provide relief to the victims.
ii. He will receive applications in the prescribed forms accompanied by supporting documents.
iii. He may follow summary procedure for conducting an enquiry on the application for relief.
iv. Concerned SDM /Revenue department officers shall maintain a register of the applications as also a register of awards and payment made.
v. The DM shall be responsible for disbursement of the funds to the victims. He may, for this purpose, draw upon the insurance companies or emergency relief fund as the case maybe. For this, he would liaise with the MAH Installations, insurance companies and the DPCC.
vi. He should ensure that the Occupiers of the MAH Installations covered under PLI Act1991 shall take Insurance policy before handling any hazardous substance and get renewed from time to time before the expiry of the period of validity.

9.0 RESOURCE MOBILIZATION & FIREFIGHTING

Oil industries in Tikri Kalan, Delhi (West) & adjoining Bahadurgarh, Haryana covering IOCL, HPCL, have formed a Mutual Aid Group named as "Mutual Aid Response Group" to help each other in case of exigency/emergency that may arise due to operational necessity of installations. Declaration between the industry members has also been signed to help each other in case of emergency/need.

9.1.1 RESOURCE MOBILIZATION IN HPCL & IOCL

Sr. No.	Total Requirement	Available with HPCL Terminal	Available with HPCL Pipeline	Available with IOCL Terminal
1	**Manpower**			
1.1	Regular employees (general shift)	15	4	37
1.2	Security staff (General shift)	1	0	5
1.3	Security staff (I shift)	6	0	9
1.4	Security staff (II shift)	6	0	9
1.5	Security staff (III shift)	6	0	9
1.6	Others (Technicians / helpers) - General shift	6	3	20
1.7	Others (Technicians / helpers) - I shift	2	3	6
1.8	Others (Technicians / helpers) - II shift	2	3	6
1.9	Others (Technicians / helpers) - III shift	1	2	6
2	**Fire Fighting Appliances / equipment / chemicals**			
2.1	Fire Tenders	0	1	0
2.2	Firefighting engines	5	0	5
2.3	Water storage capacity	11000 kl	0	8600
2.4	Fire Hoses & boxes	80	30	1
2.5	Jet Nozzles	40	15	47
2.6	Fog Nozzles	5	1	2
2.7	Spray Nozzles	2	1	2
2.8	Foam Branch	10	2	4
2.9	Jumbo Jet Nozzles	1	1	4

2. 10	Foam Compound (KL)	13	2	20
3	**Safety equipment**			
3.1	PVC Suit	4	2	1
3.2	Compressed air Breathing Apparatus Set	4	2	4
3.3	Refill Cylinders for Breathing Apparatus Set	2	1	2
3.4	Cascade Breathing Apparatus Set	0	0	0
3.5	Fire Proximity Suit	4	2	4
4	**Communication**			
4.1	Walkie-Talkie	28	8	38
4.2	Public Address System	4	1	2
4.3	Megaphone	4	2	4
5	**Transport**			
5.1	Jeeps	1	1	1
5.2	Cars	0	0	0
5.3	Ambulance	1	0	0
5.4	Trucks	0	0	0
5.5	Buses	0	0	0
5.6	Tractors	0	0	0
5.7	Boats	0	0	0
5.8	Mobile Cranes	0	0	0
6	**Miscellaneous**			
6.1	Ropes (Meters)	30	30	0
6.2	Empty drums	40	0	60
6.3	Buckets	40	5	60
6.4	Sand bags	30	0	48
6.5	Dewatering pump	1	1	1
6.6	Pneumatic pump	0	0	0
6.7	Photo Camera	1	1	2
6.8	Video Camera	1	1	1
6.9	Search lights	4	4	6
7	**equipment for Corps Disposal**			
7.1	Light Metal Stretchers	4	2	2
7.2	Tarpaulin 12' X 12"	2	1	2
7.3	Rope fibre 3/8"	2	1	2
7.4	Bucket	40	5	60

7.5	Rubber gloves	8	4	12
8	**List of Emergency Drugs and Appliances**			
8.1	Canvas Stretcher	4	2	2
8.2	Oxygen Cylinder	1	0	2
8.3	Sterlite Bandages	1	0	1
8.4	Cotton Sterilized	23	5	28
8.5	Antibiotics	Avl.	Avl.	Avl.
8.6	Analgesics	Avl.	Avl.	Avl.
8.7	Sedatives	Avl.	Avl.	Avl.
8.8	Tetanus Toxoid	Avl.	Avl.	Avl.
8.9	Dressing Instruments	Avl.	Avl.	Avl.
8. 10	Sterilizers	Avl.	Avl.	Avl.
8.11	Autoclave for sterilizing Instruments	Avl.	Avl.	Avl.
8.12	dressing	Avl.	Avl.	Avl.
8.13	B.P. Apparatus	Avl.	Not Avl	Avl
8.14	Suction Apparatus	Avl.	Not Avl	Avl
8.15	I.V. Set	Not Avl.	Not Avl	Not Avl
8.16	Antishock drugs	Not Avl	Not Avl	Not Avl
8.17	Gluco Saline Set	Avl	Not Avl	Not Avl
8.18	Gluco Saline Bottle	Avl	Not Avl	Not Avl

9.1.2 FIRE FIGHTING FACILITIES UNDER MUTUAL AID SCHEME

PORTABLE & FIXED FIRE FIGHTING FACILITY

Sr. No.	**Item**	**IOCL Terminal**	**IOCL (P/L)**	**IOCL, Bottling Plant**	**HPCL TKR Terminal**
1.	Water Storage	8600 KL	-	15000KL	**11000KL**
2.	Double Hydrant	46	10	82	26
3.	Water Monitor	48	4	75	23
4	Source of water	5 Borewell	-	5 Borewell	2 Borewell
5.	Electric Siren	1	-	1	2
6.	HVLR	5	2	-	5
7.	Fire Hoses	80	22	214	60

8.	75 Kg DCP F.E.	7	1	12	7
9.	25 Kg DCP F.E.	18	-	-	10
10.	10 Kg DCP F.E.	130	20	230	110
11.	4.5 Kg CO2 F.E.	23	4	10	10
12.	500 GPM Foam Trolley	-	-	-	3
13.	210 Lt Foam Trolley	1	1	-	3
14.	Foam Branch Pipe	4	4	-	5
15.	Portable Foam Generator	2	-	-	2
16.	Jet Nozzle	25	10		10
17.	Universal Nozzle	2	4	5	5
18.	Fog Nozzle	2	4	-	5
19.	Water Curtain Nozzle	2	-	5	5
20.	Explosive Meter	2	1	2	2
21.	Stretcher	2	1	2	2
22.	Fire Trolley	1	-	1	1
23.	DCP in Kg.	650	100	1500	1000
24.	Hand Siren	7	1	20	10
25.	Fire Proximity Suit	2	1	1	2
26.	First Aid Box	5	1	5	4
27.	Resuscitator	2	-	3	3
28.	Anti-Snake Serum	1	1	-	1
29.	SCBA with spare cylinder	2	2	2	5
30.	Water Jell Blanket	1	1	-	2
31.	Safety Helmet	40	15	50	50
32.	Sand Bucket	8	10	71	8
34.	Oil Spill Dispersant	1	-	-	1
35.	Low Temperature Suit	-	-	1	2
36	AFFF in Litter	20 KL	1.2KL	-	14 KL
37	ATC Foam (for Ethanol)	1000 L	-	-	1 KL
38	Trailer Mounted HVLR	1	-	-	-
39	PVC Suit	1	2	-	1
40	Petroleum Product Clean up chemical	1	-	-	-
41	Non Sparking Tools	1	1	1	1
42	Mechanical Tool Kit	1	1	1	1
43	Emergency Kit Trolley	1	1	1	1

9.1.3 DETAILS OF FIRE STATIONS NEAR INSTALLATIONS

S.No	Name of Fire Stations	Official Address	Contact No.	Resource Inventories	Manpower	Division
1	JWALA HARI	fire station	011-25277201	2 fire tenders	total staff-26 with in charge	13 personal at one time on duty
2	PASCHIM VIHAR	fire station	011-25262095	3 fire tenders	total staff- 31 with in charge	15 personnel at a time on duty
3	UDOG NAGAR	fire station	011-25962986	2 fire tenders	total staff-26 with in charge	13 personnel at a time on duty
4	JAWALA PURI	FIRE STATION	011-25522000	3 FIRE TANDER	TOTAL STAFF 27 WITH INCHARGE	13 PERSONEL AT ATIME FOR DUTY
5	TIKRI KALAN	FIRE STATION	011-26255303	2 FIRE TANDER	TOTAL STAFF-30 WITH INCHARGE	14 PERSONEL AT A TIME ON DUTY

9.1.4 HOSPITALS NEAR HPCL TIKRI KALAN

DETAILS OF HOSPITALS (PRIVATE & GOVT.) WITHIN 5 KMs RADIUS OF HPCL, TIKRI KALAN							
S. No.	NAME OF HOSPITAL/ HEALTH CENTRE	ORG.	NODAL OFFICER	TELEPHONE NOS	NO. OF BEDS FOR DISASTER	AMBULANCE	BLOOD BANK/ STORAGE
PRIVATE FACILITIES							
1	C. D. Global Hospital,	PVT.	Dr. Veethika	9711012741	5	YES	NO

	Mundka		Dagar				
2	Neeru Maternity center. Mundka	PVT.	Dr. NISHEET Aggarwal	9810778516	2	YES	NO
GOVT. HOSPOTALS (Single Govt. facility, more than 5 K.M)							
1.	Sanjay Gandhi Hospital	GOVT.	Dr. R.S. Nayyar	9968679704			
DETAILS OF HOSPITALS (PRIVATE & GOVT.) BEYOND 5 KMs TO 10 KM RADIUS OF HPCL, TIKRI KALAN							
S. NO.	**NAME OF HOSPITAL/ HEALTH CENTRE**	**ORG.**	**NODAL OFFICER**	**TELEPHONE NOS**	**NO. OF BEDS FOR DISASTER**	**AMBULANCE**	**BLOOD BANK/ STORAGE**
1	Altives Sonia Hospital, Gulshan Park, Nangloi	PVT.	Dr. Mahinder Mittal	9555560455	5	YES	YES
2	K.K. Hosp. Pvt. Ltd., Inder Enclave	PVT.	Dr. A.K. Singh	9654451104 011-25257540	0	YES	NO
3	Ardent Ganpati, Rajdhani Park, Nangloi	PVT.	Mr. Raj Kumar	7532941559	3	YES	NO
GOVT. HOSPOTALS (NEAREST, BUT MORE THAN 10 K.M.)							
1.	Sanjay Gandhi Hospital	GOVT.	Dr. R.S. Nayyar	9968679704			

9.2.1 RESOURCE MOBILIZATION IN KAMRUDDIN NAGAR WTP

Sr. No.	Total Requirement	Available with WTP	Remarks		
1	**Manpower**				
1.1	Regular employees (general shift)	09			
1.2	Regular employees (shift)	04			
1.3	Security staff (General shift)	1			
1.4	Security staff (1st shift)	6			
1.5	Security staff (II shift)	6			
1.6	Others (Technicians / helpers) - General shift	28			
1.7	Others (Technicians / helpers) - I shift	12			
1.8	Others (Technicians / helpers) - II shift	12			
1.9	Others (Technicians / helpers) - III shift	12			
2	**Fire Fighting Appliances / equipment / chemicals**				
2.1	Fire Tenders	0			
2. 10	Fire Extinguisher	64			
3	**Safety equipment**				
3.1	PVC Suit	6			
3.2	Compressed air Breathing Apparatus Set	1			
3.3	Refill Cylinders for Breathing Apparatus Set	2			
3.4	Cascade Breathing Apparatus Set	0			
3.5	Fire Proximity Suit	0			
4	**Communication**				
4.1	Walkie-Talkie	0			
4.2	Public Address System	1			
4.3	Megaphone	1			
5	**Transport**				
5.1	Jeeps	0			
5.2	Cars	1			
5.3	Ambulance	1			
5.4	Trucks	0			

5.5	Buses	0			
5.6	Tractors	1			
5.7	Boats	0			
5.8	Mobile Cranes	0			
6	**Miscellaneous**				
6.1	Ropes (Meters)	50			
6.2	Empty drums	0			
6.3	Buckets	01			
6.4	Sand bags	0			
6.5	Dewatering pump	4			
6.6	Pneumatic pump	0			
6.7	Photo Camera	0			
6.8	Video Camera	0			
6.9	Search lights	10			
7	**equipment for Corps Disposal**				
7.1	Light Metal Stretchers	4			
7.2	Tarpaulin 12' X 12"	2			
7.3	Rope fibre 3/8"	0			
7.4	Bucket	01			
7.5	Rubber gloves	4			
8	**List of Emergency Drugs and Appliances**				
8.1	Canvas Stretcher	4			
8.2	Oxygen Cylinder	1			
8.3	Sterlite Bandages	1			
8.4	Cotton Sterilized	15			
8.5	Antibiotics	Avl.			
8.6	Analgesics	Avl.			
8.7	Sedatives	Avl.			
8.8	Tetanus Toxoid	Avl.			
8.9	Dressing Instruments	Avl.			
8.10	Sterilizers	Avl.			
8.11	Autoclave for sterilizing Instruments	Avl.			
8.12	dressing	Avl.			
8.13	B.P. Apparatus	Avl.			
8.15	I.V. Set	Avl.			
8.16	Antishock drugs	Avl			

9.2.2 PERSONAL PROTECTIVE EQUIPMENT AVAILABLE AT WTP:

A number of personal protective equipment are available in the plant that can be used by the rescue and emergency control persons in case of any chlorine gas release. The availability of respiratory and non-respiratory protection devices is present in the following table:

Name of the protective device	**Location where it is normally kept**	**Quantity available**	**Remarks**
Self-Contained Breathing Apparatus (SCBA)	Post Chlorination Area	4	
Respirators	Stores	2	
Safety belts	Filter House	4	
Safety Helmets	Distributed to employees	>40	
Safety Shoes	Distributed to employees	>20	
Ladders	Filter house	2	

9.2.3 HOSPITALS NEAR WTP, KAMRUDDIN NAGAR

DETAILS OF HOSPITALS (PRIVATE & GOVT.) WITHIN 5 KMs TO 10 KM RADIUS OF KAMRUDDIN NAGAR PLANT							
S.NO.	**NAME OF HOSPITAL/ HEALTH CENTRE**	**ORG.**	**NODAL OFFICER**	**TELEPHONE NOS**	**NO. OF BEDS FOR DISASTER**	**AMBULANCE**	**BLOOD BANK/ STORAGE**
PRIVATE FACILITIES							
1	Jeewan Moti Khera Hospital, Near Krishan	PVT.	Dr. Anu Khera	9871096875 9315040456 25945771	4	YES	NO

	Mandir, Nangloi						
2	Satyabhama Hospital (p)Ltd., Near water Tank, Nangloi	PVT.	Dr. Manisha Sharma	8506008075/9311116607 011-25949727	5	YES	NO
3	Altives Sonia Hospital, Gulshan Park, Nangloi	PVT.	Dr. Mahinder Mittal	9555560455	5	YES	YES
4	K.K. Hosp. Pvt. Ltd., Inder Enclave	PVT.	Dr. A.K. Singh	9654451104 , 011-25257540	0	YES	NO
5	Pushpanjali Hospital, Inder Enclave	PVT.	Dr. Rakesh	9990491968 25284400/25271100	3	YES	NO
6	Mansa Ram Hospital Pvt. Ltd., Adhyapak Nagar, Nangloi	PVT.	Mr. Ravinder Singh	9811761676	5	YES	NO
7	Rathi Hospital, Ranhola	PVT.	Dr. Ankur Rathi	9711991234, 9811045292	10	YES	YES
GOVT. HOSPITALS							

(Single Govt. facility, more than 5 K.M.							
1.	Sanjay Gandhi Hospital, Mangolpuri	GOVT.	Dr. R.S. Nayyar	9968679704 011-2792117			
DETAILS OF HOSPITALS (PRIVATE & GOVT.) BEYOND 5 KMs TO 10 KM RADIUS OF KAMRUDDIN NAGAR PLANT							
S.NO.	**NAME OF HOSPITAL/ HEALTH CENTRE**	**ORG.**	**NODAL OFFICER**	**TELEPHONE NOS**	**NO. OF BEDS FOR DISASTER**	**AMBULANCE**	**BLOOD BANK/ STORAGE**
1	Sh. Balaji action medical institute, A-4, Paschim Vihar	PVT.	Dr Reeta Varshney	9910098105 011-42888700, Ext. 2055	20	YES	YES
2	Sehgal Neo Hospital, Meera Bagh	PVT.	Dr. Alok Mishra	9868162512, 011-45565656	10	YES	NO
3	Goyal Hospital, LIC Colony, Paschim Vihar	PVT.	Dr. Manoj Kumar Goyal	9540055741 041101414	4	YES	NO

4	Maharaja Agrasen Hospital, Punjabi Bagh	PVT.	Dr. Bharathi Saxena, Jt. Medical Supdt.	9958691532	25	YES	YES
5	MGS Hospital, Punjabi Bagh	PVT.	Dr Rajiv Khanna	9958235333, 011-45111444	10	YES	YES
6	Park Hospital, Keshopur	PVT.	Dr. Rekha Gupta	011-45323232, 750314144 Ext-212	4	YES	YES
	GOVT. HOSPITALS						
1	GGS Hospital, Raghubir Nagar	GOVT.	Dr. Vandana Bagga	9718383942 011-25986409-14	9	YES	YES
2	Sanjay Gandhi Hospital, Mangolpuri	GOVT.	Dr. R.S. Nayyar	9968679704			

10.0 ASSESSMENT AND TESTING OF PLAN:

The mock drill of the Off-site Emergency Plan shall be conducted once in a year to know about the development need of the plan and its effectiveness.

The broad classification of drill objectives are as under :

- Assessment of Size of emergency situations,
- Capability.
- Skills of individuals,
- Response methodology,
- Response time,
- Adequacy of infrastructure and resources,
- Identification of gaps in planning and resources,
- Search for alternatives wherever applicable.

Mock drills are very much essential for following reasons :

- To perfect the response vis-a-vis the plan document.
- To build confidence amongst the responders
- To assess the appropriateness of the equipment,
- To assess the level of preparedness.
- To gain an experience akin to one, gained from real situation.

The suggested method provide a step by step approach for testing the plan, devoid of such limitations. This approach suggesting a sequence of exercises and drills, helps in improving the response related capabilities. It is also useful in identification of resources and personnel requirement, and thus, finetuning the plan.

To satisfy these requirements, the exercises or drills will have to be planned in a particular sequence. The sequence has to be chosen in such a fashion that it builds capability, first at individual level, follows by organisation or team responding to the task contemplated. Ata later stage, it will gradually percolate to all persons, agencies, wings or teams. Once such a capability is evident, it will gradually expand the scope and size of drill and ultimately lead to various types of drills. Due to adaptability and flexibility built in these types of exercise, minor variation in sequencing might not affect the objectives.

A careful study of a plan will reveal various components of emergency planning. These would be prevention and protective strategies, communication, firefighting, control of

hazard, minimising the damage, coordination among govt. agencies, cordon of, evacuation, shelter, food, rehabilitation, etc.

11.0 IMPORTANT CONTACT NUMBERS

11.1 CONTACT DETAILS OF DCG MEMBERS

S. No.	Details of Authority	DCG status	Telephone
1.	**Ms. Neha Bansal, DM (W)**	**Chairperson/ COEC**	**01125107118**
2.	Mr. Dharmendra Kumar, ADM (W)	DOEC	01125107117
3.	**Mr. S. P. Rana, Dy. Director (ISH)/Dy. Chief Inspector of Factories**	**Member-Secretary**	**9717295551**
4.	Mr. Kausik Sadhukhan, Asstt. Director (ISH)	-do-	9910166984
5.	Dr. S.K. Singh Controller of Explosives	Member	8447639102
6.	Dr. A. Koan (DCP-Outer)	Member	01127034874 01127034877
7.	Mr. Sunil Chaudhary, Dy. CFO	Member	01125158083 01123846352 9811338552
8.	Dr. Sunita Prasad Medical Officer	Member	01125255021 8745011323
9.	Dr. Anwar Ali khan Sr. Environmental Engineer (DPCC)	Member	8417048888
10.	Ms. Sangeeta Bansal, Dy. Commissioner (NDMC)	Member	27283262 8826690501
11.	Mr. V.K. Sharma, Ex-CIF DISH, GNCTD	Member	9871668253
12.	Mr. R. N. Dahiya, Ex-CIF, LabourDeptt GNCTD	Member	9990092712
13.	Mr. Piyush Sharma, Ex- JLC, LabourDeptt GNCTD	Member	9810370304
14.	Ms. Rachna Dawar, Consultant, ISC Delhi	Member	9811124609
15.	Mr. Pradeep Rana /(Sh. Parshuram Bhatt) Nodal Officer (CATS)	Member	99115146479/ 8130496360
17.	Mr. Brij Mohan Member from Civil Defence	Member	01125170147 8368009796
18.	Sh. Jagdish Giri Trade Union Representative	Member	9811486877

11.1 Contact details of nearby factories/installations at Tikri Kalan:

INDIAN OIL CORPORATION LIMITED, Tikri Kalan Terminal				
Sr. No.	Name of Contact Person / Designation	Telephone (Office)	Mobile	Email ID
1.	Sh. B.K Jha ,DGM, I/C	011-28353520(201)	9582807501	bkjha@indianoil.in
2.	Sh. A.K Poddar, DGM (T)	01128353520(205)	9999170258	poddararun@indianoil.in
3.	Sh. K.S. Sindhu, Mgr.(T)	011-28353520(211)	9899597000	kuldeepsindhu@indianoil.in
4.	Sh. Anchal Sood, AM (Ops.) Safety)	011-28353520(217)	8826890272	sooda@indianoil.in
INDIAN OIL CORPORATION LIMITED, LPG Bottling Plant				
1.	Ashutosh Tiwari, GM(Plant)	011-28353554(201)	9167007034	ashutoshtiwari@indianoil.in
2.	Tulsi Ram Khatri, Ch. Manager(Plant)	011-28353554(202)	9974163122	tulsikhatri@indianoil.in
3.	Sanjay Sharma, CM(Plant)	011-28353554(204)	9811283570	sanjaysharma@indianoil.in
4.	Sudhir Nanda, Mgr.(LPG Safety)	011-28353554(205)	9883230464	nandasudhir@indianoil.in
5.	Deeksha Rai, Ops. Officer	011-28353554(205)	9871496053	raid1@indianoil.in
INDIAN OIL CORPORATION LIMITED, Pipeline Division				
1.	Anurag Danayak, DGM	011-65000743(204)	9891427914	anuragd@indianoil.in
2.	Sh. AJIT KUMAR, SOM	011-65000742(205)	9560933001	ajitkumar@indianoil.in
3.	Sh. SANDEEP KUMAR SHAH, O&ME	011-65000742(205)	9891307409	skshah@indianoil.in
4.	Sh. SUBODH SHARMA, O&ME	011-65000742(205)	9466348821	Sharmas6@indianoil.in
HINDUSTAN PETROLEUM CORPORATION LIMITED, Tikri Kalan Terminal				
Sr. No.	Name of Contact Person / Designation	Telephone (Office)	Mobile	
1.	Sh. Dilbagh Rai Washal	011-28353125	8860071122	dilbaghrai@hpcl.in
2.	Sh. Pankaj Garg	011-69333384	9915716689	pankajgarg@hpcl.in

11.2 Contact details of external agencies near Water Treatment Plant

Sr. no.	Name	Designation	Telephone
1.	Nearest Police Station	**SHO, Nangloi**	8750871135
2.	Nearest Fire Station , Jwalapuri	**Station Officer**	011-25286717, 9250746171
3.	District Fire Station, Moti Nagar	**Station Officer**	011-25101151
4.	Emergency Vehicle/Ambulance	**Plant**	108 8800595235
5.	Nearest Hospital Sonia	**Enquiry**	9891616982
6.	Govt. Hospital Sanjay Gandhi Memorial Hospital	**Enquiry**	011-27921117
7.	Sri Balaji Action Medical Institute	**Paschim Vihar**	011-42888888
8.	Disaster Management Team	**SDM, Punjabi Bagh**	011-27397814

11.3 Contact details of nearby hospitals at Nangloi:

S.No.	Name of Hospital	Contact Number
1	Sonia Hospital Nangloi	8750060177
2	Satyabhama Hospital Pvt Ltd	1125949727
3	J M Khera Hospital	7290096211
4	Konark Hospital	1125941497
5	Krishna Surgical and Maternity	9810673855
6	Santosh Hospital	9654588949
7	Rao Ranghubir Hospital	8130945500
8	Sanklp Hospital	1125945570
9	Bhardwaj Satyabhama Hospital	1125185399
10	Dgd Nangloi Dispensary	1125474141

11.4 Contact nos. of external agencies:

Sr. No.	Particulars	Name	Address	Phone no.
1	Fire Station	Fire Station, Tikri Kalan	Tikri Kalan	101 / 09968313915
2	Police Station	Police Station, Mundka	Hiran Kudna, Mundka	100 / 2853 – 2010/6571 / 5032
5	Municipality office	Municipal corporation of Delhi	Civic Centre, Minto Road, Delhi -02	011-23911708
6	Dy. Commissioner of police		Rajouri Garden	(011) 25224162
8	State electricity board (BSES)	Sub Divisional officer	Tikri Kalan	9350130461
9	Hospitals	Jeevan Jyoti Hospital (6-7 beds for burn patients)	Bahadurgarh	(01276) 267070
		MGS, Hospital(2-3 beds for burn patients)	Punjabi Bagh	(011) 25226100
		Maharaja Agrasen Hospital (Total 380 Beds, burn injuries are treated)	Punjabi Bagh	(011) 25226645
		Max Healthcare (Total 98 beds, burn injuries are treated)	Pitampura	011-47351844
		Shakuntala Hospital (Total 50 beds, Burn injuries are treated)	Sakarpura	011-66585550
		Orchid Hospital & Heart Centre (Total 50 beds, Burn Injuries are treated)	Janakpuri	011-45654565
12	Spill response and/or Clean-up Services	Dulevo India	Sector-5, Noida	0120-4273051/52/53

13	Helicopter and Air transport Services	Y-Link Journey	Y-Link Journey Pvt. Ltd. Connaught place, New-Delhi	011-66228641
14	Surface Transport Services	O-Travels	O-Travels, Pahar Ganj, Delhi	011-66218478
15	Safety and Monitoring equipment suppliers	Reliable Systems	Pitam-Pura, Delhi	9810009129
16	Directorate of Industrial Safety & Health	Dy. Director (ISH)/DY. CIF office	5,Sham Nath Marg Delhi -54	011-23973756/ 23973965
17	Delhi Pollution Control Committee	DPCC	4th Floor, ISBT Building, Kashmere Gate, Delhi- 06	9717593527
18	Petroleum and Explosive Safety Organization (PESO),	Chief Controller of Explosives Joint Chief Controller of Explosives, North Circle	A-Block, CGO Complex, Fifth floor, Seminar Hills, Nagpur Hall No 502 & 507,Level-5,BLOCK-II, OLD CGO Complex, Faridabad-121001	0712-2510248 0129-2410730-34
19	Environmental Laboratories	Shriram Institute for Ind Research	19, university Road-Delhi-7	011-27667267
20	Firefighting chemical suppliers	Foam tech anti fire company	57, Sharda Niketan, Pitampura, Delhi	011-27016897
21	Public and private Consultant associated with emergency handling	International SOS Services(I) Pvt. Ltd.	Suite no. 605-606, sixth floor, copia corporate suites, plot no. 9, Jasola distt. centre New-Delhi	011-41898802

12.0 Material Safety Data Sheet (MSDS)

12.1 Motor Spirit/Gasoline

MSDS for MS

1. CHEMICAL IDENTITY

Chemical Name : *Motor Spirit* Chemical classification : *Fuel*
Synonyms : *Gasoline* Trade Name : *Petrol*

Formula :*A Complex Mixture of hydrocarbons* C.A.S. No. *8006-61-9* U.N.No. : *1203*

Regulated Identification Codes / Label : *33/Class 3, Flammable Liquid* Shipping Name :*Gasoline* Hazchem No. : *3 Y E* Hazardous Waste I.D No. : *5*

HAZARDOUS INGREDIENTS	C.A.S. No.
Motor Spirit	*8006-61-9*

2. PHYSICAL AND CHEMICAL DATA

Boiling Range :*30°C to 215°C* Physical state : *Liquid @ 15°C & 1 atm* Appearance: *Orange (Octane 87) Red (Octane 93)*

Vapour pressure: *@ 35°C* Odour : *Aromatic Odour*
Freezing point: *- 40°C* *: 6 to 10psi @ 38°C* Others : *Easily soluble in Alcohol, Ether, Chloroform & Benzene*
Vapour Density: *3.0 to 4.0 (Air = 1)* Solubility in water @ 30°C : *Insoluble in water Floats on water*
Specific Gravity: *0.733 gm/l @ 15.6°C* pH (Water = 1) : *Not pertinent*

3. FIRE AND EXPLOSION HAZARD DATA

Flammability : *Yes* **LEL** :*1.4 %* Flash Point : *- 30°C min* (CC)
TDG Flammability :*3* **UEL** : *7.6 %* Flash Point : *Data not available* (OC)

Auto ignition Temperature : *390°C*
Explosion sensitivity to impact : *Stable*
Explosion sensitivity to static Electricity : *May explode*
Hazardous Combustion Products : CO / CO_2 / SO_2 / NO_X
Hazardous Polymerization : *Does not occur*

Combustible Liquid :*Yes* Explosive Material : *No* Corrosive Material : *No*
Flammable Material :*Yes* Oxidiser : *No* Others : *No*
Pyrophoric Material :*No* Organic Peroxide : *No*

4. REACTIVITY DATA

Chemical Stability : *Chemically Stable*
Incompatibility with other material : *Incompatible with strong oxidisers.*
Reactivity : *Does not react with common materials but may react with oxidising agents.*
Hazardous Reaction products : *Data not available*

5. HEALTH HAZARD DATA

Routes of entry : *Inhalation / Ingestion / Dermal absorption / Eye*

Effects of Exposure / Symptoms : *Inhalation : Inhalation in very high concentration of vapour causes loss of consciousness, coma and sudden death. In less severe cases causes headache, nausea and mental confusion and depression may occur*
: Ingestion : Ingestion causes irritation of gastro intestinal tract with vomiting colic and diarrhoea
: Skin : Prolonged skin contact will dry an defat skin with dermatitis
: Eye : Contact with eye causes pain and slight transient corneal epithelial disturb axes

Emergency Treatment : *If drenched with product remove soaked clothing immediately. Flush affected area with plenty of water and then was with soap and water. If inhaled, remove the victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, call physician. If swallowed, do not induce vomiting. If eye is affected, flush with plenty of water until irritation subsides. Keep patient warm and lying down. Give hot drinks like milky tea or coffee. Call physician or transport victim to hospital, if necessary. If ingested, liquid paraffin, olive oil or any other vegetable oil is to be given orally to retard absorption of gasoline. Gastric lavage and the induction of vomiting are not advisable because of possibility of aspiration of gasoline. Gastric lavage and the induction of vomiting are not advisable because of possibility of aspiration of gasoline and the subsequent development of chemical pneumonia.*

TLV (ACGIH)	: *300 ppm 900 mg/m³*	STEL	: *500 ppm1500 mg/m³*
PEL	: *300 ppm 900 mg/m³*	Odour Threshold	: *0.25 ppm300 mg/m³*
LD_{50}	: *Not Listed*	LD_{50}	: *Not Listed*

NFPA Hazard Signals	Health :*1*	Flammability : 4	Reactivity : *0*	Special : *Nil*

6. PREVENTIVE MEASURES

Personnel Protective Equipment : *Hand gloves / Gas mask / PVC suit.*

Handling & Storage Precautions :

Avoid contact with liquid or Vapours	*Use flameproof electrical equipment only*
Stay upwind while gauging / Sampling / handling	*Earth all equipment and pipelines properly.*
Do not wash / clean hands with the product	*Store in an enclosed vessel in a cool, well ventilated area*
Do not suck the product	*from heat & flame*
Gas free the tank before entering / cleaning	*No smoking or open flames*
Change oil soaked clothing promptly	*Provide adequate ventilation at work site*

7. EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	: *Foam / DCP / CO_2.*
	Special Procedures	: *Keep the containers cool by spraying water if exposed to fire.*
	Unusual Hazards	: *Flashback may occur along vapour trail.*

EXPOSURE	First Aid Measures: *A/a*	Antidotes / Dosages : *Not available*

SPILLS	Steps to be Taken	: *Eliminate all sources of ignition.* *Ventilate the area.* *Stop leaks if no risk involved* *Collect leaking product into closed container.* *Contain / absorb spillage in sand / earth bund.* *Use water spray to disperse / dilute the vapours, if necessary* *Prevent run-off from entering into sewers.*
	Waste Disposal Method	: *Collect all the waste in vapour tight plastic bags for eventual disposal.*

8. **ADDITIONAL INFORMATION / REFERENCES**

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9. **MANUFACTURERS / SUPPLIERS DATA** : ***HINDUSTAN PETROLEUM CORPORATION LIMITED***
10. **DISCLAIMER**

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12.2 High Speed Diesel

MSDS for HSD

CHEMICAL IDENTITY

Chemical Name : High Speed Diesel — Chemical classification : *Fuel*
Synonyms : Gas Oil — Trade Name : *Diesel Oil*

Formula :*A Complex Mixture of hydrocarbons* C.A.S. No. U.N.No. :*1202*

Regulated Identification Codes / Label : *30/Class 3, Flammable Liquid* Shipping Name :*Diesel oil* Hazardous Waste I.D No. : *5* Hazchem No. : *3 Z*

HAZARDOUS INGREDIENTS **C.A.S. No.**

2. **PHYSICAL AND CHEMICAL DATA**

Boiling Range :*110 to 400°C* Physical state : *Liquid @ 15°C & 1 atm* Appearance: *yellow to oily brown*
Vapour pressure: *< 0.1 psi @ 38°C* Odour : *Characteristic*
Freezing point: 0 - 18°C Others: *Insoluble and floats in water*
Vapour Density: *3.0 to 5.0 (Air = 1)*
Specific Gravity: *0.840 gm/ml @ 15°C* pH: *Not pertinent*

3. **FIRE AND EXPLOSION HAZARD DATA**

Flammability : *Yes* **LEL** :*0.5 %* Flash Point : *> 32°C min* (CC)
TDG Flammability :*3* **UEL** : *5.0 %* Flash Point : *> 35°C min* (OC)

Auto ignition Temperature : *230 - 300°C*
Explosion sensitivity to impact : *Stable*
Explosion sensitivity to static Electricity : *Stable*
Hazardous Combustion Products : *Acrid smoke and irritating fumes* of CO / CO_2 / NO_X
Hazardous Polymerization : *Does not occur*

Combustible Liquid :*Yes* Explosive Material : *No* Corrosive Material : *No*
Flammable Material :*Yes* Oxidiser : *No* Others : *No*
Pyrophoric Material :*No* Organic Peroxide : *No*

4. **REACTIVITY DATA**

Chemical Stability : *Chemically Stable*
Incompatibility with other material : *Incompatible with strong oxidisers.*
Reactivity : *Does not react with common materials but may react with oxidising agents.*
Hazardous Reaction products : *Data not available*

5. **HEALTH HAZARD DATA**

Routes of entry : *Inhalation / Ingestion / Skin / Eye*

Effects of Exposure / Symptoms : *Inhalation : Dizziness, headache and bluish tint to the skin.*
: *Ingestion : Nausea and vomiting. Irritation of mouth and gastro intestinal tract may follow, rapidly developing potentially fatal chemical*

Skin : *Irritation, will remove fat from the skin. Prolonged or repeated contact should be avoided, otherwise skin chapping, cracking or possible contact dermatitis may occur. Dry skin, erythema, oil acne, and oil folliculitis & watery growth may occur which may become skin cancer subsequently on repeated exposure.*

Eye : *eye irritation*

Emergency Treatment :*If inhaled, Remove victim to fresh air, give artificial respiration if required, remove contaminated clothing quickly, do not induce vomiting if ingested, keep victim warm and quiet. Wash all the affected skin thoroughly with soap and water. Irrigate affected eyes with copious amount of water. Administration of Olive oil or any other vegetable oil may reduce adsorption thru digestive tract. Gastric lavage should be done only after endotracheal intubation in view of respiration which may cause serious chemical pneumonitis for which antibiotic and corticosteroid therapy may be indicated.*

TLV (ACGIH)	: *Not listed*	STEL	: *Not listed*
PEL	: *Not listed*	Odour Threshold	: *Not listed*
LD_{50}	: *0.5 to 5 gm/Kg*	*Limit* LD_{50}	: *Not listed*

NFPA Hazard signal	Health :*1*	Flammability : 3	Reactivity : *0*	Special : *Nil*

6. PREVENTIVE MEASURES

Personnel Protective Equipment : *Avoid contact with liquid or vapour.*
Use gum boots, gloves while handling the product.

Handling & Storage Precautions : *Store in dry, cool, ventilated area away from heat and flame.*
Keep away from oxidising agents

7. EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	: *Foam / DCP / CO_2.*
	Special Procedures	: *Keep the containers cool by spraying water if exposed to fire.*
	Unusual Hazards	: *Flashback may occur along vapour trail.*

EXPOSURE	First Aid Measures: *A/a*	Antidotes / Dosages : *Not available*

SPILLS	Steps to be Taken	: *Shut off leaks without risk.* *Contain leaking liquid on sand or earth* *Prevent liquid from entering into sewers.*
	Waste Disposal Method	: *Seal all the waste in vapour tight plastic bags for eventual disposal.*

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA : *HINDUSTAN PETROLEUM CORPORATION LIMITED*

10. DISCLAIMER

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12.3 Hexane

MATERIAL SAFETY DATA SHEET

1. CHEMICAL IDENTITY

Chemical Name : *Hexane*

Chemical classification : *Solvent*

Synonyms : *Petroleum Distillate* Trade Name : *Food Grade Hexane*

Formula: C_6H_{14} C.A.S. No. *110-54-3* U.N.No. : *1208*

Regulated Identification Shipping Name : *Hexane* Hazchem No. : *3 Y E*

Codes / Label : *33/Class 3, Flammable Liquid* Hazardous Waste I.D No. : *5*

HAZARDOUS INGREDIENTS	C.A.S. No.
Hexane	*110-54-3*

2. PHYSICAL AND CHEMICAL DATA

Boiling Range : *63 to 70°C* Physical state : *Liquid @ 15°C & 1 atm* Appearance: *Colorless liquid*

Vapour pressure : *140 mm Hg @ 20°C* Odour : *Fiant, typical*

Freezing point: *-95°C* Others: *Soluble in Alcohol, acetone and ether, Insoluble in water*

Vapour Density: *2.5 to 4.8 (Air = 1)*

Specific Gravity: *0.670 (typ) @ 15.56°C* pH: *Neutral*

3. FIRE AND EXPLOSION HAZARD DATA

Flammability : *Yes* LEL : *1.1 %* Flash Point : *- 23°C*

TDG Flammability : *3* UEL : *5.9 %* Flash Point : *Data not Available*

Auto ignition Temperature : *230 - 300°C*

Explosion sensitivity to impact : *Stable*

Explosion sensitivity to static Electricity : *May explode*

Hazardous Combustion Products : *Acrid smoke and irritating fumes*

Hazardous Polymerization : *Does not occur*

Combustible Liquid : *Yes* Explosive Material : *No* Corrosive Material : *No*

Flammable Material : *Yes* Oxidiser : *No* Others : *No*

Pyropheric Material : *No* Organic Peroxide : *No*

4. REACTIVITY DATA

Chemical Stability : *Chemically Stable*

Incompatibility with other material : *Incompatible with strong oxidisers.*

Reactivity : *Does not react with common materials but may react with oxidising agents.*

Hazardous Reaction products : *Data not available*

5. HEALTH HAZARD DATA

Routes of entry: *Inhalation / Ingestion / Skin / Eye*

Effects of Exposure / Symptoms : *Inhalation : Can cause unconsciousness which may go to coma. Stentorious breathing and bluish tint to the skin.*

: *Ingestion : In mild form, intoxication resembles drunkenness. Sometimes headache, lack of appetite, dizziness, sleepiness, indigestion, nausea, chemical pneumonotis, results if aspirated during ingestion or while vomiting. Can* cause systemic effects after repeated exposure.

Skin : *Causes irritation to the skin, prolonged or repeated contact results in dry scaly skin and development of dermatitis.*

Eye : *eye irritation*

Emergency Treatment : *Remove victim to fresh air, give artificial respiration if required, remove contaminated clothing quickly, do not induce vomiting if ingested, keep victim warm and quiet. Olive oil or any other vegetable oil should be given orally to retard absorption of Hexane.*

TLV (ACGIH)	: *50 ppm*	STEL	: *Not listed*
PEL	: *Not listed*	Odour Threshold	: *Not listed*
LD_{50}	: *Not listed*		

NFPA Hazard signal	Health : *1*	Flammability : *4*	Reactivity : *0*	Special : *Nil*

6. PREVENTIVE MEASURES

Personnel Protective Equipment : *Avoid contact with liquid or vapour. Use gum boots, gloves while handling the product.*

Handling & Storage Precautions : *Store in dry, cool, ventilated area away from heat and flame. Keep away from oxidising agents*

7. EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	: *Foam / DCP / CO_2.*
	Special Procedures	: *Keep the containers cool by spraying water if exposed to fire.*
	Unusual Hazards	: *Flashback may occur along Vapour trail.*

EXPOSURE First Aid Measures : *A/a* Antidotes / Dosages : *Not available*

SPILLS	Steps to be Taken	: *Shut off leaks without risk. Contain leaking liquid on sand or earth Prevent liquid from entering into sewers.*
	Waste Disposal Method	: *Seal all the waste in Vapour tight plastic bags for eventual disposal.*

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA : *HINDUSTAN PETROLEUM CORPORATION LIMITED*

10. DISCLAIMER

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12.4 Mineral Solvent

MATERIAL SAFETY DATA SHEET

1. CHEMICAL IDENTITY

Chemical Name : Mineral Solvent — Chemical classification : *Solvent*
Synonyms : *Light Petroleum Distillate* — Trade Name : *Solvent 1425*

Formula : *A Complex Mixture of hydrocarbons* — C.A.S. No. — U.N.No. : *1268*

Regulated Identification — Shipping Name : Solvent 1425 — Hazchem No. : *3 Y E*
Codes / Label : *33/Class 3, Flammable Liquid* — Hazardous Waste I.D No. : *5*

HAZARDOUS INGREDIENTS	C.A.S. No.
Solvent 1425	N A

2. PHYSICAL AND CHEMICAL DATA

Boiling Range : *50 to 120°C* — Physical state : *Liquid @ 15°C & 1 atm* — Appearance: *Colorless liquid*
Vapour pressure: *140 mm Hg @ 20°C* — Odour : *Faint, typical*
Freezing point: *Data not available* — Others: *Soluble in Alcohol, acetone and ether, Insoluble in water*
Vapour Density: *2.5 to 4.8 (Air = 1)*
Specific Gravity: *0.69 to 0.78 gm/ml @ 15.6°C* — pH: *Neutral*

3. FIRE AND EXPLOSION HAZARD DATA

Flammability : *Yes* — LEL : *1.1 %* — Flash Point : *- 23°C* (typ)
TDG Flammability : *3* — UEL : *5.9 %* — Flash Point : *Data not Available*

Auto ignition Temperature : *230 - 300°C*
Explosion sensitivity to impact : *Stable*
Explosion sensitivity to static Electricity : *May explode*
Hazardous Combustion Products : *Acrid smoke and irritating fumes*
Hazardous Polymerization : *Does not occur*

Combustible Liquid : *Yes* — Explosive Material : *No* — Corrosive Material : *No*
Flammable Material : *Yes* — Oxidizer : *No* — Others : *No*
Pyrophoric Material : *No* — Organic Peroxide : *No*

4. REACTIVITY DATA

Chemical Stability : *Chemically Stable*
Incompatibility with other material : *Incompatible with strong oxidizers.*
Reactivity : *Does not react with common materials but may react with oxidizing agents.*
Hazardous Reaction products : *Data not available*

5. HEALTH HAZARD DATA

Routes of entry: *Inhalation / Ingestion / Skin / Eye*
Effects of Exposure / Symptoms : *Inhalation : Can cause unconsciousness which may go to coma. Stertorous breathing and bluish tint to the skin.*
: *Ingestion : In mild form, intoxication resembles drunkenness. Sometimes headache, lack of appetite, dizziness, sleepiness, indigestion, nausea, chemical pneumonitis, results if aspirated during ingestion or while vomiting. Can* cause systemic effects after repeated exposure.
Skin : *Causes irritation to the skin, prolonged or repeated contact results in dry scaly skin and development of dermatitis.*

Eye : *eye irritation*

Emergency Treatment : *Remove victim to fresh air, give artificial respiration if required, remove contaminated clothing quickly, do not induce vomiting if ingested, keep victim warm and quiet. Olive oil or any other vegetable oil should be given orally to retard absorption of Hexane.*

TLV (ACGIH)	: *Not listed*	STEL	: *Not listed*
PEL	: *Not listed*	Odor Threshold	: *Not listed*
LD_{50}	: *Not listed*		

NFPA Hazard signal Health : *1* Flammability : *4* Reactivity : *0* Special : *Nil*

6. PREVENTIVE MEASURES

Personnel Protective Equipment : *Avoid contact with liquid or Vapour.*
Use gum boots, gloves while handling the product.

Handling & Storage Precautions : *Store in dry, cool, ventilated area away from heat and flame.*
Keep away from oxidizing agents

7. EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	: *Foam / DCP / CO_2.*
	Special Procedures	: *Keep the containers cool by spraying water if exposed to fire.*
	Unusual Hazards	: *Flashback may occur along Vapour trail.*

EXPOSURE First Aid Measures : *A/a* Antidotes / Dosages : *Not available*

SPILLS	Steps to be Taken	: *Shut off leaks without risk.* *Contain leaking liquid on sand or earth* *Prevent liquid from entering into sewers.*
	Waste Disposal Method	: *Seal all the waste in Vapour tight plastic bags for eventual disposal.*

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA : *HINDUSTAN PETROLEUM CORPORATION LIMITED*

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12.5 Kerosene

NAME OF PRODUCT / CHEMICAL : Kerosene

IDENTITY OF MATERIAL:					
Product Name:	Kerosene, Stove oil, Jet fuel, Illuminating oil, Range oil, Fuel oil no. 1, Coal oil	**UN No.**	1223	**Label / Class**	**Red Flammable Liquid/ 3.3 Group II**
Trade Name	Kerosene	**CAS No.**			
Formula	Complex mixture of Hydrocarbons	**HAZCHEM Code**	3Y		
PHYSICAL AND CHEMICAL PROPERTIES					
Physical State	Liquid	**Boiling Point / Range, deg.C**	145-300	**Vapor Pressure at 20deg.D, mm Hg.**	5
Appearance	Colourless	**Melting / Freezing Point, deg.C**	43 to -49		
Odor	Gasoline like	**Vapor Destiny (Air = 1)**	4.1	**Evaporation Rate at 30 deg.C**	
Solubility in Water	0.0002 to 0.0004	**Specific Gravity, 20 deg.C**	0.80 to 0.85		
Calorific Value (Kcal / Kg.)	4.35E + 07	**Dyn. Viscosity (PA.S 30deg. C)**		Heat of Vaporization, Kcal /Kg.	2.72E + 05
		Molecular Weight		**Sp. Heat liq. J/KG**	2.09E + 03
FIRE AND EXPLOSIVE DATA					
Explosivity	Moderate	Auto Ignition Temp.deg.C		Flash Point, C, CC/OC	
Flammability	Moderate	Explosive Limits, %		Burning Rate	

Extinguishing Media	Foam, CO2, DCP. Water may be ineffective and cause fire to spread. May be used to cool fire exposed containers.
Special Procedures	If a leak or spill has not ignited use water spray to disperse vapours and to protect men attempting to stop leak. Water spray may be used to flush spills away from exposures.
Unusual Hazards	

REACTIVE HAZARDS

Stability	Stable	**Conditions to Avoid**	Keep away from hear and open flame.
Hazardous Poly		**Conditions to Avoid**	
Incompatibility	Oxidising agents.		
Hazardous Combustion / Decomposition Products		Toxic gases / vapours (CO).	

HEALTH HAZARD DATA

Entry Route	Skin absorption				
TLV, PPM, mg. / cu.m.	500 ppm	**STEL, PPM, mg. / cu.m.**	500ppm / 1500mg/ mg^3	**Odor Threshold, PPM.**	1
PEL, PPM, mg. / cu.m.		**LD 50oral, Rat g. / kg.**	20g / kg	**LD50, Rabbit g/kg**	2.8
Sign / Symptoms of Exposure		**Delayed Toxicity**		**LD50, Rabbit g/kg**	0.2 (oral)
Inhalation	Dizziness, headache and nausea, CNS depressant / anaesthetics effect. Continued inhalation produces visual and auditory, hallucinations, delirium and mania. Also symptoms of fatigue, somnolence, staggering gait, loss of memory.				
Ingestion	Spontaneous vomiting, low to moderate oral toxicity. Irritation of mouth throat & gastro intestinal tract, nausea, weakness, dizziness, slow and shallow respiration, convulsions, unconsciousness.				
Contact	Skin-irritation, prolonged contact can result in drying of skin, dermatitis and eye irritation.				

Emergency Treatment (Immediate Medical Attention Required)	
Inhalation	Remove victim to fresh air, give artificial respiration if breathing has stopped, oxygen if breathing is lobored.
Ingestion	Give conscious victim water to drink. Do not induce vomiting. Liquid paraffin, olive oil or some vegetable oil is to be given rally to retard absorption of gasoline. Gastric lavage and induction of vomiting are not advisable.
Contact	Remove contaminated clothing and wash affected part (skin / eyes) with plenty of water.

HAZARD SPECIFICATION						
NFPA Rating	**Health**	0	**Flammability**	2	**Material factor**	16
		0	**Special**			
KNOWN HAZARDS						
Combustible Liquid		**Flammable Material**		Flammable liquid	**Pyrophoric material**	
Explosive Material		**Unstable Material**			**Water reactive material**	
Oxidizer		**Organic Peroxide**			**Corrosive material**	
Compressed Gas		**Irritant**			**Sensitizer**	
Carcinogen		**Mutagen**			**Other**	
SAFE USAGE DATA						**PRECAUTIONS**
Ventilation	Adequate ventilation					
Protective Equipment	**Eyes**	Goggles / face Shields		**Handling and Storage**	Kerosene should be stored in well ventilate, properly labelled and approved containers. Sniffing, siphoning and use a solvent and cleaning agent should be	
	Respiratory	Self-contained berating apparatus for containment / clean-up operations.				

	Gloves	Rubber		avoided. Do not transfer to un-label, unsuitable or incorrectly labelled containers. All containers should be kept out of reach of children and kept fully closed when not in use. Cleaning and inspection / maintenance of storage tanks should be done according to proper procedures and precautions (work permit system, gas feeding of tanks, using lifeline and wearing air supplied breathing apparatus.)
	Clothing	Rubber	**Others**	
	Others			

EMERGENCY RESPONSE DATA	
Release / Spill	
Waste Disposal	

ADDITIONAL INFORMATION

Gastric lavage should be done after endotracheal intubation, in view of risk aspiration which can cause chemical pneumonitis for which antibiotic and corticosteroid therapy may be indicated.

Manufacturer / Supplier
Name:
Address:
Telephone No. :
Contact Person:

12.6 Chlorine

CAS No: 7782-50-5
RTECS No: FO2100000
UN No: 1017
EC No: 017-001-00-7

MATERIAL SAFETY DATA SHEET

Liquid Chlorine (Cl_2)
Molecular mass: 70.9

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Not combustible but enhances combustion of other substances. Many reactions may cause fire or explosion.	NO contact with combustibles, acetylene, ethylene, hydrogen, ammonia and finely divided metals.	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion on contact with combustible substances, ammonia and finely divided metals.		In case of fire: keep cylinder cool by spraying with water but NO direct contact with water.
EXPOSURE		**AVOID ALL CONTACT!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Corrosive. Burning sensation. Shortness of breath. Cough. Headache. Nausea. Dizziness. Laboured breathing. Sore throat. Symptoms may be delayed (see Notes).	Breathing protection. Closed system and ventilation.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
Skin	ON CONTACT WITH LIQUID: FROSTBITE. Corrosive. Skin burns. Pain.	Cold-insulating gloves. Protective clothing.	First rinse with plenty of water, then remove contaminated clothes and rinse again. Refer for medical attention.
Eyes	Corrosive. Pain. Blurred vision. Severe deep burns.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Evacuate danger area! Consult an expert! Ventilation. NEVER direct water jet on liquid. Remove gas with fine water spray. (Extra personal protection: complete protective clothing including self-contained breathing apparatus). Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 23-36/37/38-50 S: (1/2-)9-45-61 UN Hazard Class: 2.3 UN Subsidiary Risks: 8	Special insulated cylinder. Marine pollutant.

EMERGENCY RESPONSE	STORAGE
Transport Emergency Card: TEC (R)-2 NFPA Code: H 4; F 0; R 0; OX	Separated from strong bases, combustible and reducing substances. Cool. Dry. Keep in a well-ventilated room.

IMPORTANT DATA

Physical State; Appearance
GREENISH-YELLOW GAS, WITH PUNGENT ODOUR.

Physical dangers
The gas is heavier than air.

Chemical dangers
The solution in water is a strong acid, it reacts violently with bases and is corrosive. Reacts violently with many organic compounds, ammonia, hydrogen and finely divided metals causing fire and explosion hazard. Attacks many metals in presence of water. Attacks plastic, rubber and coatings.

Occupational exposure limits
TLV: 0.5 ppm; 1.5 mg/m³ (as TWA)
TLV: 1 ppm; 2.9 mg/m³ (STEL) (ACGIH 1999).

Routes of exposure
The substance can be absorbed into the body by inhalation.

Inhalation risk
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

Effects of short-term exposure
Tear drawing. The substance is corrosive to the eyes, the skin and the respiratory tract. Inhalation of gas may cause pneumonitis and lung oedema, resulting in reactive airways dysfunction syndrome (RADS) (see Notes). Rapid evaporation of the liquid may cause frostbite. Exposure far above the OEL may result in death. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
The substance may have effects on the lungs, resulting in chronic bronchitis. The substance may have effects on the teeth, resulting in erosion.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: -34°C Melting point: -101°C Relative density (water = 1): 1.4 at 20°C, 6.86 atm (liquid) Solubility in water, g/100 ml at 20°C: 0.7 Vapour pressure, kPa at 20°C: 673 Relative vapour density (air = 1): 2.5	The substance is very toxic to aquatic organisms.

NOTES

The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential.
Immediate administration of an appropriate spray, by a doctor or a person authorized by him/her, should be considered.
The odour warning when the exposure limit value is exceeded is insufficient.
Do NOT use in the vicinity of a fire or a hot surface, or during welding.
Do NOT spray water on leaking cylinder (to prevent corrosion of cylinder).
Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.

13.0 ACRONYMS

ACGIH : American Conference of Governmental Industrial Hygienists
BLEVE: Boiling Liquid Expanding Vapour Explosion
CCG : Central Crisis Group
COEC : Chief Off-site Emergency Controller
CMG : Crisis Management Group
DCG : District Crisis Group
DFS : Delhi Fire Service
DISH : Directorate of Industrial Safety & Health
DMRC: Delhi Rail Metro corporation
DPCC : Delhi Pollution Control Committee
DTC: Delhi Transport Corporation
ERC : Emergency Response Centre
EPA: Environment protection Act
HAZOP: Hazard and Operability Study
LCG : Local Crisis Group
LEL: Lower Explosive Limit
MAH : Major Accident Hazards
MARG : Mutual Aid Response Group
MCD: Municipal Corporation of Delhi
MCLS : Maximum Credible Loss Scenario
MSDS : Material Safety Data Sheet
MTNL : Mahanagar Telephone Nigam Ltd.
NDMC : New Delhi Municipal Corporation
NGO : Non-Governmental Organisation
PAC: Protective Action Criteria
PWD : Public Works Department
RTO : Regional Transport Authority
SCG : State Crisis Group
SCBA: Self Contained Breathing Apparatus
UEL: Upper Explosive Limit
UVCE: Unconfined Vapour Cloud Explosion

14.0 GLOSSARY OF SAFETY TERMS

Auto-Ignition Temperature
The auto-ignition temperature is the lowest temperature at which materials begin to burn in air in the absence of a spark or flame. Many chemicals will decompose (break down) when heated. The auto-ignition temperature is the temperature at which the chemicals formed by decomposition begin to burn. Auto-ignition temperatures for a specific material can vary by one-hundred degrees Celsius or more depending on the test method used. Therefore values listed on the MSDS may be rough estimates. To avoid the risk of fire or explosion, materials must be stored and handled at temperatures well below the auto-ignition temperature.

Accident
An undesired event that results in harm to people and/or damage to property, process or the environment.
OR
An unplanned, unwanted, and unexpected event which, because of an unsafe act or unsafe condition, results in property damage, injury, or death.

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.

Accident Cause
The last occurrence in a sequence of events which directly contributed to or produced an accident or incident.

Accident Investigation
A detailed, defined, and recorded review of an occurrence, done to uncover and record the factors and causes and their relationships which led up to and caused an accident or incident.

Accident Prevention
The application of measures designed to reduce accidents or accident potential within a system, organization or activity. An accident prevention program is one which aims to avoid injury to personnel and/or damage to property.

Accident Records
Recorded information in the form of reports and records detailing what accidents or incidents have occurred in a company or industry and what losses and injuries resulted.

Accident Report
A document containing the information and facts about an individual accident or incident, put in chronological order to province a complete picture as to what happened. Also a tool to help establish the ROOT cause.

ACGIH Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs)
American Conference of Governmental Industrial Hygienists, ACGIH is a private, not-for-profit, nongovernmental corporation. It is not a standards setting body. ACGIH is a scientific association that develops recommendations or guidelines to assist in the control of occupational health hazards. TLVs and BEIs are health-based values and are not intended to be used as legal standards.

Acute Exposure Guideline Levels(AEGLs)
AEGLs estimate the concentrations at which most people—including sensitive individuals such as old, sick, or very young people—will begin to experience health effects if they are exposed to a hazardous chemical for a specific length of time (duration). For a given exposure duration, a chemical may have up to three AEGL values, each of which corresponds to a specific tier of health effects. The three AEGL tiers are defined as follows:

- **AEGL-3** is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.
- **AEGL-2** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- **AEGL-1** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic no sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

ALOHA
ALOHA (Areal Locations of Hazardous Atmospheres) is a computer software, which is designed to model chemical releases for emergency responders and planners. It is

developed jointly by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA).

Boiling Point
The boiling point is the temperature at which the material changes from a liquid to a gas. Below the boiling point, the liquid can evaporate to form a vapor. As the material approaches the boiling point, the change from liquid to vapor is rapid and vapor concentration in the air can be extremely high. Airborne gases and vapours may pose fire, explosion and health hazards. Sometimes, the boiling point is given as a range of temperatures. This is because different ingredients in a mixture can boil at different temperatures.

CAS Registry Number
The CAS Registry Number is a number assigned to a material by the Chemical Abstract Service (CAS) to provide a single unique identifier. A unique identifier is necessary because the material can have many different names. For example, the name given to a specific chemical may vary from one language or country to another. The CAS Registry Number has no significance in terms of the chemical nature or hazards of the material. The CAS Registry Number can be used to locate additional information on the material, for example, when searching in books or chemical databases.

Disaster
Any real or anticipated occurrence which endangers the lies, safety, welfare and well-being of some or all of the people and cannot be brought under control by the use of all regular Municipal Government services and resources.

Explosive Limits
LEL & LFL - The Lower Explosive Limit (LEL), or lower flammable limit (LFL), is the lowest concentration of gas or vapor which will burn or explode if ignited.

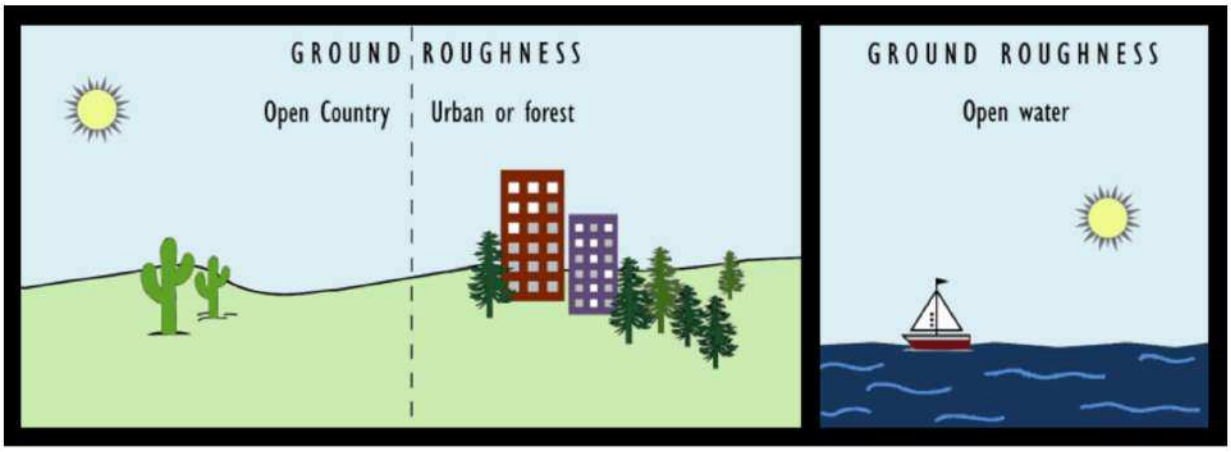
UEL, UFL - The Upper Explosive Limit (UEL), or the upper flammable limit (UFL), is the highest concentration of gas or vapor which will burn or explode if ignited. From the LEL to the UEL, the mixture is explosive. Below the LEL, the mixture is too lean to burn. Above the UEL, the mixture is too rich to burn. However, concentrations above the UEL are still very dangerous because, if the concentration is lowered (for example, by introducing fresh air), it will enter the explosive range. In reality, explosive limits for a material vary since they depend on many factors such as air temperature. Therefore the values given on an MSDS are approximate.

Emergency
An abnormal situation, which to limit damage to persons, property or the environment requires prompt action beyond normal procedures.

Emergency Planning
The act of putting together an overall plan and developing it for response to emergency situations involving workers and equipment (e.g.: logical sequence of events).

Flash Point
The Flash Point is the lowest temperature at which a liquid or a solid gives off enough vapor to form flammable air-vapor mixture near its surface. The lower the flash point, the greater the fire hazard. The flash point is an approximate value and should not be taken as a sharp dividing line between safe and hazardous conditions. The flash point is determined by a variety of test methods which give different results. Two of these methods are abbreviated as OC (open cup) and CC (closed cup).

Ground Roughness
Ground roughness is a measure of the number and size of small obstacles (called roughness elements) that a chemical cloud might encounter as it travels downwind over the terrain. As the cloud passes over the roughness elements (such as shrubs), the flow of air is disturbed due to the friction between the ground and air passing over it—causing an increase in atmospheric turbulence. Because the air nearest the ground is slowed the most, eddies develop (just as they would in the water next to a riverbank). Greater ground roughness results in greater atmospheric turbulence.
Open Country: This type of terrain has low roughness and low turbulence, because the chemical cloud is traveling over an area with only small or isolated roughness elements (e.g., open fields or parking lots). A chemical cloud generally travels farther across open country (than over an urban area or a forest) and remains narrower; because it encounters fewer (and smaller) roughness elements, less turbulence is created. ALOHA's threat zone will be longer when you choose Open Country rather than Urban or Forest ground roughness.



Urban or Forest: This type of terrain has high roughness and high turbulence, because the chemical cloud is traveling over an area with many friction-generating roughness elements, such as trees or small buildings (e.g., residential housing developments, industrial areas, or forests). Note that large obstacles (such as tall buildings) do not contribute to the ground roughness, because the cloud is diverted around these obstacles. For example, in a downtown area on a Sunday morning with no cars on the streets, the best choice for a small release may be Open Country. In this example, the buildings are obstacles and the street are the roughness the pollutant cloud will experience.
Open Water: This type of terrain has very low roughness and very low turbulence, because the chemical cloud is traveling over a body of water that is large relative to the size of the cloud (e.g., oceans or large lakes) and it is unlikely to encounter many roughness elements.

Hazard, Hazardous
Hazard is the potential for harmful effects. Hazardous means potentially harmful. The hazards of a material are evaluated by examining the properties of the material, toxicity, flammability and chemical reactivity, as well as how the material is used. How a material is used can vary greatly from workplace to workplace and, therefore, so can the hazard.

Inversion Height (Low Level)
An inversion is an atmospheric condition in which an unstable layer of air near the ground lies beneath a very stable layer of air above. The height of the abrupt change of atmospheric stability is called the inversion height. An inversion can trap pollutant gases below the inversion height, causing ground-level concentrations to reach higher levels than would otherwise be expected.

IDLHs

Immediately Dangerous to Life or Health limits (IDLHs) are workplace exposure limits that are meant to protect workers when they are exposed to a toxic chemical in the course of their work.

An immediately dangerous to life or health condition is such a situation "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."

The IDLH limit represents the concentration of a chemical in the air to which healthy adult workers could be exposed (if their respirators fail) without suffering permanent or escape-impairing health effects.

Incident/Near Miss

An undesirable event which has the potential to cause a serious accident.
OR
An undesired event that, under different circumstance, could have resulted in personal harm, and/or damages to property, process or the environment.
OR
A specific unplanned event or sequence of events that has an unwanted and unintended consequence on the safety or health of people, property or the environment, or on legal or regulatory compliance.
OR
An unplanned event or sequence of events that does not have actual consequences but that could, under slightly different circumstances, have unwanted and unintended effects on people's health and safety, on property, on the environment or on legal or regulatory compliance.

Liquefied Gases

A liquefied gas is a general term for a substance that is a gas under normal pressures and temperatures, but which has been stored under enough pressure—or at a cold enough temperature—to liquefy it. For example, chlorine is a gas at normal pressures and temperatures, but it is usually stored under pressure as a liquid.

Due to the pressure, pressurized liquids remain liquid even at temperatures above their normal boiling point. (Most pressurized liquids have a normal boiling point well below typical ambient air temperatures.) Because this is an artificially induced state, the substance will become a gas as soon as the pressure is removed.

Labels for different classes and subclasses of dangerous goods

MSDS

Material Safety Data Sheet- The MSDS includes information such as the properties of chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. Chemical manufacturer, distributor, or importer must provide MSDSs for each hazardous chemical to downstream users to communicate information on these hazards.

Major Accident Hazards (MAH) Installation

Means - 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, column 3 of schedule 2 and 3 respectively; of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989.

Protective Action Criteria

The PACs dataset is a hierarchy-based system of the three common public exposure guideline systems: AEGLs(Acute Exposure Guideline Levels), ERPGs(Emergency Response Planning Guidelines), and TEELs(Temporary Emergency Exposure Limits). A particular hazardous substance may have values in any—or all—of these systems.

The PACs dataset implements the following hierarchy when choosing which values to use for the PACs:

1. Final, 60-minute AEGL values (preferred)
2. Interim, 60-minute AEGL values
3. ERPG values
4. TEEL values

The PACs dataset has a single set of values (PAC-1, PAC-2, and PAC-3) for each chemical, but the source of those values will vary.

Permissible Exposure Limits (PEL's)

are legal exposure limits in India defined in Schedule 2 of the Factories Act, 1948. Sometimes, a manufacturer will recommend an exposure limit for a material. Exposure limits have not been set for many chemicals, for many different reasons. For example, there may not be enough information available to set an exposure limit. Therefore, the absence of an exposure limit does not necessarily mean the material is not harmful. The ACIGH TLVs and BEIs are widely accepted worldwide where the values for a chemical is not set/available in a country.

Threshold Limit Values (TLVs) refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse effects.

There are three types of exposure limits in common use:
TWA - Time-Weighted Average exposure limit is the average concentration of a chemical in air for a normal 8-hour workday and 40-hour workweek to which nearly all workers may be exposed day after day without harmful effects. Time-weighted average means that the average concentration has been calculated using the duration of exposure to different concentrations of the chemical during a specific time period. In this way, higher and lower exposures are averaged over the day or week.
STEL - Short-Term Exposure Limit is the average concentration to which workers can be exposed to for a short period (usually 15 minutes) without experiencing irritation, long-term or irreversible tissue damage or reduced alertness. The number of times the concentration reaches the STEL and the amount of time between these occurrences can also be restricted.
Ceiling - Ceiling (C) exposure limit is the concentration which should not be exceeded at any time.

TREM Card
Transport emergency card is a sheet of various information regarding hazards of the substances, precautionary measure to be taken and emergency response procedures on spillage or leakage.

TDG - Transportation of Dangerous Good
Regulations established to cover transporting hazardous materials.
OR
A legislated program for information and training on the transportation of dangerous goods.

Toxic Chemicals
Exposure of any chemical is by the three major workplace exposure routes, mouth (oral), skin (dermal), or breathing (inhalation). The analysis is based on the LD_{50} (median lethal dose by oral or dermal exposure) and LC_{50}(median lethal inhalation concentration) for a one-hour exposure. The LD_{50} and LC_{50} represent the dose or concentration, respectively, at which 50% of the test animals (and supposedly humans) will be expected to die.

UN number:
UN Numbers of four digits have been assigned to the hazardous substances in which each digit indicates the degree of four types of hazards i.e. flammability hazard, toxicity hazard, reactivity hazard and skin hazard ranging from 0 to 9.

Unsafe Combination of Chemicals
Below is the chemical compatibility chart. The X mark shows the unsafe combination:

	Chemical Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Inorganic Acids																								
2	Organic Acids	X																							
3	Caustics	X	X																						
4	Amines & Alkanolamines	X	X																						
5	Halogenated Compounds	X		X	X																				
6	Alcohols, Glycols, and Glycol Ethers	X																							
7	Aldehydes	X	X	X	X		X																		
8	Ketone	X		X	X			X																	
9	Saturated Hydrocarbons																								
10	Aromatic Hydrocarbons	X																							
11	Olefins	X			X																				
12	Petroleum Oils																								
13	Esters	X		X	X																				
14	Monomers and Polymerizable Compounds	X	X	X	X	X	X																		
15	Phenols			X	X			X							X										
16	Alkylene Oxides	X	X	X	X		X	X							X	X									
17	Cyanohydrins	X	X	X	X	X		X									X								
18	Nitriles	X	X	X	X												X								
19	Ammonia	X	X					X	X					X	X	X	X	X							
20	Halogens			X			X	X	X	X	X	X	X	X	X	X				X					
21	Ethers	X													X										
22	Phosphorus, Elemental	X	X	X																					
23	Sulfur, Molten									X	X	X	X				X								
24	Acid Anyhdrides	X		X	X		X	X							X		X	X	X	X					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Chemical Storage Compatibility Chart

X Represents Unsafe Storage Combinations

Represents Safe Storage Combinations

Identify class to which a specific compound belongs, read unsafe combinations with other classes both horizontally and vertically.

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