OFF-SITE EMERGENCY PLAN

NORTH-WEST DISTRICT, DELHI

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

Developed & prepared by:
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Message from Chairperson

Industries are the indispensible part of a nation for its growth and development. Sometimes industries use, handle, store & transport hazardous chemicals and require special attention.Any undesired event in the plant may lead to serious consequences like fire, explosion or toxic release that may impact the surroundings and vicinity.

Unlike natural disaster, chemical disaster may be avoided or the impact may be minimised with good planning, preparedness and timely response.

With this background, the Off-Site Emergency Plan for North-West Districtis prepared incompliance to the rules envisaged under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989. This Plan is prepared to create a systematic approachamong the authorities/agencies to tackle any emergency due to chemical accident. The roles and responsibilities of the concerned authorities and control measures including evacuation procedures have been defined to address any emergency.

I hope this plan will help the district authorities and Major Accident Hazards Installations to deal with any undesired emergency situation that warrants swift and effective response.

(CHESHTA YADAV, IAS)
DISTRICT MAGISTRATE/CHAIRPERSON
DISTRICT DISASTER MANAGEMENT AUTHORITY
DISTRICT NORTH WEST, DELHI

Acknowledgements

The formation of Districts Crisis Group (DCG) and preparation of Off-Site Emergency Plan is an important aspect in compliance of the mandate given in the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 and the Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Rules, 1989 respectively, framed under the Environment Protection Act. 1986. The Off-site Emergency Plan for district North-West has been prepared as mandated in the Rules.

Adequate information to enable adequate precautions has been provided in the plan for emergency responders to deal with any emergency. The Directorate of Industrial Safety and Health (DISH) and the members of the DCG provided their technical input and support in order to compile the information.

Mr. R. B. Singh, Assistant Director (ISH) of Labour Department and Mr. Hemant Kumar, District Project Officer, DDMA, NWplayed crucial role in preparation of the plan.

I am hopeful that the Off-Site Emergency Plan is a document that will help government departments/agencies to prepare themselves better in order to respond to any chemical disaster.

(AMIT KUMAR)
ADM (NW)/CEO-DDMA(NW)
DISTRICT NORTHWEST, DELHI

Acknowledgement

The Off-site Emergency Plan for district North-West of NCT of Delhi has been prepared with a view to address any off-site emergency due to the hazardous chemicals handled by Major Accident Hazards Installations in Northwest district. On-site emergency plans have already been prepared by all the MAH installations in the district. Even following best practices and guidelines, accidents due to any unsafe condition or act may happen leading to a disaster.

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 extended their support to provide data and information, so that the plan can be a full-fledged document covering all parameters 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 suggestions to finalize this document. I am thankful to my colleagues, DCG members and stakeholders who have spent their time and energy for the preparation of this plan. I am specially thankful to the district administration for their support and logistics.

(Pinkesh Kumar)
Dy. Director (ISH)/ Member-Secretary (DCG)
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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. 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 government and the central government.

The leakage of deadly gas Methyl Iso Cyanate (MIC) in Bhopal Disaster in the night of Dec 2-3/1984 can never be forgotten. The killer cloud of gas that leaked abruptly and in an uncontrolled manner left some 3500 people dead and thousands were injured. It is considered among the world's worst industrial disasters. 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.

Chemical accidents can be prevented and their impacts can be minimized by better planning, preparedness and response. The emergency 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. 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 elimination of 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 North-West district administration took the initiative in preparing a comprehensive off-site emergency plan for North-West district to manage the eventualities 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. In order to be in a state of preparedness to respond to the accidents/disasters and minimize their adverse impacts on the offsite population, Rule 14 of the MSIHC Rules, 1989 (Amended in 2000), under EPA, 1986, requires an offsite emergency plan to be prepared by the District Magistrate for every district in consultation with The Chief Inspector of Factories & with the members of District Crisis Group.

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 the 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 Occupational Safety & Health (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 injury. 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 Hazard 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 North-West district is covered under this plan. The plan will apply to the following emergency scenario:

- Release of toxic/ flammable chemical, both liquid & gases outside/ beyond the Major Accident Hazard Installation;
- Any emergency situation that is uncontrolled by any Major Accident Hazard Installation or any factory involving hazardous chemicals located in the North-West district.

2.0 GEOGRAPHICAL FEATURES OF NORTH-WEST DISTRICT:

2.1 DISTRICT PROFILE:

North-West district is one of the eleven districts of the NCT of Delhi that came into existence from September 2012 when Delhi was divided into eleven revenue Districts. North-West District having its head quarter at Kanjhawala has predominantly rural but also has a sizeable urban population. There are 27 villages in the district with all characteristics of rural India. The total population of the district as per 2011 Census is 22,46,311 out of which the male population crosses 1,200,468 and 1,045,843 are females. The density of population of District North-West is 8,298 persons/ sq. km. Rohini and Saraswati Vihar Subdivision has 100% urban population whereas Kanjahawla subdivision holds 88% rural population of the District. The literacy rate of the district is 86.09%.

2.2 LOCATION:

The latitudinal and longitudinal locations of Delhi are 23.38 degree north and 77.13 degree east. North-West district lies to the north west of Delhi. It is surrounded by North, West & Central districts of NCT of Delhi and by Haryana state.

2.3 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.

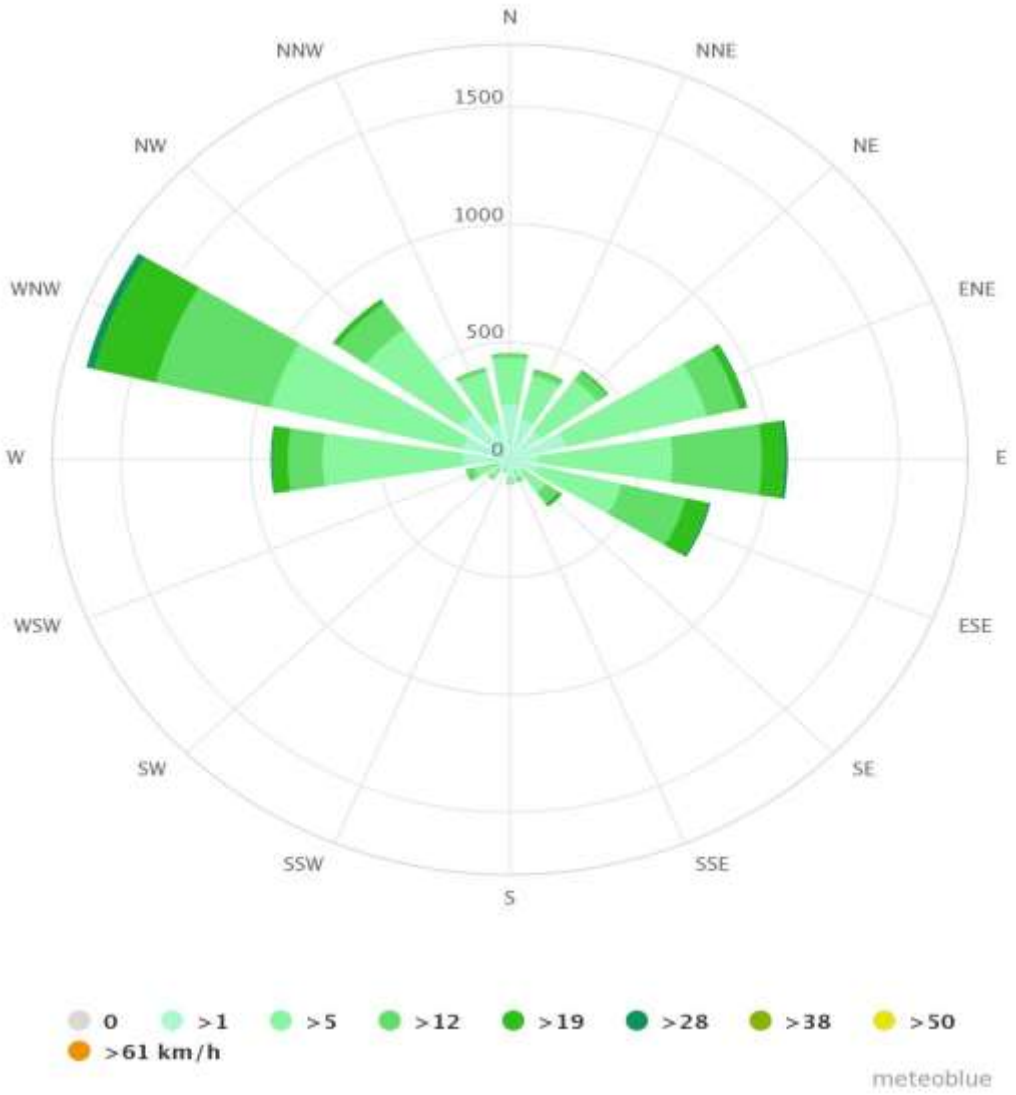
2.4 RAINFALL:

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.

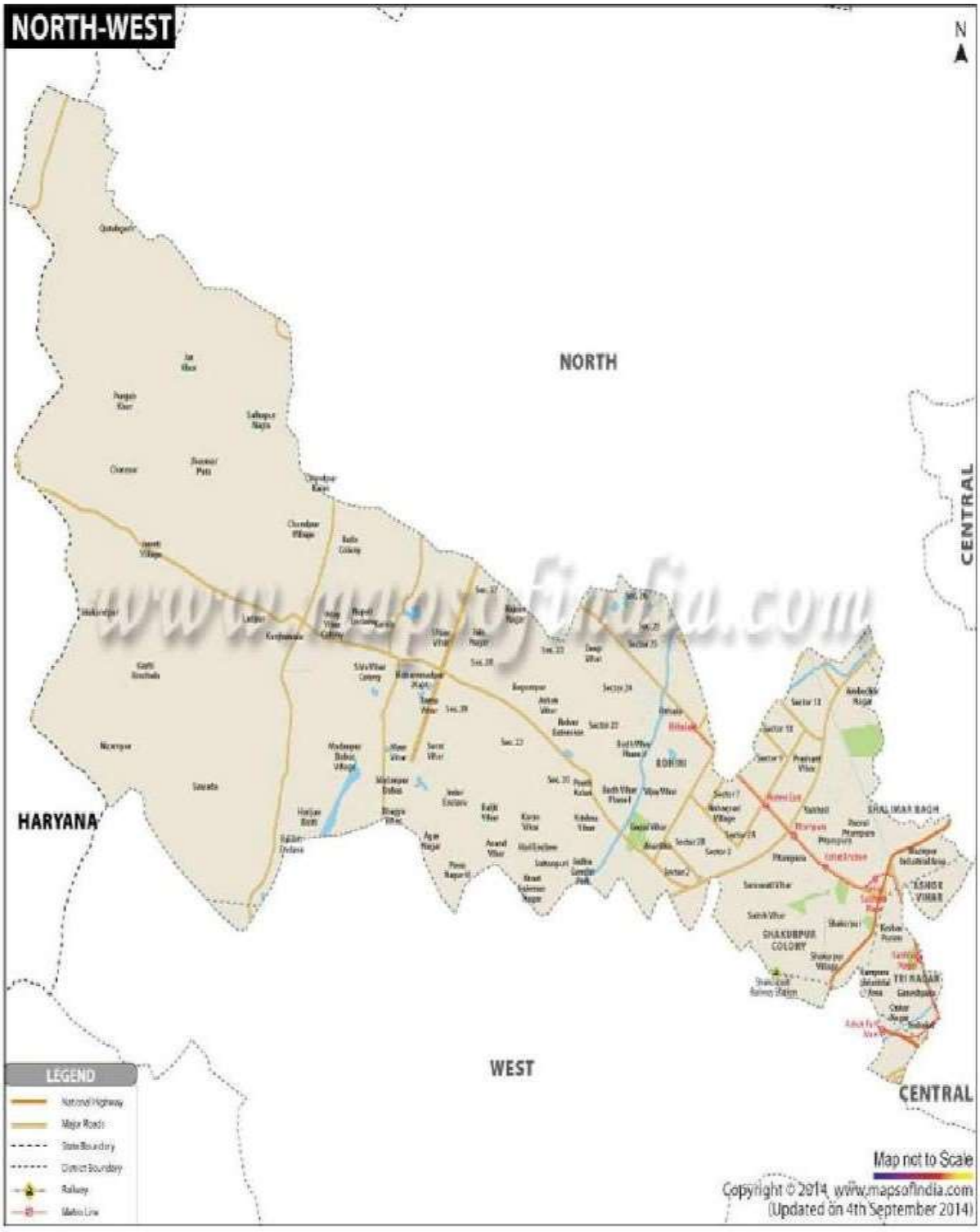
2.5 METEROLOGICAL DATA:

Maximum Temperature --- 35º C,
Minimum Temperature --- 20º 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

2.6 WIND VELOCITY/DIRECTIONS:



2.7 GEOGRAPHICAL MAP OF NORTH-WEST DELHI



3.0 MAJOR ACCIDENT HAZARD INSTALLATION (MAH) IN NORTH-WEST DISTRICT:

In North-West district there are three MAH Installations namely:

- IOCL INDANE Bottling Plant
- IOCL Tikrikalan Terminal
- Haiderpur Water Treatment Plant

3.1 IOCL INDANE BOTTLING PLANT:

3.1.1 Introduction:

Indian Oil Corporation Limited (IOCL) has an existing LPG Bottling Plant (BP) at Ghevra Village near Tikrikalan, Delhi for the purpose of receipt & storage of LPG, filling LPG cylinders and dispatch to the assigned market of Delhi. IOCL operates Delhi Bottling Plant in Tikrikalan for Storage of LPG and supply of filled LPG cylinders to Delhi market by Stack Trucks. Bulk LPG is received in rail tank wagons from RIL Jamnagar, IOCL Import Terminal Kandla, ONGC Hazira, GAIL Vijaipur etc & in Bulk LPG tankers trucks from IOCL LPG bottling plants at Madanpur Khader, Mathura etc. It occupies an important place in the Indian Oil distribution network.

3.1.2 Facilities:

The plant receives bulk LPG mostly through Railway Tank wagons. Total capacity of LPG storage is 10600 MT. After filling LPG in cylinders, filled LPG cylinders are transported to LPG distributers/ Consumers in 5.0 Kg, 14.2 KG, 19 KG, 47.5 KG & 425 KG cylinders. The overview of plant is given below:-

- Bulk LPG TT loading/ unloading facilities with eight bays.
- 6x600 MT + 5x1400 MT Horton Spheres in two clusters for storage of LPG.
- LPG filling shed/ evacuation shed/ filled cylinder shed.
- Three numbers of carousals (1x48-point) in Phase-II and (2x24-point) in Phase-I

- In filling shed, plant has other facilities such as; Integrated weight correction unit

  (ICU), Valve change without evacuation (VCM), Evacuation unit, Water bath, purging unit etc.
- TT parking area for parking for 128 stack Trucks & 16 Bulk TTs.

3.1.3 Demography:

Around 64000 people are residing in radius of 5 km of Delhi Bottling Plant. However, Population of Ghevra village as of 2011 consensus is 2520.

3.1.4 Operation:

Following activities are performed in the plant:

- Receipt of LPG from Railway Tank Wagon
- Storage of LPG in Horton sphere.
- Receiving of empty LPG cylinders.
- Filling of LPG into cylinders.
- Dispatch of filled cylinders.
- Filling of LPG in TTs to other plants / unloading of LPG from TTs.

3.2 INDIAN OIL CORPORATION LIMITED (IOCL) TIKRIKALAN TERMINALS, DELHI:

3.2.1 Facilities:

Tikrikalan Terminal is part of the Marketing Division of Indian Oil Corporation Ltd. It is a POL terminal which serves as supply point of petroleum products to the Retail Outlets, consumers of NCR & beyond. The Tikrikalan Terminal of Indian Oil Corporation Limited is located on the National Highway-10, Rohtak Road near Ghevra More Tikrikalan. The main activities of the facility are Receipt, Storage and Delivery of Motor Spirit (MS) & High Speed Diesel (HSD). The Terminal also handles Ethanol and Biodiesel (B100), which is mixed in a proportion of 10% by volume with MS and 7% by volume with HSD respectively for dispatches.

Details of Existing & Additional Storage Facilities:

Material	Existing		Additional		Total	
	Storage Capacity (KL)	No. of Storage Tanks	Storage Capacity (KL)	No. of Storage Tanks	Storage Capacity (KL)	No. of Storage Tanks
HSD	20476	7	--	--	20476	7
MS	14830	4	--	--	14830	4
ETHANOL	3954	2	400	2	4354	4
TOTAL STORAGE CAPACITY	39260	13	400	2	39660	15

There are total 13 Storage Tanks available at Tikrikalan Terminal.

3.2.2 Demography:

Around 64000 people are residing in radius of 5 km of the Terminal. However, Population of Ghevra village as of 2011 consensus is 2520.

3.3 HAIDERPUR WATER TREATMENT PLANT:

3.3.1 Introduction

Haiderpur Water Treatment Plant is located on outer ring road, Sector 15, Rohini, Delhi. The total area of the plant is 416520 SQ. MTR. The main function of this plant is to treat raw water with the help of Chlorine & Alum cake.

3.3.2 Chemical used for purification of water:

S.No	Name of Chemical Used	Capacity of one Cylinder	Total No of Cylinder
1	Chlorine	930 Kg	63

3.3.3 Demography:

Haiderpur Water Treatment Plant is surrounded by densely populated area having high rise residential societies. There are many strategic locations situated in the vicinity of this installation like District Court Rohini, District Jail Rohini, Badli Industrial Area, GT Karnal Road Industrial Area, Azadpur Fruits & Vegetables Mandi etc.

4.0 HAZARD IDENTIFICATION:

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. 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.

Major hazards posed in North-West district are due to petroleum products (LPG, MS, HSD, etc) stored & handled in IOCL bottling plant and terminal located at Tikri Kalan & chlorine stored and used at Haiderpur Water Treatment Plant, Haiderpur. The petroleum products being handled by IOCL plants are inflammable in its basic character whereas the chlorine is highly toxic in nature.

4.1 IDENTIFICATION OF DISASTER AND DISASTER PRONE AREAS:

In the North-West district, the nature of emergencies /Disaster could possibly due to any of the following events:

a) In plant Emergencies due to deficiencies in:
    - Operation
    - Maintenance
    - Vessel design failure.
b) Natural calamities like:
    - Flood
    - Earthquake
c) Deliberate act of man
    - Sabotage
    - Riots
    - War
d) Emergencies during transportation of Chemicals.

4.2 CONSEQUENCES:

- Fire & explosion
- Release of toxic gas
- Chemical and heat burns to human and livestock
- Overpressure shocks to human and livestock
- Damage to property and environment.

4.3 DISASTER SCENARIOS:

4.3.1 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 may be catastrophe rupture of MS/Ethanol/HSD tank and flooding from dyke. Though all the equipments are flame proof in petroleum installations yet the possibility of ignition source cannot be ruled out. In such scenario pool fire is possible.

4.3.2 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). Chances of explosion in MS/HSD/ethanol tanks and LPG horton sphere due to leakage of liquid followed by ignition are possible. Flammable vapour cloud may form and if ignited, may explode. The LPG has more potential to cause harm to property, lives and environment.

4.3.3 BLEVE (Boiling Liquid Expanding Vapour Explosion):

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.

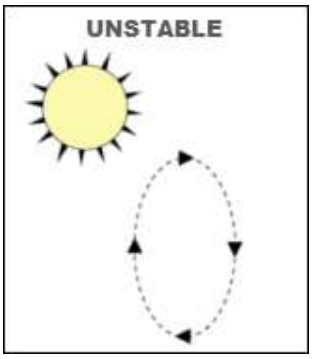
The primary hazards associated with a BLEVE are thermal radiation, overpressure, hazardous fragments, smoke, and toxic by-products from the fire. BLEVE is very unlikely where petroleum products like (MS, Ethanol, HSD, etc) are stored as liquid in storage tanks at atmospheric pressure and below its boiling point but where the petroleum products like LPG is stored in pressurised liquified conditions BLEVE cannot be ruled out and hence considered a possible credible scenario.

4.4 ATMOSPHERIC AND PHYSIOLOGICAL FACTORS:

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).

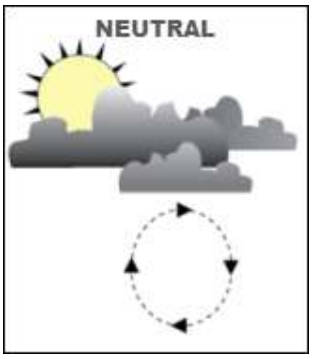
4.4.1 Background on Atmospheric Stability Classes:

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)

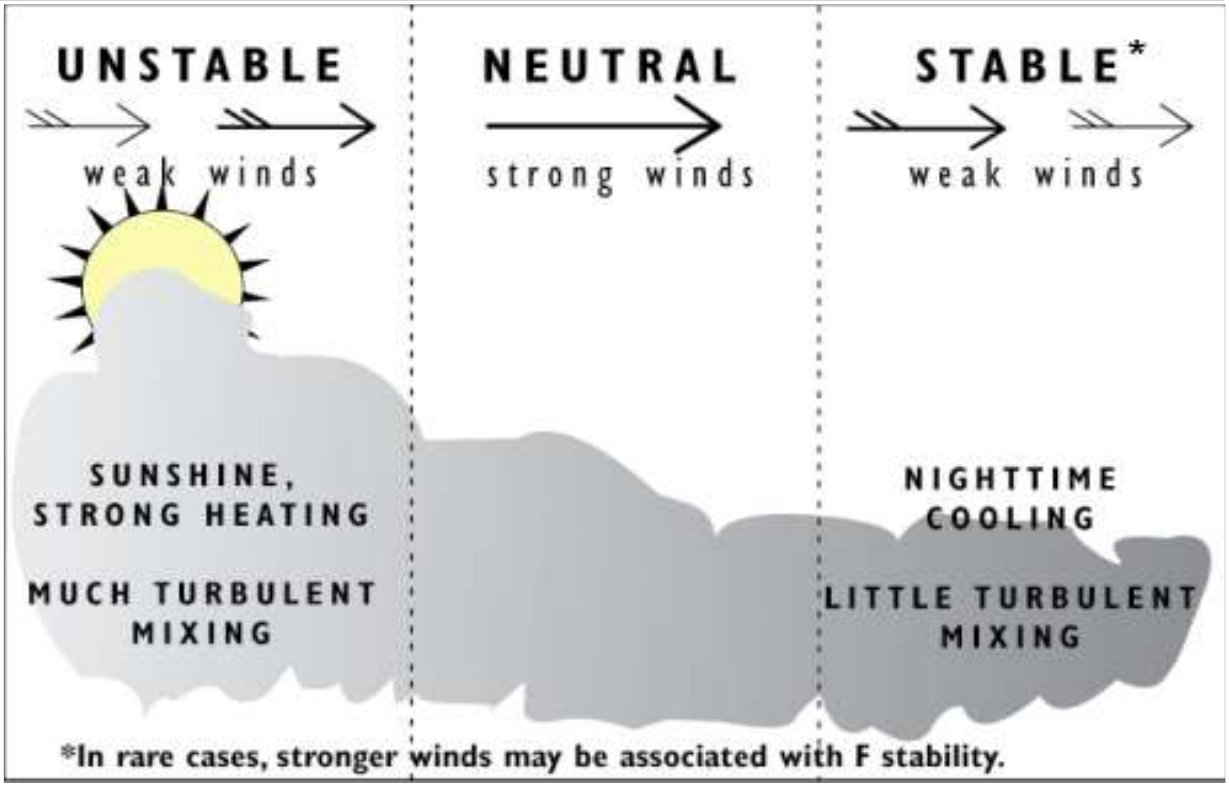


Relatively strong wind speeds and moderate solar radiation are associated with neutral stability (moderate turbulence).

- 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.

4.4.2 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 3 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).

4.4.3 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. ALOHA displays 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.

4.4.4 Toxic Release:

Chlorine is 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.

5.0 CREDIBLE LOSS SCENARIOS MODELING:

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 is 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).

5.1 SCENARIO 1 (POOL FIRE-BURNING PUDDLE):

SITE DATA:

- Location: DELHI, INDIA
- Building Air Exchanges Per Hour: .01 (user specified)
- Time: November 23, 2020 2143 hours ST (using computer's clock)

CHEMICAL DATA:

- Chemical Name: 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: 0.96 atm
- Ambient Saturation Concentration: 989,892 ppm or 99.0%

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: 35° 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: 24 meters
- Tank Length: 16.59 meters
- Tank Volume: 7,505 cubic meters
- Tank contains liquid
- Internal Temperature: 35° C
- Chemical Mass in Tank: 3,514 tons
- Tank is 69% full
- Circular Opening Diameter: 10 inches
- Opening is 6 inches from tank bottom
- Max Flame Length: 89 meters
- Burn Duration: ALOHA limited the duration to 1 hour
- Max Burn Rate: 20,300 kilograms/min

- Total Amount Burned: 925,084 kilograms

Note: The chemical escaped as a liquid and formed a burning puddle.

The puddle spread to a diameter of 59 meters.

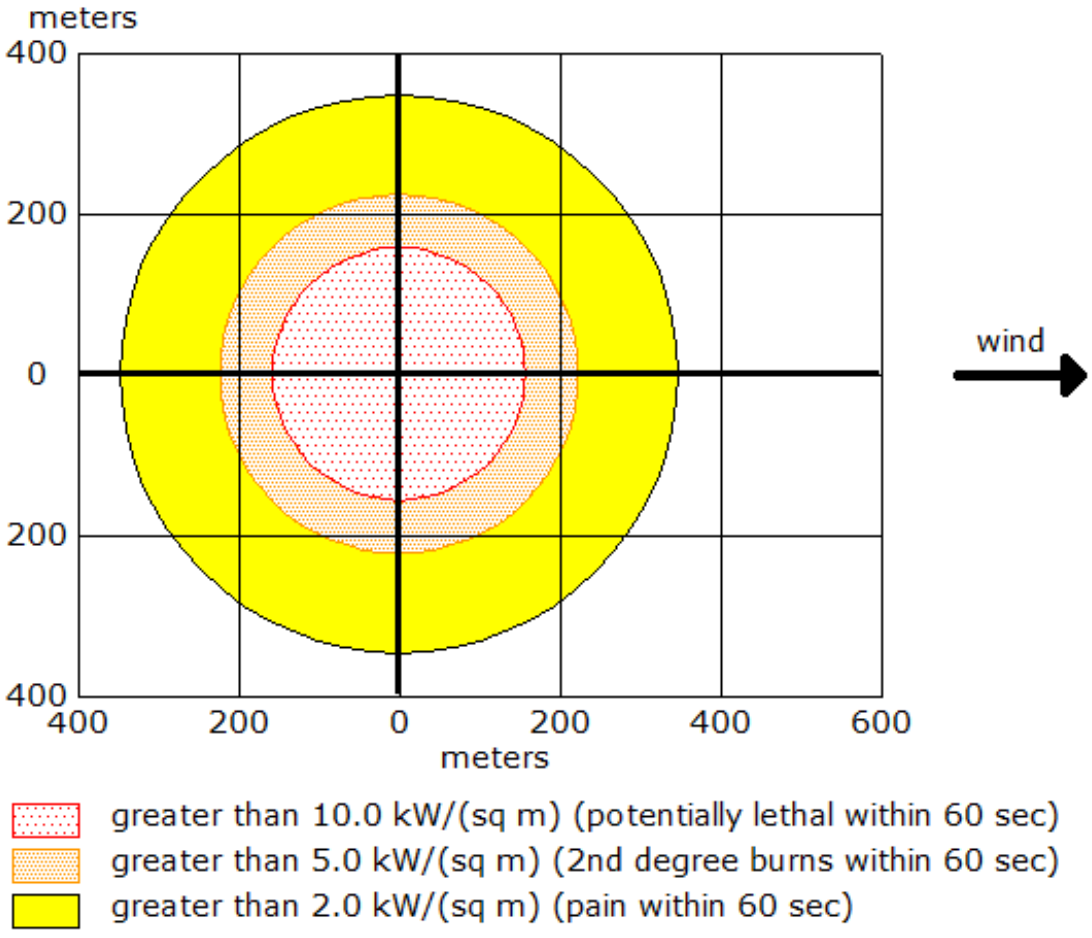
THREAT ZONE:

Threat Modeled: Thermal radiation from pool fire

Red : 157 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

Orange: 222 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Yellow: 346 meters --- (2.0 kW/(sq m) = pain within 60 sec)



From scenario 1, it is clear that the thermal radiation periphery of greater than 10 kw/sq. m shall be around 170 meters. It means that most of the thermal radiation effect shall be felt within the premises. However, domino effect due to the same may affect nearby tanks and other vulnerable equipment in the vicinity.

5.2 SCENARIO 2- FLAMMABLE AREA OF VAPOUR CLOUD (LPG HORTON SPHERE)

SITE DATA:

- Location: DELHI, INDIA
- Building Air Exchanges Per Hour: .01 (user specified)
- Time: November 23, 2020 2049 hours ST (using computer's clock)

CHEMICAL DATA:

- Chemical Name: LPG
- CAS Number: 68476-85-7
- Molecular Weight: 44.10 g/mol
- AEGL-1 (60 min): 5500 ppm
- AEGL-2 (60 min): 17000 ppm
- AEGL-3 (60 min): 33000 ppm
- IDLH: 2100 ppm
- LEL: 21000 ppm
- UEL: 95000 ppm
- Ambient Boiling Point: -42.7° 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: 35° C
- Stability Class: E
- No Inversion Height
- Relative Humidity: 50%

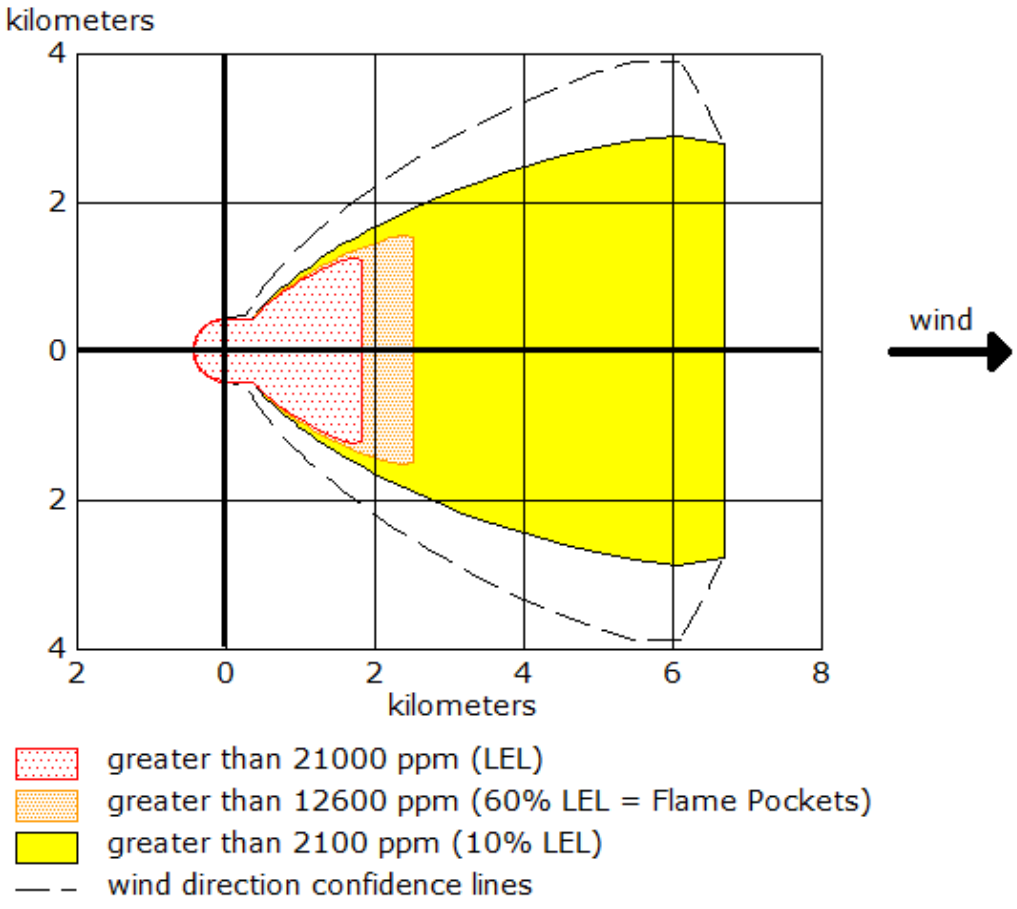
SOURCE STRENGTH:

- Direct Source: 1400 tons
- Source Height: 0
- Release Duration: 1 minute
- Release Rate: 21,200 kilograms/sec
- Total Amount Released: 1,270,059 kilograms

Note: This chemical may flash boil and/or result in two phase flow.

THREAT ZONE:

Threat Modeled: Flammable Area of Vapor Cloud
Model Run: Heavy Gas
Red : 1.8 kilometers --- (21000 ppm = LEL)
Orange : 2.5 kilometers --- (12600 ppm = 60% LEL = Flame Pockets)
Yellow : 6.7 kilometers --- (2100 ppm = 10% LEL)



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

From scenario 2, it is clear that the flammable area of vapour cloud shall be around 1.8 Killometers. Hence, Off-Site Emergency Plan for the district needs to be invoked in such case including evacuating the area affected.

5.3 SCENARIO 3- BLEVE (LPG HORTON SPHERE):

SITE DATA:

- Location: DELHI, INDIA
- Building Air Exchanges Per Hour: .01 (user specified)
- Time: November 23, 2020 2049 hours ST (using computer's clock)

CHEMICAL DATA:

- Chemical Name: LPG
- CAS Number: 68476-85-7
- Molecular Weight: 44.10 g/mol
- AEGL-1 (60 min): 5500 ppm
- AEGL-2 (60 min): 17000 ppm
- AEGL-3 (60 min): 33000 ppm

- IDLH: 2100 ppm LEL: 21000 ppm
- UEL: 95000 ppm
- Ambient Boiling Point: -42.7° 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: 35° C
- Stability Class: E
- No Inversion Height
- Relative Humidity: 50%

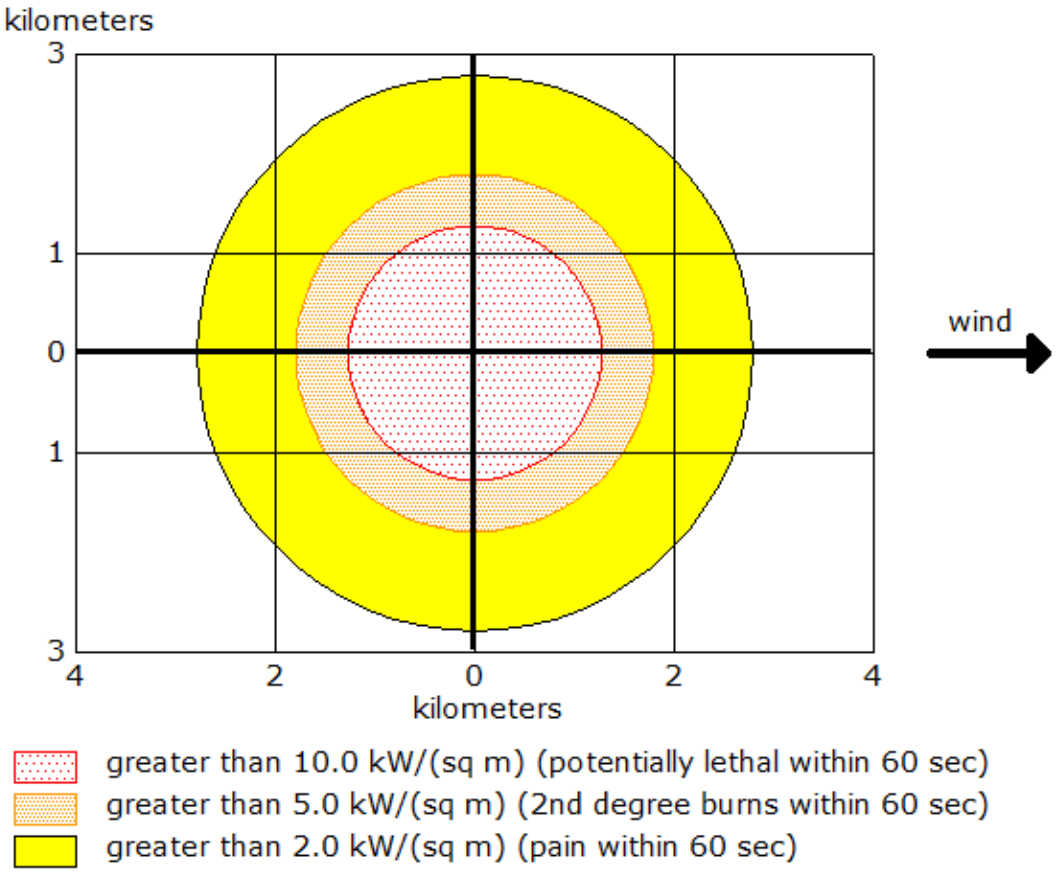
SOURCE STRENGTH:

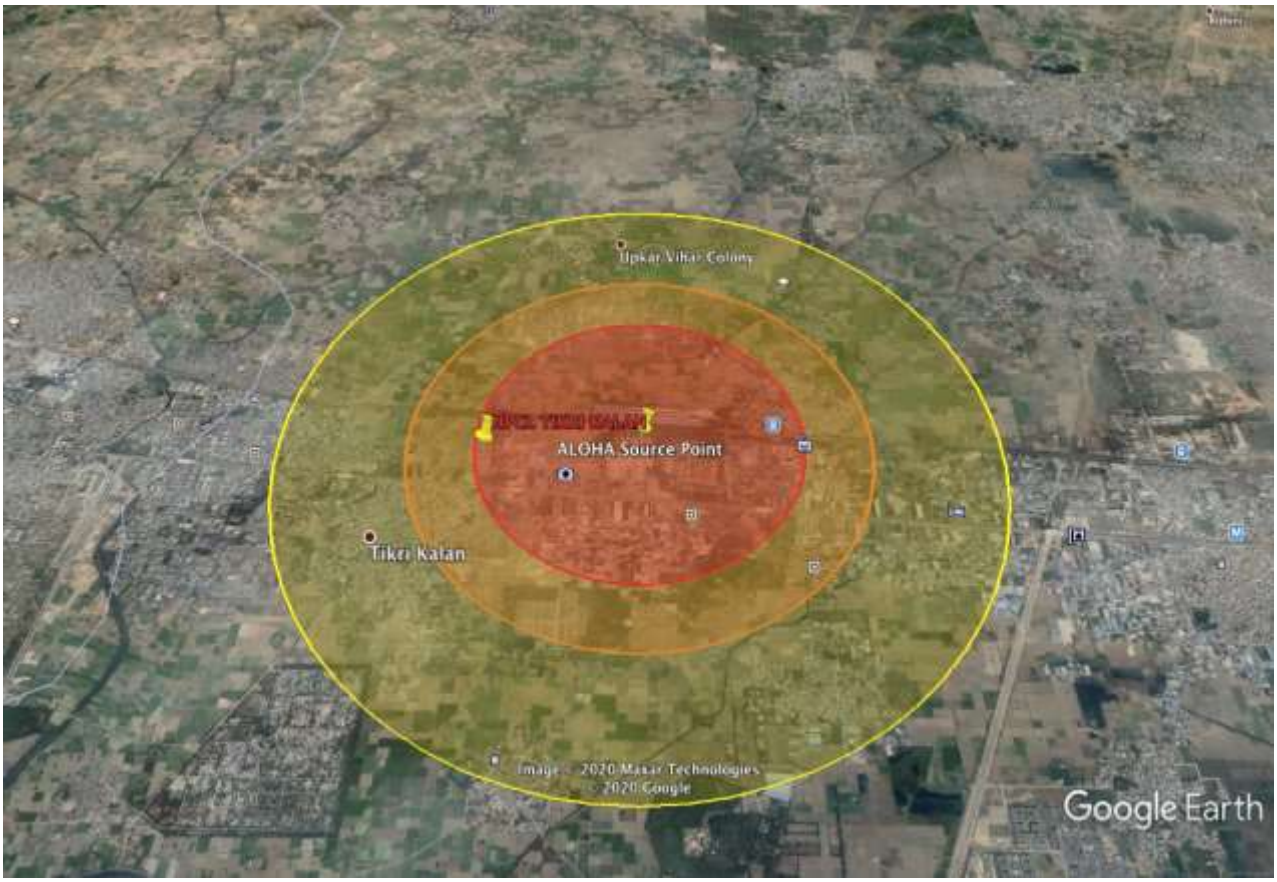
- BLEVE of flammable liquid in spherical tank
- Tank Diameter: 18 meters
- Tank Volume: 3,054 cubic meters
- Tank contains liquid
- Internal Storage Temperature: 35° C
- Chemical Mass in Tank: 1,370 tons
- Tank is 85% full
- Percentage of Tank Mass in Fireball: 100%
- Fireball Diameter: 624 meters
- Burn Duration: 30 seconds

THREAT ZONE:

Threat Modeled: Thermal radiation from fireball

Red : 1.3 kilometers --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
Orange : 1.8 kilometers --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
Yellow : 2.8 kilometers --- (2.0 kW/(sq m) = pain within 60 sec)


kilometers
3
1
0
1
3
4
2
0
2
4
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)



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

From scenario 3, it is clear that the thermal radiation periphery of greater than 10 kw/sq. m shall be around 1.3 kilometers and can surround the area outside the premises/installation. Off-site Emergency Plan for the district needs to be invoked in such case including evacuating the area affected.

5.4 SCENARIO 4 (CHLORINE LEAKAGE):

SITE DATA:

- **Location**: Haiderpur Water Treatment Plant Delhi
- Building Air Exchanges per Hour: 0.76 (unsheltered single storied)

CHEMICAL DATA:

- Chemical Name: CHLORINE
- CAS Number: 782-50-5
- Molecular Weight: 70.91 g/mol
- Acute Exposure Guideline Levels (AEGL-1) (60 min) : 0.5 ppm

- Acute Exposure Guideline Levels (AEGL-2) (60 min) : 2 ppm
- Acute Exposure Guideline Levels (AEGL-3) (60 min) : 20 ppm
- Immediate Danger Level to Health: 10 ppm
- Ambient Boiling Point: -34.0° 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: 35° F
- 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: 0.76 meters
- Tank Length: 2.085 meters
- Tank Volume: 0.95 cubic meters
- Tank contains liquid
- Internal Temperature: 35° F
- Chemical Mass in Tank: 930 kilograms
- Tank is 67% full
- Circular Opening Diameter: 1 inch
- Opening is 0.27 meters from tank bottom
- Release Duration: 4 minutes
- Max Average Sustained Release Rate: 501 kilograms/min (Averaged over a minute or more)
- Total Amount Released: 570 kilograms

Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

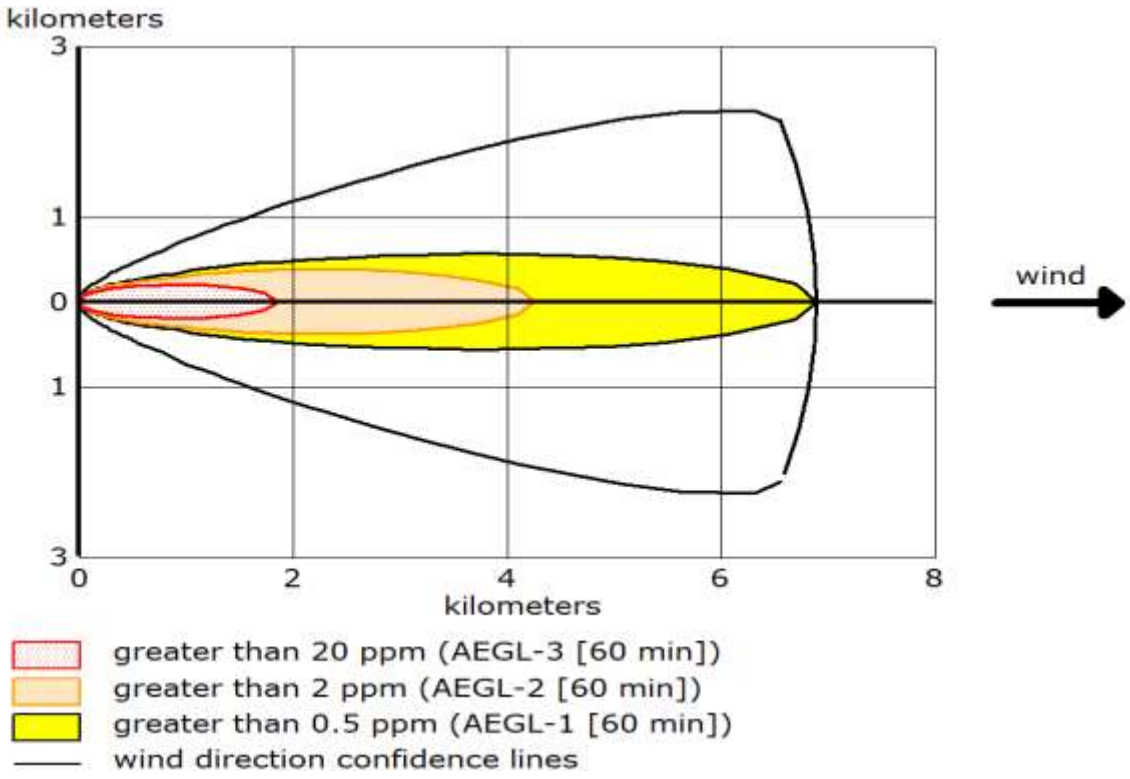
THREAT ZONE:

Model Run: Heavy Gas

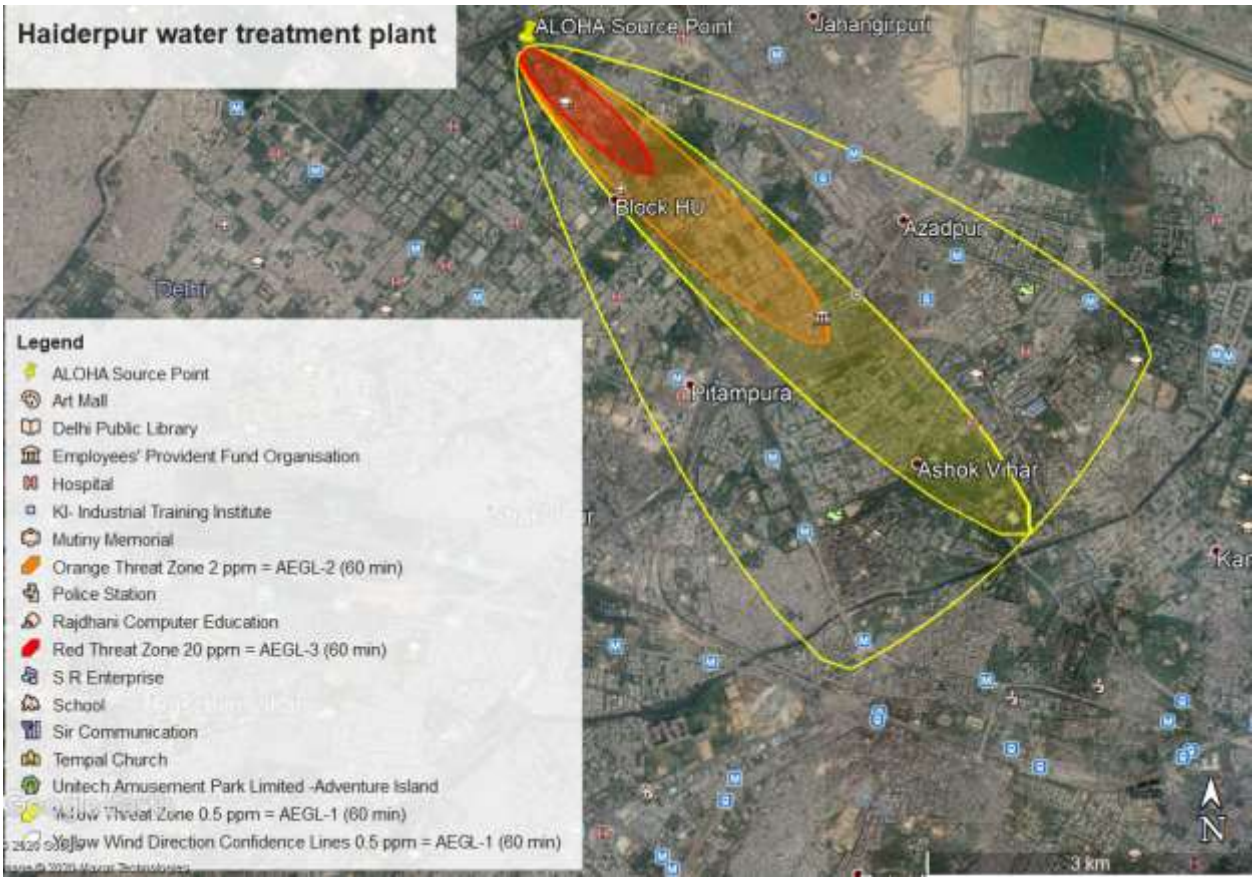
Red : 1.9 kilometers --- (20 ppm = AEGL-3 [60 min])

Orange : 4.3 kilometers --- (2 ppm = AEGL-2 [60 min])

Yellow : 6.9 kilometers --- (0.5 ppm = AEGL-1 [60 min])



A level of 10 ppm is considered immediately dangerous to Life and Heath under the Nation Institute of public Safety & Health. The imminent danger zone is 1.98 KM around the Haiderpur Water Works. It is also pertinent to mention here that chlorine gas is 2.5 times heavier than air and will sink to the lowest level in the area. The boiling point of chlorine gas is -29.15 degrees F and liquid chlorine that escapes from cylinder or Ton container will be immediately convert to gas. Since the plant is located around a densely populated area; Off-Site Emergency Plan for the district needs to be invoked in such case including evacuating the area affected.



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

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 North-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 & DETAILS OF DISTRICT CRISIS GROUP MEMBERS:

S. No.	Name with designation	DCG status	Office Address	Telephone	E-mail
1.	Ms. Cheshta Yadav (IAS), DM	**Chairperson/COEC**	District Magistrate North-West, Kanjhawala, Delhi-110081	011-25953785	dcnw@nic.in
1A, alternate	Sh. Amit Kumar, ADM	DOEC	-Do-	011-25953786	admnw@nic.in
2	Sh. Pinkesh Kumar, Dy. Director (ISH)/Dy. CIF	**Member-Secretary**	Labour Department, D Block 2nd Floor 5 Sham Nath Marg Delhi 54	9868321010	pinkeshkumar1975@gmail.com
2A, alternate	Sh. R. B. Singh, Asstt. Director (ISH)/Inspector of Factories	-do-	-do-	9818829355	rbsingh.ad@gmail.com
3	Sh. R. N. Meena, Joint Chief Controller of Explosives	Member	Hall No. 502-507, Level 5, Block-D, Old CGO Complex, NH-4, Faridabad, Haryana	0129-2410739 0129-2410731	rnmeena@explosives.gov.in
4	Sh. Manmohan Singh, ACP (HQ)	Member	Deep Cinema Market, Ashok Vihar, Phase-II, Delhi-110052	8700633107 011-27416686	kailash28060078@gmail.com
5	Sh. Dharampal Bhardwaj, Dy. CFO	Member	Delhi Fire Station, Near Super Bazar, New Delhi – 110001	9810445332	dharampalbhardwaj1563@gmail.com

6	Sh. Ashok Kumar Tanwar, Sr. Instructor	Member	Room No. 32, Civil Defence Office, O/o District Magistrate North-West, Kanjhawala, Delhi-110081	9810072193	dcdo.outer@gmail.com
7	Dr. Meenakshi Hembrum, Medical Officer	Member	DGD Sector-13, Rohini, Near Bhagwati Hospital, Delhi	011-27867278	cdmonorthwest@gmail.com
8	Mohd. Aarif, Sr. Environmental Engineer (DPCC)	Member	2nd floor, C Block, Vikas Bhawan-II, Civil Lines, Delhi-110054	9717593510	arif430@gmail.com
9	Sh. Vivek Pakash, Deputy Commissioner	Member	Deputy Commissioner, MCD, Near Rajiv Gandhi Cancer Hospital, Sector-5, Rohini, New Delhi	9711353866	dcrohinizone@gmail.com
10	Sh. Dhoom Singh, Extension Officer	Member	O/o District Magistrate North-West, Kanjhawala, Delhi-110081	9910469688	bdonorthwest@gmail.com
11	Mr. V.K. Sharma, Ex-CIF, Labour Deptt GNCTD	Member	D 170 Kamla Nagar, Delhi-110007	9871668253	vksd170@gmail.com
12	Maj Sudhir Nanda, Sr. Manager(LPG-Safety)	Member	Indane Bottling Plant, Ghevra More, Rohtak Road, Delhi	9883230464	nandasudhir@indianoil.in

13	Sh. Ashok Kumar Chaudhary, Manager (Operation Safety)	Member	Indian Oil Corporation Ltd, Marketing Division, Tikri Kalan, Ghevra More, Rohtak Road, Tikri Kalan, Delhi	7800203000	cashok@indianoil.in
14	Sh. G.P. Singh, Chief Water Analyst	Member	Haiderpur Water Treatment Plant, Haiderpur, Delhi	9650039741	cwaws2.djb@gmail.com
15	Sh. Ashok Kumar Tanwar, Sr. Instructor	Member	Room No. 32, Civil Defence Office, O/o District Magistrate North-West, Kanjhawala, Delhi-110081	9810072193	dcdo.outer@gmail.com
16	Sh. Kanta Prasad, Trade Union Member	Member	J-1413, Jahangir Puri, Delhi	9811271724	

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 District Magistrate/DOEC office.

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 flammable and toxic materials 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, local Crisis Group, the concerned industries and other stakeholders. Few copies of the plan shall be made available at "Emergency Response Centre".

6.5 AMENDMENTS IN PLAN:

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
4. hazard industry/ installations, major railway/ road accidents, air raids and the natural calamities e.g. Earth quake, flood, lighting etc.
5. 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.
6. 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.
7. 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.
8. Issue instructions, standing orders to all departments, organisations, MAH Installations and services to prepare and act in accordance with the Off-site Emergency plan.
9. Be familiar with the Major Accident Hazard Installations as well as possible effectson MAH installations due to natural calamities.
10. Ensure the training of all the members of Off-site Emergency Plan.
11. Ensure awareness in respect of the public emergency preparedness through News Paper, Radio, T.V. etc.
12. Hold periodical mock/training exercise to ensure optimum operational preparedness. Evaluate and review the mock drill reports.
13. 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 ROLE & 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 Controllerto 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 Hazard 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 Hazard Installations and suggest/ arrange to procure the additional equipment /facilities.

7. Review the adequacy of fire prevention arrangements in Major Accident Hazard Installations and suggest to make adequate fire prevention arrangements.
8. Participate in mutual aid programme/ scheme with Major Accident Hazard 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 Hazard 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 Hazard 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 Hazard 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 hazard installation and district administration.
7. Advise the District administration for the development of additional fire fighting personnel/ requirement of additional equipment etc.
8. Seek help of police/ civil defence in fire fighting 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 fire fighting facilities used.
5. Record the lapses/ promptness in action during fire fighting 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 Hazard 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 Hazard Installations.
6. To control the encroachment/ congestion on the roadways leading to Major Accident Hazard 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 hazard 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 Hazard 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 Hazard (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.

7.6 ROLES & RESPONSIBILITIES OF THE DISTT. MEDICAL OFFICER:

1. Keep a list of Major Accident Hazard 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 Hazard 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 Hazard 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 NORTH DELHI MUNICIPAL CORPORATION (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 fire fighting 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 AND 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 ou 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 & 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

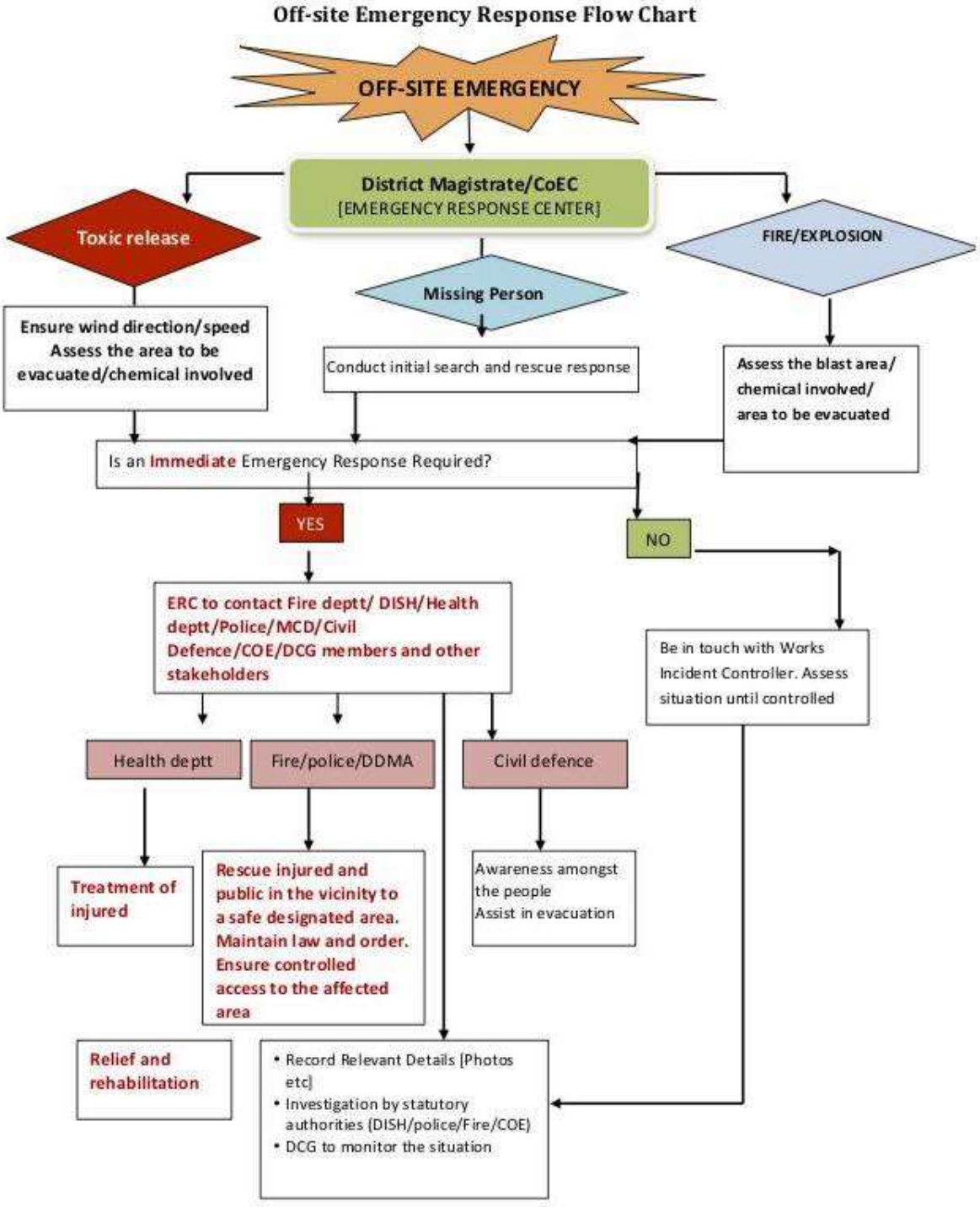
Technical Experts:
Promptly respond to provide the necessary technical advice to MAH Installation, DM, Factory Inspectors, Fire Department, and Medical Department among others.
Provide on-phone help after properly understanding and assessing the situation.
Make visit to the site in co-ordination with 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 DEA, Police and other Authorities. Act responsibly in disseminating vital information and dispel rumors, 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 administration, 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, North-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, North-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.

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 station 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 situation has to be conveyed by ERC to others for information and 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 District Magistrate.

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 North-West assisted by the various departments. The functions 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 District Magistrate, 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 Magistrate has definite role in implementation of PLI 1991 as mentioned in hereunder.

i. Whenever it comes to the notice of the District Magistrate 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 ASSESSMENT AND TESTING OF PLAN:

The mock drill of the Off-site Emergency Plan shall be conducted once 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 provides 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, fine tuning 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.

10.0 LIST OF HOSPITALS IN NORTH-WEST DELHI:

10.1 NEAR TO IOCL BOTTLING PLANT & IOCL TIKRIKALAN TERMINAL:

S.No	Name of Hospital	Contact Number
1.	Cygnus Sonia Hospital, Nangloi	8750060177
2.	Jaipur Golden Hospital, Sector-3, Rohini	011-27907000
3.	Sri Balaji Action Medical Institute, Paschim Vihar	011-42888888
4.	Maharaja Agrasen Hospital, Shivaji Park, Punjabi Bag	011-25226645
5.	Max Hospital, Pitampura	011-47351844
6	Orchid Hospital & Heart Centre C-3/91-92, Block C3A, Janakpuri, Delhi 110058	011-45654565
7	Agrasen Hospital Punjabi Bagh Dwarka Flyover, Pocket 4, Sector 1, Dwarka, Delhi 110045	(011) 25226645
8	Max Healthcare Pitampura, A-2, PP Tower,, Netaji Subhash Place, Pritampura, Delhi 110034	011- 47351844
9	Sonia Hospital,1, Rohtak Road, Gulshan Park, Nangloi, Delhi 110041	011-66227368

10.2 NEAR HAIDERPUR WATER TREATMENT PLANT:

SN	Hospital	Contact Number
1.	Santom Hospital, D-56, Prashant Vihar, Sector-14, Outer Ring Road, Delhi	011-27561024
2.	Max Hospital, FC-50, Shalimar Place Site, Shalimar Bagh, Delhi-110088	011-66422222
3	Saroj Multi Specialility Hospital, Near Madhuban Chowk, Block-A, Sector-14, New Delhi-110085	011-47903333
4.	Ambedkar Hospital, Bhagwan mahavir Marg, Sector-6, Rohini, Delhi	011-27933258
5.	Babu Jagjivan Ram Hospital, Near ITI, D-Block, Jahangirpuri, Delhi	011-27636955

11.0 FIRE FIGHTING ARRANGEMENTS:

11.1 LIST OF FIREFIGHTING AND SAFETY EQUIPMENT'S AVAILABLE WITH IOCL TIKRIKALAN TERMINAL:

S.No	Name Of Equipments	Availability
1	Fire Water Storage (Kl)	8600
2	Fire Pump Capacity 615 (Kl/H),105m Head	5
3	DCP Extinguisher 9/10 Kg	137
4	DCP Extinguisher 25 Kg	18
5	DCP Extinguisher 75 Kg	6
6	CO_2- Fire Extinguisher 4.5 Kg	22
7	Fire Hoses	94
8	Jet Nozzle	34
9	Fog Nozzles	4
10	Universal Nozzle	4
11	CO_2 Cartridge 200gm_10kg Dcp Fe	45
12	CO_2 Cartridge 1kg_75kg Dcp Fe	6
13	Water Curtain Nozzle	2
14	Double Headed Hydrant	47
15	AFFF(Kl)	17
16	Water Cum Foam Monitor	48
17	9 Lit Sand Bucket & Stand	3
18	Multi Gas Detector	1
19	Resuscitators	2
20	Fire Proximity Suit	2
21	Hand Operated Siren	8
22	Sand Drum With Scoops	5
23	Scaba With Spare Cylinder	2
24	ATC Foam (Kl)	6
25	Water Jel Blankets	1
26	Stretcher	2
27	First Aid Box	5

28	Rubber Hand Gloves (Pair)	2
29	Foam Compound Trolley200/210	2
30	Electric Siren (3 Km Range)	1
31	Manual Call Point	17
32	MEFG (Medium Expansion Foam Generator)	8

11.2 LIST OF FIREFIGHTING AND SAFETY EQUIPMENT'S AVAILABLE WITH IOCL LPG BOTTLING PLANT, TIKRIKALAN

S. No	Name Of equipment	Availability
1	9/10 KG DCP FE	271
2	75 KG DCP FE	16
3	Fire Water Storage (KL)	15000
4	Fire Engines (700 KLPH)	6
5	Jockey Pumps	2
6	Fire Hoses	225
7	Jet Nozzles	94
8	Fog Nozzles	2
9	Universal Nozzles	2
10	Water curtain Nozzles	2
11	Water Monitors	86
12	Hydrant Points	90
13	4.5 KG CO2 FE	6
14	CO2 Cartridge 200gm	100
15	CO2 Cartridge 2KG	6
16	DCP Powder	500 Kg
17	Safety Helmet	115
18	Stretcher with blanket	2
19	First Aid Box	2
20	Rubber Hand Gloves	02 Pairs
21	Explosi meter	2
22	Fire Proximity Suit	1
23	Resuscitators	2
24	Electrical siren (1 km range)	3
25	Hand operated siren	19
26	Water Jel Blankets	2
27	Red/Green flags for Fire drill	2

28	SCABA with spare cylinder	1
29	PA System	1
30	Hose box	90
31	First Aid Trolley	1
32	No of DVs	59

11.3 CHLORINE SAFETY EQUIPMENTS AT HAIDERPUR WATER TREATMENT PLANT:

Sl. No.	Name of equipments	Quantity
1.	Chlorine Leak Absorption System	3
2.	Alarm Hooter	3
3.	Breathing Apparatus	2
4.	Air Breathing Apparatus	3
5.	Leak Detector	3
6.	Tonner Roller Support	22
7.	Chlorine Tonner Hood	2
8.	Emergency Shower System	3
9.	Automatic Hoist	3
10.	Head Operated Sensor	6
11.	Stretcher	1
12.	Gum Boot (Pairs)	4
13.	First Aid Box	1
14.	Helmet	4
15.	Hand Gloves (Pairs)	6
16.	Safety Belt	1
17.	Wind Socks	1
18.	Emergency Kit	1

11.4 MUTUAL AID AGREEMENT:

Sr No.	Name of the Members	Represented By (Name & Designation)	Mobile No
1.	IOCL LPG Bottling Plant, Tikri Kalan	Mr. Naro Tundup, DGM(P) Incharge	9910805962
2.	IOCL LPG Bottling Plant, Tikri Kalan	Mr. Sudhir Nanda, Sr. Mgr(LPG-Safety)	9883230464
3.	IOCL LPG Bottling Plant, Tikri Kalan	Mr Sahil Singla,Manager(P),(M&I)	8588846605
4.	IOC Tikri Kalan Terminal, Delhi	Mr. Niraj Kumar, GM(T), TikriKalan Terminal	9667774275
5.	IOC Tikri Kalan Terminal, Delhi	Mr. Ravinder Kumar Kaushik, CM(T), TikriKalan Terminal	9971441166
6.	IOC Tikri Kalan Terminal, Delhi	Mr. Ashok Chaudhary, Mgr(Ops. Safety), Tikri Kalan terminal	7800203000
7.	HPCL Delhi Terminal	Mr. Dilbagh Rai Washal (DGM I/C)	9869583100
8.	HPCL Delhi Terminal	Mr. Navneet Pandey (HPCL PPL)	8004497758
9.	HPCL Delhi Terminal	Mr. Siddharta Das (Dy. Mgr.)	9007110255
10.	HPCL Delhi Terminal	Mr. Lavneet (Mgr- Safety)	8708621007
11.	HPCL Asauda Terminal, Bahadurgarh	Mr. Siddharth Singh (DM(HSE))	01276280013
12.	HPCL Asauda Bottling Plant, Bahadurgarh	Mr. D Mahapatra	01276280007
13.	Jeewan Jyoti hospital, Bahadurgarh	Reception	01276267070
14.	Maharaja Agersen Hospital, Punjabi Bagh	Emergency	01125226645
15.	Sonia Hospital Nangloi	Ambulance	01166227368
16.	Jaipur Golden Hospital, Rohini	Reception	01127907000
17.	Max Healthcare	Pitampura	01147351844

12.0 IMPORTANT CONTACT NUMBERS:

12.1 IOCL - LPG BOTTLING PLANT:

Sr. No	Name	Designation	Contact no
1.	Sh. Shyam Bohra	ED, Delhi State Office	8929670719
2.	Sh. Alok Kumar	CGM I/c (LPG, DSO)	
2.	Sh. S K Aggarwal	GM(LPG-O), DSO	9426568453
3.	Sh. Ashutosh Tiwari	GM (LPG-O), DSO	9167007034
4.	Sh. Naro Tundup	DGM (P) Delhi BP/ Works Incident Controller	6375995962
5.	Sh. Tulsi Ram Khatri	Chief MGR (P) Delhi BP/ Site Incident Controller	9974163122
6.	Maj Sudhir Nanda	Sr. Mgr. (LPG-Safety) Delhi BP	9883230464
7.	Sh. Sahil Singla	Manager (Plant) , Delhi BP	8588846605

12.2 IOCL TIKRI KALAN:

Sr. No.	Name	Designation	Phone Number
1	Mr. Niraj Kumar	GM(T)/ Works Incident Controller	9667774275
2	Mr. Rishabh Bhatia	SM(T)	9005555692
3	Mr. Gyan Singh Patel	Mgr (Ops-Im)	9415248968
4	Mr. Pawan Kumar	Mgr (Lab)	9411166218
5	Mr. Ashok Chaudhary	Mgr (Ops-Saf)	7800203000
6	Ms. Ritu Sharma	AM(Ops- Im)	7289860121
7	Mr. Naresh Chand Saxena	PA(Grd 07)	9811007022
8	Mr. Ravinder Kaushik	Chief Mgr/ SiteIncident Controller	9971441166

12.3 HAIDERPUR WATER TREATMENT PLANT:

SL NO	Name	Designation	Contact no
1.	Sh. Sandeep Kapur	Superintending Engineer/ Works Incident Controller	9650291464
2.	Sh. Sunil Kumar	Executive Engineer/ Site Incident Controller	9999379538
3.	Sh. Arun Sharma	ACWA	9891467663
4.	Sh. Y.S. Rana	Assistant Engineer	9650334467

12.4 DISTRICT ADMINISTRATION:

S.No.	Name with designation	Designation	Contact Number
1	Ms. Cheshta Yadav, (IAS)	District Magistrate	01125953785
2	Sh. Amit Kumar	Addl. District Magistrate	011-25953786
3	Sh.Arun Gupta-SDM	SDM (HQ)	011-25953375
4	Ms. Vijayanta Arya	DCP (NW)	011-27229835
5	Sh. Manmohan Singh	ACP (HQ) NW	8700633107
6	Sh. Sejup Kurvilla	DCP Outer	011-27034874
7	Sh. Rajinder Paul	ACP (HQ) Outer	011-27011090
8	Sh. S.D. Mishra	DCP (Rohini)	011-27579004
9	Smt. Parvati Devi	ACP9HQ) Rohini	011-27061749
10	Sh. Pinkesh Kumar, Dy. Director (ISH)/Dy. CIF	Member-Secretary	9868321010
11	Sh. R. B. Singh, Asstt. Director (ISH)/Inspector of Factories	-do-	9818829355
12	Sh. R. N. Meena, Joint Chief	Member Controller of Explosives	0129-2410739 0129-2410731
13	Sh. Dharampal Bhardwaj, Dy. CFO	Delhi Fire Service	9810445332
14	Dr. Meenakshi Hembrum, Medical Officer	Chief District Medical Officer	011-27867278

15	Mohd. Aarif,	Sr. Environmental Engineer (DPCC)	9717593510
16	Sh. Vivek Pakash, Deputy Commissioner (MCD-Rohini)	Deputy Commissioner – MCD Rohini	9711353866
17	Sh. Hem Dutt Dixit	Senior ICD	011-25952859
18	Sh. Ashok Kumar Tanwar, Sr. Instructor, Civil Defence, North-West	Member	9810072193
Hospital Numbers			
1	A.I.I.M.S		26589540, 26588776, 26588900
2	Safdarjung Hospital		26165032, 26168336, 26165060, 26168337
3	Jaipur Golden Hospital		413296832
4	Indian Spinal Injuries Centre		26894884, 26896642, 26898448,

13.0 MATERIAL SAFETY DATA SHEET:

13.1 CHEMICAL IDENTITY (LPG):

Chemical Name	Liquefied Petroleum Gas		Chemical Classification	Hydrocarbon Mixture	
Synonyms	LPG, Propane, Butane, Propylene, Purofax, Bottled Gas		Trade Name	LPG	
Formula	C_3H_8 & C_4H_{10} (Mixture)	C.A.S. NO.	68476-85-7	UN NO.	1075
Regulated Identification	Shipping Name Codes/Label Hazardous waste I.D. No. Hazchem Code	Petroleum Gases, Liquefied Flammable, Class 2 2 WE			
HAZARDOUS INGREDIENTS	C.A.S. NO.	HAZARDOUS INGREDIENTS	C.A.S. NO.		
1. Propane	74-98-6	3. Propylene	115-07-1		
2. Butane	106-97-8				

PHYSICAL AND CHEMICAL DATA

Boiling Point/ Range ^{o}C Melting/ Freezing Point ^{o}C	> -40 Not Pertinent	Physical State Vapour pressure @ 35 ^{o}C, mm Hg	Gas at 15^{o}C and 1 atm Not available	Appearance Odour	Colourless Mercaptan added as an odouriser
Vapour Density (Air = 1)	1.5	Solubility in water @ 30 ^{o}C	Slight	Solubility in others	Soluble in Organic Solvents, Alcohol
Specific Gravity (Water = 1)	0.51 – 0.58 at 15 ^{o}C	pH	Not pertinent		

FIRE AND EXPLOSION HAZARD DATA

Flammability TDG Flammability	Yes 2	LEL (%V) UEL (%V)	1.9% 9.5%	Flash Point (OC) ^{o}C Flash Point, (CC) ^{o}C	 - 104.4
Auto ignition Temperature ^{o}C Explosion Sensitivity to Impact Explosion Sensitivity to Static Electricity Hazardous Combustion products Hazardous Polymerization		466.1 Propane, 405 Bunate Not established May explode Emits CO, CO_2 Does not occur			
Combustible Liquid	No	Explosive Material	No	Corrosive Material	No
Flammable Material	Yes	Oxidiser	No	Others	
Pyrophoric Material	No	Organic Peroxide	No		

REACTIVITY DATA

Chemical Stability	Stable
Incompatibility with other material	Strong Oxidisers
Reactivity	No reaction with common materials but may react with oxidising materials
Hazardous Reaction Products	Not available

HEALTH HAZARD DATA

Routes of Entry Effects of Exposure/ Symptoms	Inhalation, Skin Concentration in air greater than 10% causes dizziness in few minutes. 1% conc. Gives the samesymptoms in 10 mts. High concentration causes asphyxiation. Liquid on skin causes frostbite.
Emergency Treatment **Inhalation** **Contact**	Seek medical aid immediately If inhaled, remove the victim to fresh air area. Provide artificial resuscitation. Skin : Remove the wetted clothes & wash the affected area with plenty of water Eyes : Flush with plenty of water for 15 min.

LD_{50} (Oral-Rat), mg/kg	Not listed	LD_{50} , mg/kg	
Permissible mg/kg Exposure Limit ppm	Not listed Not listed	Odor Threshold, ppm mg/kg	5000 to 20000
TLV (ACGIH) ppm mg/kg	1000 1800 mg/m^3	STEL, ppm mg/kg	Not listed Not listed

NFPA Hazard Signals	Health 1	Flammability 4	Reactivity/ Stability 0	Special

PREVENTIVE MEASURES

Personal Protective Equipment	Avoid contact with liquid or gas
Handling and Storage Precautions	Provide hand gloves, safety goggles, gas mask, protective over-clothing and shoes

EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	CO_2, Dry Chemical Powder, Water spray.
	Special Procedure	Keep the containers cool by spraying water if exposed to fire or heat
	Unusual Hazards	If not cooled sufficiently, containers will explode in fire.
EXPOSURE	First Aid Measures	If inhaled, remove the victim to open air area and artificial resuscitation may be provided if required. If skin is affected with the liquid, remove the clothing & wash the affected area with plenty of water. Seek medical aid.
	Antidotes/ Dosage	Not available
SPILLS	Steps to be taken	Shut off leaks if without risk. Warn everybody that air mixture is explosive.
	Waste Disposal Method	Allow gas to burn under control

ADDITIONAL INFORMATION/ REFERENCES

Avoid contact with oxidisers. Olefinic impurities may lead to narcotic effect or it may act as a simple asphyxiant. A very dangerous hazard when exposed to heat or flame. If fire is big, keep surrounding areas cool by spraying water.

13.2 MOTOR SPIRIT:

MATERIAL SAFETY DATA SHEET

Motor Spirit (MS)

Chemical Identity

Chemical Name : Petrol Trade Name : Petrol
Chemical Classification : Flammable Liquid
Synonyms : Gasoline, Motor spirit
Formula : Mixture of hydrocarbons
C.A.S. No. : 8006-61-9 U.N.No. : 1203
Shipping Name : Gasoline, Petrol
Hazchem Code : Class 3
Hazardous waste ID No: N.A.
Hazardous Ingredients : Gasoline
C.A.S. No. 8006-61-9

Hazardous Ingredients	C.A.S. No
n-Hexane Trace	110-54-3
Benzene Trace	71-43-2

Gasoline is complex mixture of hydrocarbons. It's exact composition depends on the source of crude oil from which it is produced and the refining methods used.

Physical & Chemical Data

Boiling Point/Range (°C) : 30 to 215 C
Physical State : Liquid
Appearance : Orange, Red
Melting/freezing point (°C) : -90 to -75.
Vapor pressure : 300 to 600 mm Hg (20°C)
Odor : Characteristic odor Vapor density: 3-4
solubility in water @ 30°C : 1-100ppm /100 ml water
Specific Gravity 0.75-0.85 at 20°C.
pH : NA Others : Floatability (water): Floats;

Fire & Explosion Hazard Data

Flammability : Yes ignited by Sparks/flames.
LEL : 1.4%
UEL : 7.6%
Flash Point(OC) : Typically about -38 to -42 (CC)
TDG Flammability: Class 3
Ignition Temp (°C) : 456
Explosion Sensitivity to Impact : Not sensitive to Mechanical Impact
Explosion Sensitivity to Static Electricity : For vapors sensitivity exist.
Hazardous Combustion Products : Carbon Monoxide, Nitrogen Oxide & Other Aromatic Hydrocarbons.
Hazardous Polymerization : N.A.
Combustible Liquid : Yes
Explosive Material : Yes
Corrosive Material : No
Pyrophoric Material : N.A.
Flammable Material : Yes Oxidiser : N.A.
Organic Peroxide : N.A. Others : N.A.

Reactivity Data

Chemical Stability : Stable
Incompatibility with other material : Oxidizers such Peroxides ,Nitric acid & Perchorates
Hazardous reaction products : On fire it will liberate some amount carbon monoxide, Nitrogen oxide & other aromatic hydrocarbons.

Health Hazard Data

Routes of Entry : Inhalation, Skin absorption, ingestion
Effects of Exposure/ Symptoms :
Inhalation : excessive inhalation Vapors cause rapid breathing, excitability, staggering, headache ,fatigue ,nausea and vomiting, dizziness, drowsiness, narcosis convulsions, coma.
Skin Contact : Skin-dryness, cracking, irritation eyes watering, stinging and inflammation.
Emergency treatment : In case of contact with Skin flush with fresh water, remove containment clothing, in case of excessive inhalation move the victim to fresh air, obtain medical assistance.
TLV (ACGIH) : 300 ppm STEL: 500
Permissible Exposure limit : $L.D_{50}$ (Oral-Rat) : 13.6 g/kg
$L.C_{50}$: (rat for 4hrs) 43g/m3
Odor Threshold : N.A.
NFPA Hazard signal Health : 0 Flammability : 3
Reactivity : 0 Special : Nil

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. Keep away from oxidising agents.

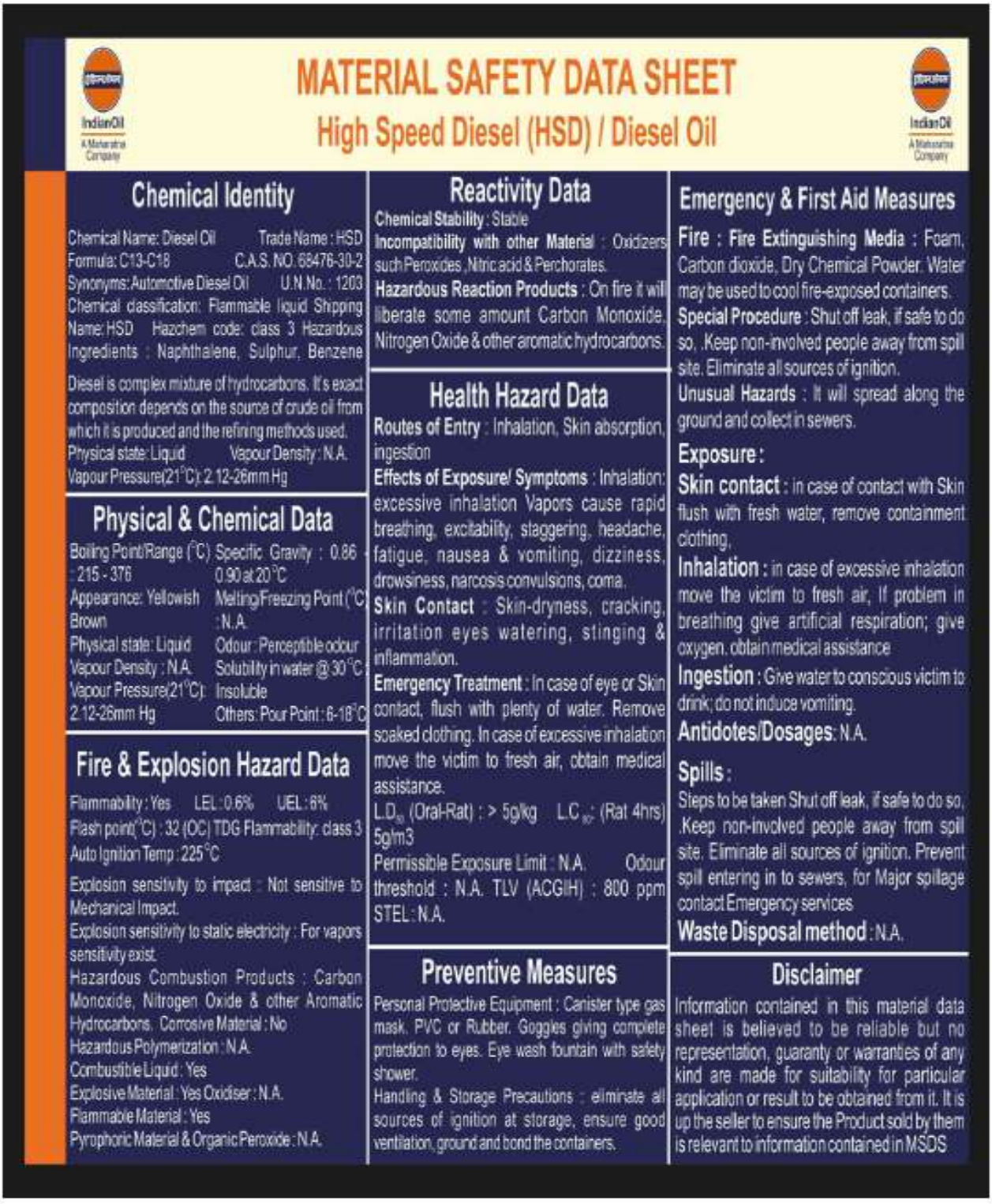
Emergency & First Aid Measures

Fire : Fire Extinguishing Media : Foam, Carbon dioxide, Dry Chemical Powder. Water may be used to cool fire-exposed containers.
Special Procedure : Shut off leak, if safe to do so, .Keep non-involved people away from spill site. Eliminate all sources of ignition.
Unusual Hazards : It will spread along the ground and collect in sewers.

Exposure :
Skin contact : in case of contact with Skin flush with fresh water, remove containment clothing.
Inhalation : in case of excessive inhalation move the victim to fresh air, If problem in breathing give artificial respiration; give oxygen, obtain medical assistance
Ingestion : Give water to conscious victim to drink; do not induce vomiting.
Antidotes/Dosages: N.A.

Spills :
Steps to be taken Shut off leak, if safe to do so, .Keep non-involved people away from spill site. Eliminate all sources of ignition. Prevent spill entering in to sewers, for Major spillage contact Emergency services
Waste Disposal method : N.A.

13.3 HIGH SPEED DIESEL:



MATERIAL SAFETY DATA SHEET

High Speed Diesel (HSD) / Diesel Oil

Chemical Identity

Chemical Name: Diesel Oil Trade Name : HSD
Formula: C13-C18 C.A.S. NO.:68476-30-2
Synonyms: Automotive Diesel Oil U.N.No. : 1203
Chemical classification: Flammable liquid Shipping Name: HSD Hazchem code: class 3 Hazardous
Ingredients : Naphthalene, Sulphur, Benzene

Diesel is complex mixture of hydrocarbons. It's exact composition depends on the source of crude oil from which it is produced and the refining methods used.
Physical state: Liquid Vapour Density : N.A.
Vapour Pressure(21°C): 2.12-26mm Hg

Physical & Chemical Data

Boiling Point/Range (°C) : 215 - 376
Specific Gravity : 0.86 - 0.90 at 20°C
Appearance: Yellowish Brown
Melting/Freezing Point (°C) : N.A.
Physical state: Liquid
Odour : Perceptible odour
Vapour Density : N.A.
Solubility in water @ 30°C : Insoluble
Vapour Pressure(21°C): 2.12-26mm Hg
Others: Pour Point : 6-18°C

Fire & Explosion Hazard Data

Flammability : Yes LEL : 0.6% UEL : 8%
Flash point(°C) : 32 (OC) TDG Flammability: class 3
Auto Ignition Temp : 225°C

Explosion sensitivity to impact : Not sensitive to Mechanical Impact.
Explosion sensitivity to static electricity : For vapors sensitivity exist.
Hazardous Combustion Products : Carbon Monoxide, Nitrogen Oxide & other Aromatic Hydrocarbons. Corrosive Material : No
Hazardous Polymerization : N.A.
Combustible Liquid : Yes
Explosive Material : Yes Oxidiser : N.A.
Flammable Material : Yes
Pyrophoric Material & Organic Peroxide : N.A.

Reactivity Data

Chemical Stability : Stable
Incompatibility with other Material : Oxidizers such Peroxides ,Nitric acid & Perchorates.
Hazardous Reaction Products : On fire it will liberate some amount Carbon Monoxide, Nitrogen Oxide & other aromatic hydrocarbons.

Health Hazard Data

Routes of Entry : Inhalation, Skin absorption, ingestion
Effects of Exposure/ Symptoms : Inhalation: excessive inhalation Vapors cause rapid breathing, excitability, staggering, headache, fatigue, nausea & vomiting, dizziness, drowsiness, narcosis convulsions, coma.
Skin Contact : Skin-dryness, cracking, irritation eyes watering, stinging & inflammation.
Emergency Treatment : In case of eye or Skin contact, flush with plenty of water. Remove soaked clothing. In case of excessive inhalation move the victim to fresh air, obtain medical assistance.
LD_{50} (Oral-Rat) : > 5g/kg LC_{50} (Rat 4hrs) 5g/m3
Permissible Exposure Limit : N.A. Odour threshold : N.A. TLV (ACGIH) : 800 ppm STEL : N.A.

Preventive Measures

Personal Protective Equipment : Canister type gas mask. PVC or Rubber. Goggles giving complete protection to eyes. Eye wash fountain with safety shower.
Handling & Storage Precautions : eliminate all sources of ignition at storage, ensure good ventilation, ground and bond the containers.

Emergency & First Aid Measures

Fire : Fire Extinguishing Media : Foam, Carbon dioxide, Dry Chemical Powder. Water may be used to cool fire-exposed containers.
Special Procedure : Shut off leak, if safe to do so, .Keep non-involved people away from spill site. Eliminate all sources of ignition.
Unusual Hazards : It will spread along the ground and collect in sewers.

Exposure :
Skin contact : in case of contact with Skin flush with fresh water, remove containment clothing,
Inhalation : in case of excessive inhalation move the victim to fresh air, If problem in breathing give artificial respiration; give oxygen. obtain medical assistance
Ingestion : Give water to conscious victim to drink; do not induce vomiting.
Antidotes/Dosages: N.A.

Spills :
Steps to be taken Shut off leak, if safe to do so, .Keep non-involved people away from spill site. Eliminate all sources of ignition. Prevent spill entering in to sewers, for Major spillage contact Emergency services
Waste Disposal method : N.A.

Disclaimer

Information contained in this material data sheet is believed to be reliable but no representation, guaranty or warranties of any kind are made for suitability for particular application or result to be obtained from it. It is up the seller to ensure the Product sold by them is relevant to information contained in MSDS

13.4 XTRA PREMIUM:

MATERIAL SAFETY DATA SHEET
XTRA PREMIUM

IndianOil
A Maharatna Company

Product Information

Product Name : P 994 **Form** : Liquid **Color** : Amber **Vapor Density** : >1 (Air=1)
Chemical Gas : Nitrogenous & Hydrocarbonic compounds in solution in all solvents.
Temp. Phase Change : Flowing Point < 30 °C **Specific Gravity** : 0.91-0.94
Temp. Auto Inflammation : > 400 °C Flash Point : More than 55 °C **Odor** : Aromatic Solvent

Fire & Explosion Data

Extinguishing Media : Suitable CO2, DCP & Foam. **Not Recommended** : Water jet
Protective measures for the Fire Fighters : Use water curtains to protect the personnel. Insulated breathing apparatus must be worn in confined space with heavy concentration of fumes and gases.

Emergency & First Aid Precautions

Eye Contact : Keep eyes open & rinse immediately and repeatedly with water for at least 15 minutes.
Skin Contact : Remove contaminated clothing immediately, then wash with soap and water.
Inhalation : In case exposure to intense concentration of vapors, fumes or spray, transport the person away from the contaminated zone, keep warm and allow to rest.
Ingestion : Do not induce vomiting. Get medical attention immediately.

Accidental Release Measures

Personal Protection : As applicable in view of risk of exposure, wear suitable protective clothing, gloves goggles & boots.
Spill cleanup Method : Recovery : Contain and recover by physical means. Absorb with inert, damp, non-combustible material, then flush are with water.
Elimination : Hand over contaminated materials to an approved collector.

Handling & Storage

Handling

Prevention of User Exposure : Ventilate extensively if the formation of vapors, fumes, mists or aerosol is a risk. Handle in well ventilated premises. Keep the product away from food and beverages. Avoid handling vapors. Avoid contact with the skin and mucous membranes. Do not smoke. Wear suitable protection and protective clothing.
Prevention of fire and explosion : prevent any build up of static electricity. Make provision of water network to avoid any spread of fire.
Precautions : Avoid static electricity build up with connection to earth. do not eat or drink or smoke during use.

Storage

Technical measures prevent any build up of static electricity. storage precautions suitable keep containers closed when not in use. Incompatible products dangerous reaction with strong oxidizing agents
Packaging Material : Use only hydrocarbon resistant containers, joints, pipes, etc

13.5 DORF:

IndianOil
A Maharatna Company

MATERIAL SAFETY DATA SHEET
DORF

IndianOil
A Maharatna Company

Product Information

Product Name : DORF 1440
Chemical Family : Organic Mixture
Physical Appearance : Liquid
Color : Clear yellow to brownish liquid
Viscosity : 20-90 cSt @ 40°C
Odour : Aminic
pH : 5.1 (suspension 1% in water)
Flash point(COC) : Min 90°C
Relative density/Sp. Gr. : 0.97-1.00 @ 15.6 °C
Water solubility @23 °C : < 0.1
Solubility : Soluble in aromatic solvents
Acute Toxicity : LD_{50}/oral/rat = > 2000 mg/kg

Hazard Identification & First Aid Precautions

Eye Contact : Keep eyes open & rinse immediately and repeatedly with water for at least 15 minutes.
Skin Contact : Remove contaminated clothing immediately, then wash with soap and water.
Inhalation : In case exposure to intense concentration of vapors, fumes or spray. transport the person away from the contaminated zone, keep warm and allow to rest.
Ingestion : Do not induce vomiting. Get medical attention immediately.Affected person should drink 500-800 ml water, if possible with suspended activated carbon for medical use. In case of spontaneous vomiting be sure that vomitus can freely drain because of danger of suffocation. Give water repeatedly.

Fire Fighting Measures

Flash Point : Min 90EC (COC)
Suitable Extinguishing Media : Warm mist; Carbon Dioxide; Foam; Dry powder.
Unsuitable Extinguishing Media : High pressure water jet.
Fire And Explosion Hazards : Thermal decomposition or burning may release oxides of carbon, nitrogen and other toxic gases or vapors. Do not release chemically contaminated water into drains, soil or surface waters. Sufficient measures must be taken to retain water used for extinguishing. Dispose of contaminated water and soil according to local regulations.
Special Protective Equipment : Use full protective clothing for chemicals and self contained breathing apparatus.

Accidental Release Measures

Personal Protection : Avoid contact with skin, eyes and clothing.
Environmental Precautions : Prevent contamination of soil, drains and surface waters.
Clean-up : Take up with absorbent, inert material (e.g. Kieselghur, sand) and place in suitable and closable container for disposal.

Handling & Storage

Handling : Dangerous for the environment. Handle with care. Ensure good ventilation and local exhaust. Do not eat, drink or smoke at the workplace.
Storage : Keep away from food and drink. Store in the original container securely closed. Storage at under 100C may lead to partial solidification. To reliquify heat contents to 35 - 400C.

Exposure Control & Personal Protection

Engineering Measures : No special safety measures required.
Personal Protection Equipment : Avoid contact with skin, eyes and clothing. Handle in accordance with industrial hygiene and safety practice.
Eye Protection : Wear suitable goggles or face mask.
Hand Protection : Wear suitable gloves.
Skin & Body Protection : Wear overalls and closed footwear.
Respiratory Protection : In case of insufficient ventilation, wear suitable respiratory protective equipment.

13.6 BIO-DIESEL:

Chemical Product / General Product Name: BIODIESEL (B100) Synonyms: Fatty Acid Methyl Ester(FAME), Methyl Soyate, Rapeseed Methyl Ester (RME), Methyl Tallowate Product Description: Methyl esters from lipid sources CAS Number: Methyl Soyate: 67784-80-9; RME: 73891-99-3; Methyl Tallowate: 61788-71-2

Composition/Information on Ingredients

This product contains no hazardous materials.

Hazards Identification Potential Health Effects:

INHALATION: Negligible unless heated to produce vapors. Vapors or finely misted materials may irritate the mucous membranes and cause irritation, dizziness, and nausea. Remove to fresh air.

EYE CONTACT: May cause irritation. Irrigate eye with water for at least 15 to 20 minutes. Seek medical attention if symptoms persist.

SKIN CONTACT: Prolonged or repeated contact is not likely to cause significant skin irritation. Material is sometimes encountered at elevated temperatures. Thermal burns are possible.

INGESTION: No hazards anticipated from ingestion incidental to industrial exposure.

First Aid Measures

EYES: Irrigate eyes with a heavy stream of water for at least 15 to 20 minutes.

SKIN: Wash exposed areas of the body with soap and water.

INHALATION: Remove from area of exposure; seek medical attention if symptoms persist.

INGESTION: Give one or two glasses of water to drink. If gastro-intestinal symptoms develop, consult medical personnel. (Never give anything by mouth to an unconscious person.)

FIRE FIGHTING MEASURES

Flash Point (Method Used): 101°C min.
Flammability Limits: Not known

EXTINGUISHINGMEDIA: Dry chemical, Foam (AFFF), CO_2, water spray (fog). Water stream may splash the burning liquid and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES: Use water spray to cool drums exposed to fire.

13.7 LIQUID CHLORINE (CL2):

MATERIAL SAFETY DATA SHEET

CAS No: 7782-50-5
RTECS No: FO2100000
UN No: 1017 **Liquid Chlorine (Cl2)**
EC No: 017-001-00-7 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.	

14.0 ACRONYMS:

BLEVE: Boiling Liquid Expanding Vapour Explosion
CCG : Central Crisis Group
COEC : Chief Off-site Emergency Controller
CMG : Crisis Management Group
DCG : District Crisis Group
DCP : Deputy Commissioner of Police
DFS : Delhi Fire Service
DISH : Directorate of Industrial Safety & Health
DM : District Magistrate
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 Hazard
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
UEL: Upper Explosive Limit
UVCE: Unconfined Vapour Cloud Explosion

15.0 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 HygienistsACGIH 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 nonsensory 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 isdesigned 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 vapors 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

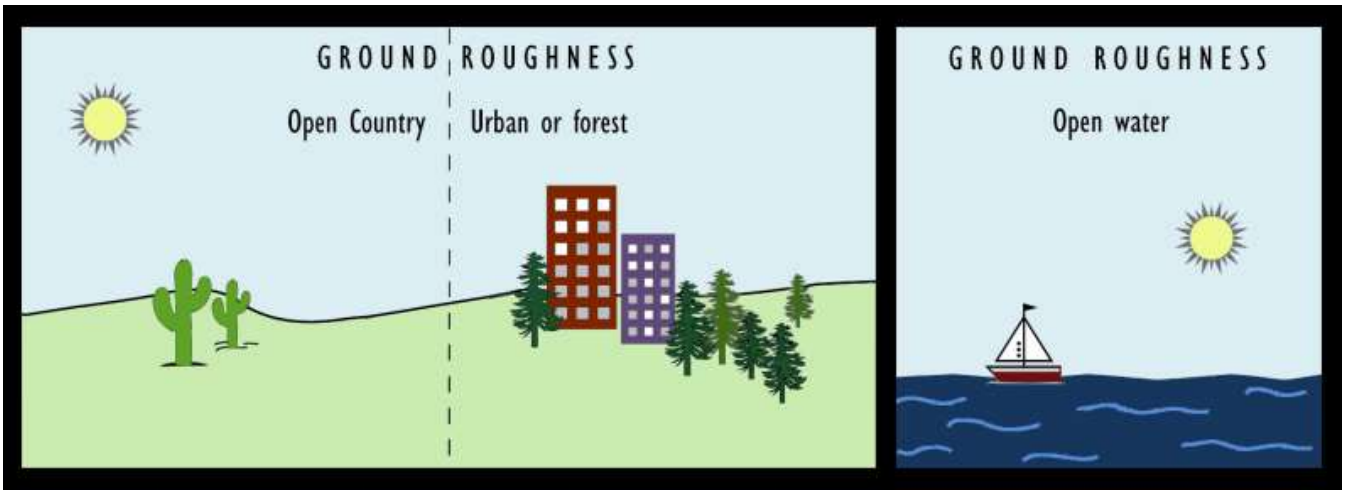
concentration is lowered (for example, by introducing fresh air), it will enter the explosive range. In reality, explosive limits for a material vary since they depend on many factors such as air temperature. Therefore the values given on an MSDS are approximate.

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 is 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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