CHAPTER 6
QUANTITATIVE RISK ASSESSMENT

6.1 OBJECTIVE OF THE STUDY

The main objective QRA (Quantitative Risk Analysis) is to determine the potential risks of major disasters having damage potential to life and property and provide a scientific basis for decision makers to be satisfied about the safety levels of the facilities to be set up. This is achieved by the following:

- Identification of hazards that could be realized from process plant.
- Identify the potential failure scenarios that could occur within the facility.
- To Asses, the potential risks associated with identified hazards to which the plant and its personal and community outside may be subjected. Consequences analysis of various hazards is carried out to determine the vulnerable zones for each probable accident scenario.
- Evaluate the process hazards emanating from the identified potential accident scenarios.
- Analyze the damage effects to the surroundings due to such accidents.
- Conclusion and Recommendation to mitigate measures to reduce the hazard / risks.
- To provide guidelines for the preparation of On-site response plan.

6.2 METHODOLOGY ADOPTED FOR QRA

Consequences of loss of containment can lead to hazardous situation in any industry handling potentially hazardous materials. Following factors govern the severity of consequence of the loss of containment.

- Intrinsic properties; flammability, instability and toxicity.
- Dispersive energy; pressure, temperature and state of matter.
- Quantity present
- Environmental factors; topography and weather.

Consequence analysis and calculations are effectively performed by computer software using models validated over a number of applications. Consequence modeling is carried out by PHAST (version 6.53) of DNV Software, UK.

PHAST uses the Unified Dispersion Model (UDM) capable of describing a wide range of types of accidental releases. The Model uses a particularly flexible form, allowing for sharp-edged profiles, which become more diffuse downwind.

PHAST contains data for a large number of chemicals and allows definition of mixtures of any of these chemicals in the required proportion. The calculations by PHAST involve following steps for each modeled failure case:

- Run discharge calculations based on physical conditions and leak size.
- Model first stage of release (for each weather category).
- Determine vapor release rate by flashing of liquid and pool evaporation rate.
- Dispersion modeling taking into account weather conditions.
- In case of flammable release, calculate size of effect zone for fire and explosion.

The hazardous materials considered in this study are mostly flammable liquids. Flow chart (Refer Fig.6.0) for consequence analysis is shown in the form of event tree for release of flammable liquid.

6.3 SCOPE OF THE STUDY

The Project will undertake QRA study for the solvent storage day tank farm area. Process plant area is not considered as there it's a batch process and in production area inventory of raw material, at a time, will be very low. Hence, a quantitative risk assessment (QRA) was under taken to assess the risk impacts associated with the Tanks & connected pipelines, and to establish whether these risks comply with the applicable criteria.

Table-6.1: Tanks covered in this QRA

SR. NO.	TANK ID	CHEMICAL STORED	CAPACITY	STORAGE CONDITION		ELEV. MT.	TANK DIM. MT.		DYKE DETAIL		
				Press.	Temp.		ID	Ht.	Hd	W	L
1.	Methanol Tank	Methanol	9KL	ATM	RT	0.15	1.8	3.5	0.36	0.31	3.3
2.	Reformer	Hydrogen	370 m^3	11.0	252	-	0.8	4.18	No dyke		
3.	Cylinder	Hydrogen	500 Kgs	140	RT	0.30	-	-	No dyke		
4.	ST-1105	CST	300	ATM	RT	-	6.5	9.0	1	15	125

Following flammable chemicals or solvents stored, used and handled in the premises.

Table-6. 2: Chemical covered in this QRA

Sr. No	solvents/Material	Flammability	Flash Point (^{0}C)	LEL-UEL
1	Methanol (Liquid)	Flammable (Pool fire, Jet fire, flash fire, overpressure)	16	6-36.5
2	Hydrogen	Flammable (Jet fire, flash fire, overpressure)	16	5

And the study will include following task:

- Hazard Identification
- Failure Scenario
- Consequence Analysis
- Dispersion Modeling
- Risk Assessment
- Evaluation of risk reduction options. and risk management plan

6.4 METROLOGICAL CONDITION

The consequences of released toxic or flammable material are largely dependent on the prevailing weather conditions. For the assessment of major scenarios involving release of toxic or flammable materials, the most important meteorological parameters are those that affect the atmospheric dispersion of the escaping material. The crucial variables are wind direction, wind speed, atmospheric stability and temperature. Rainfall does not have any direct bearing on the results of the risk analysis; however, it can have beneficial effects by absorption / washout of released materials. Actual behavior of any release would largely depend on prevailing weather condition at the time of release. For the present study we use the metrological data of the Mumbai.

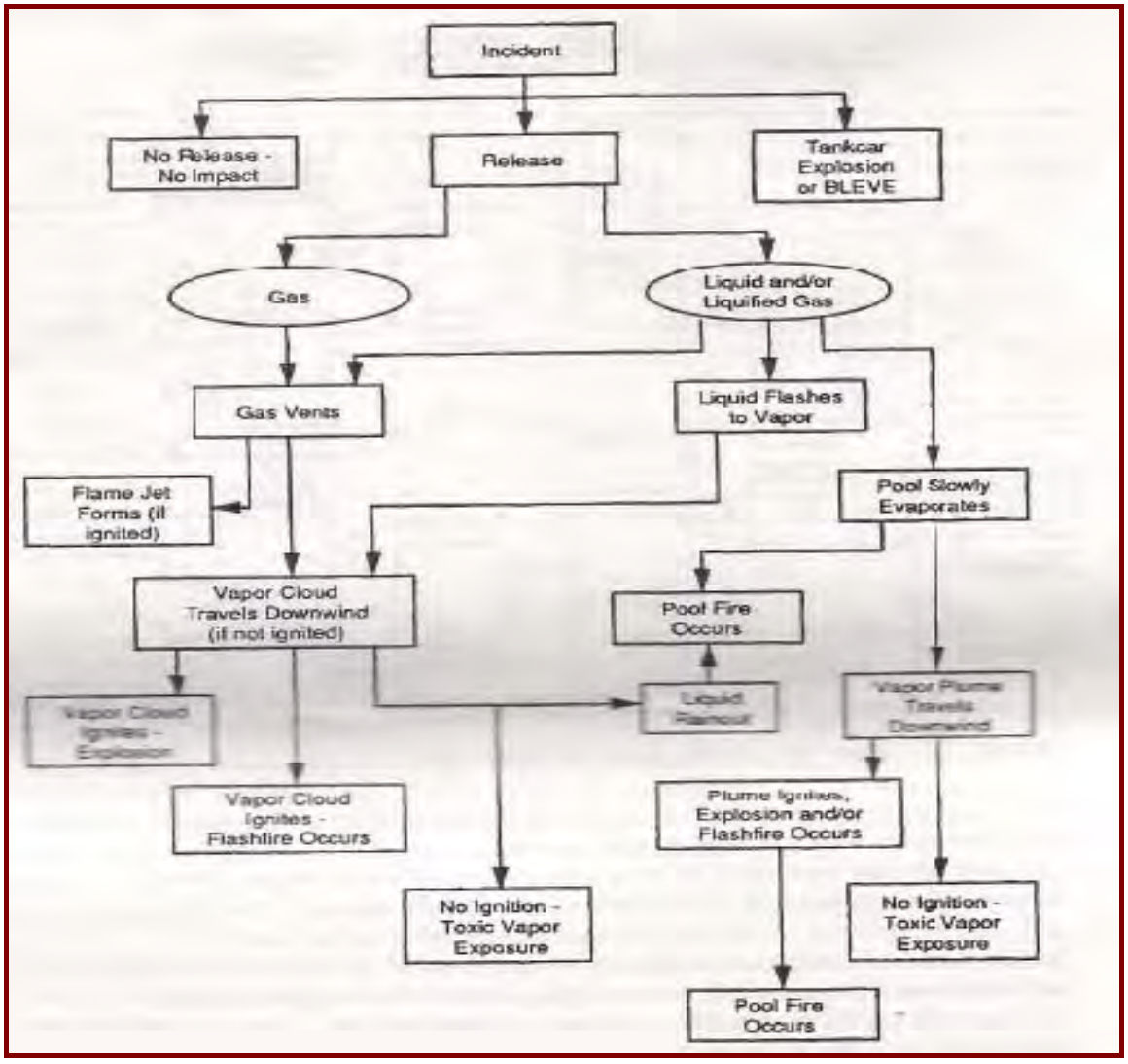

Figure-6.1 Methodology adopted for the study

6.4.1 ATMOSPHERIC PARAMETERS

The wind speed and wind direction data which have been used for the study is summarized below:

Wind Speed	: 1.50 m/s
Atmospheric Stability	: D and F
Wind Direction	: West
Relative humidity	: 70%

6.4.2 WEATHER CATEGORY

One of the most important characteristics of atmosphere is its stability. Stability of atmosphere is its tendency to resist vertical motion or to suppress existing turbulence. This tendency directly influences the ability of atmosphere to disperse pollutants emitted into it from the facilities. In most dispersion scenarios, the relevant atmospheric layer is that nearest to the ground, varying in thickness from a few meters to a few thousand meters. Turbulence

induced by buoyancy forces in the atmosphere is closely related to the vertical temperature gradient.

Temperature normally decreases with increasing height in the atmosphere. The rate at which the temperature of air decreases with height is called Environmental Lapse Rate (ELR). It will vary from time to time and from place to place. The atmosphere is said to be stable, neutral or unstable according to ELR is less than, equal to or greater than Dry Adiabatic Lapse Rate (DALR), which is a constant value of 0.98°C/100 meters.

Pasquill stability parameter, based on Pasquill – Gifford categorization, is such a meteorological parameter, which describes the stability of atmosphere, i.e., the degree of convective turbulence. Pasquill has defined six stability classes ranging from `A' (extremely unstable) to `F' (moderately stable). Wind speeds, intensity of solar radiation (daytime insulation) and nighttime sky cover have been identified as prime factors defining these stability categories.

When the atmosphere is unstable and wind speeds are moderate or high or gusty, rapid dispersion of pollutants will occur. Under these conditions, pollutant concentrations in air will be moderate or low and the material will be dispersed rapidly. When the atmosphere is stable and wind speed is low, dispersion of material will be limited and pollutant concentration in air will be high. In general, worst dispersion conditions (i.e. contributing to greater hazard distances) occur during low wind speed and very stable weather conditions.

6.5 HAZARDS & DAMAGE CRIETERIA OF MATERIALS

DEFINITIONS

The release of flammable gas or liquid can lead to different types of fire or explosion scenarios. These depend on the material released, mechanism of release, temperature and pressure of the material and the point of ignition. Types of flammable effects are as follows.

6.5.1 Hazards associated with Flammable chemicals

6.5.1.1 Pool fire

The released flammable material which is a liquid stored below its normal boiling point, will collect in a pool. The geometry of the pool will be dictated by the surroundings. If the liquid is stored under pressure above its normal boiling point, then a fraction of the liquid will flash into vapor and the remaining portion will form a pool in the vicinity of the release point. Once sustained combustion is achieved, liquid fires quickly reach steady state burning. The heat release rate is a function of the liquid surface area exposed to air. An unconfined spill will tend to have thin fuel depth (typically less than 5 mm) which will result in slower burning rates. A confined spill is limited by the boundaries (e.g. a dyked area) and the depth of the resulting pool is greater than that for an unconfined spill.

6.5.1.2 Flash fire

It occurs when a vapor cloud of flammable material burns. The cloud is typically ignited on the edge and burns towards the release point. The duration of flash fire is very short (seconds), but it may continue as jet fire if the release continues. The overpressures generated by the combustion are not considered significant in terms of damage potential to persons, equipment or structures. The major hazard from flash fire is direct flame impingement. Typically, the burn zone is defined as the area the vapor cloud covers out to half of the LFL. This definition provides a conservative estimate, allowing for fluctuations in modeling. Even where the concentration may be above the UFL, turbulent induced combustion mixes the material with air and results in flash fire.

6.5.1.3 Jet Fire:

Jet flames are characterized as high-pressure release of gas from limited openings (e.g. due to small leak in a vessel or broken drain valve). Boiling liquid expanding vapor explosion (BLEVE) or fireball: A fireball is an intense spherical fire resulting from a sudden release of pressurized liquid or gas that is immediately ignited. The best known cause of a fireball is a boiling liquid expanding vapor explosion (BLEVE). Fireball duration is typically 5 – 20 seconds.

6.5.1.4 Vapor cloud explosion

When a large quantity of flammable vapor or gas is released, mixes with air to produce sufficient mass in the flammable range and is ignited, the result is a vapor cloud explosion (VCE). Without sufficient air mixing, a diffusion-controlled fireball may result without significant overpressures developing. The speed of flame propagation must accelerate as the vapor cloud burns. Without this acceleration, only a flash fire will result.

6.5.2 HAZARDS ASSOCIATED WITH TOXIC MATERIALS

It is necessary to specify suitable concentration of the toxic substance under study to form the end-point for consequence calculations. The considerations for specifying the end-points for the hazardous material involved in the failure scenario are described in the following paragraphs

American Industrial Hygiene Association (AIHA) has issued Emergency Response Planning Guidelines (ERPG) for many chemicals.

- ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.
- ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible

or other serious health effects or symptoms, which could impair an individual's ability to take protective action.

- ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

Toxic limit values as Immediately Dangerous to Life or Health (IDLH) concentrations are issued by US National Institute for Occupational Safety and Health (NIOSH).

TLV: Threshold Limit Value – is the permitted level of exposure for a given period on a weighted average basis (usually 8 hrs. for 5 days in a week).

STEL: A Short Term Exposure Limit (STEL) is defined by ACGIH as the concentration to which workers can be exposed continuously for a short period of time without suffering from:

- irritation
- chronic or irreversible tissue damage
- Narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency.

It is permitted Short Time Exposure Limit usually for a 15-minute exposure.

IDLH: IDLH is an acronym for Immediately Dangerous to Life or Health. This refers to a concentration, formally specified by a regulatory value, and defined as the maximum exposure concentration of a given chemical in the workplace from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. This value is normally referred to in respirator selection.

6.5.3 Hazards Associated with Explosives chemicals

DAMAGE CRITERIA

Damage estimates due to thermal radiations and overpressure have been arrived at by taking in to consideration the published literature on the subject. The consequences can then be visualized by the superimposing the damage effects zones on the proposed plan site and identifying the elements within the project site as well as in the neighboring environment, which might be adversely affected, should one or more hazards materialize in real life.

Thermal damage

The effect of thermal radiation on people is mainly a function of intensity of radiation and exposure time. The effect is expressed in terms of the probability of death and different degrees of burn. The following tables give the effect of various levels of heat flux.

FATAL RADIATION EXPOSURE LEVELS

Table-6. 3: Fetal radiation Exposure Level

RADIATION LEVEL kW/m²	FATALITY		
	1%	50%	99%
	EXPOSURE IN SECONDS		
4.0	150	370	930
12.5	30	80	200
37.5	8	20	50

OVERPRESSURE DAMAGE:

Table-6.4: Overpressure Damage Criteria

OVER PRESSURE (mbar)	MECHANICAL DAMAGE TO EQUIPMENTS	DAMAGE TO PEOPLE
300	Heavy damage to plant & structure	1% death from lung damage >50% eardrum damage >50% serious wounds from flying objects
100	Repairable damage	>1% eardrum damage >1% serious wounds from flying objects
30	Major glass damage	Slight injury from flying glass
10	10% glass damage	***

6.6 CONSEQUENCE ANALYSIS

INTRODUCTION

The consequence analysis is carried out to determine the extent of spread (dispersion) by accidental release which may lead to jet fire, pool fire, tank fire resulting into generating heat radiation, overpressures, explosions etc.

In order to form an opinion on potentially serious hazardous situations and their consequences, consequence analysis of potential failure scenarios is conducted. It is qualitative analysis of hazards due to various failure scenarios. In consequence analysis, each failure case is considered in isolation and damage effects predicted, without taking into the account of the secondary events or failures it may cause, leading to a major disastrous situation. The results of consequence analysis are useful in developing disaster management plan and in developing a sense of awareness among operating and maintenance personnel. It also gives the operating personnel and population living in its vicinity, an understanding of the hazard they are posed to.

SELECTED FAILURE CASES

Earlier, it was the practice to select a particular item in a unit as failure scenario, e.g. rupture of reactor outlet pipe. Such selection is normally subjective on following parameters:

- Properties of material namely Toxic or Flammable.
- The likely severity of consequence in the event of accidental release based on inventory, operated pressure & operated temperature.
- The probability of failure of various equipments such as valves, flanges, pipe, pressure vessels etc. used in the plant.

Size of Release: For accidental releases identified for consequence analysis is 50mm leakage. The scenarios are considered to be confined to those equipment failures which involve the leakage of flammable or toxic products, of which the frequency of occurrence and the severity of the consequences have been taken into consideration and which may have a low probability of early detection.

Taking this factor into consideration, a list of selected failure cases was prepared based on process knowledge, inventory, engineering judgment, and experience, past incidents associated with such facilities and considering the general mechanisms for loss of containment. Cases have been identified for the consequence analysis.

EFFECT OF RELEASE

When hazardous material is released to atmosphere due to any reason, a vapor cloud is formed. Direct cloud formation occurs when a gaseous or flashing liquid escapes to the atmosphere.

Table-6.5 CONSEQUENCE RESULTS FOR METHANOL TANK FAILURE

Sr. No.	**1**		
Scenario description	**Leakage (Methanol Tank)**		
	Weather data	**1.5m/s F**	**1.5m/s D**
		Damage Distances (m)	
Flash Fire	UFL	6.84225	6.84967
	LFL	18.6513	16.4304
	LFL Fraction	55.5499	52.3525
Jet Fire (kW/m2)	4	55.4507	55.7918
	12.5	44.4847	44.7386
	37.5	Not Reached	Not Reached
Overpressure (bar)	0.02068	81.242	81.8868
	0.1379	58.0893	58.2563
	0.2068	56.2593	56.3885

Pool fire (kW/m2)	4	66.0661	65.7403
	12.5	43.364	43.1521
	37.5	30.028	29.895

Sr.No	**2**		
Scenario description	**Rupture (Methanol Tank)**		
	Weather data	**1.5m/s F**	**1.5m/s D**
		Damage Distances (m)	
Flash Fire	UFL	9.49774	9.37424
	LFL	19.1469	19.7597
	LFL Fraction	36.3887	41.3099
Jet Fire (kW/m2)	4	NA	NA
	12.5	NA	NA
	37.5	NA	NA
Overpressure (bar)	0.02068	116.059	115.805
	0.1379	48.7446	47.3302
	0.2068	44.5041	43.4097
Pool fire (kW/m2)	4	62.8653	62.6173
	12.5	39.1226	38.9145
	37.5	25.0667	24.8861

FIG.6.2 MAXIMUM CONCENTRATION- METHANOL TANK LEAK

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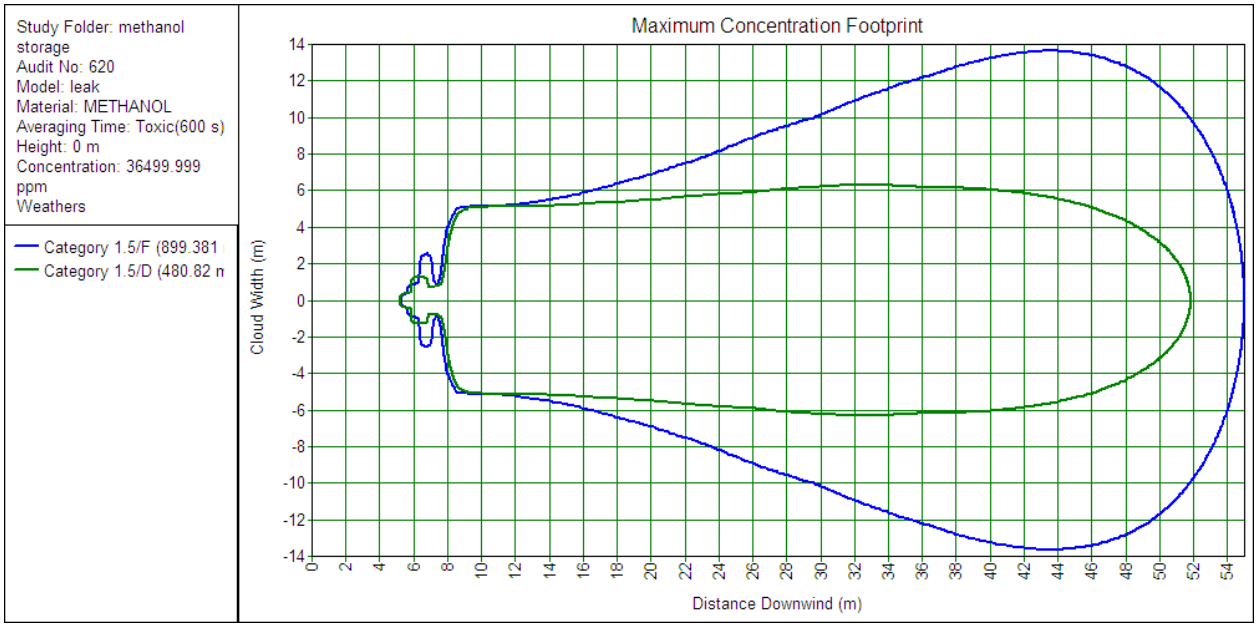

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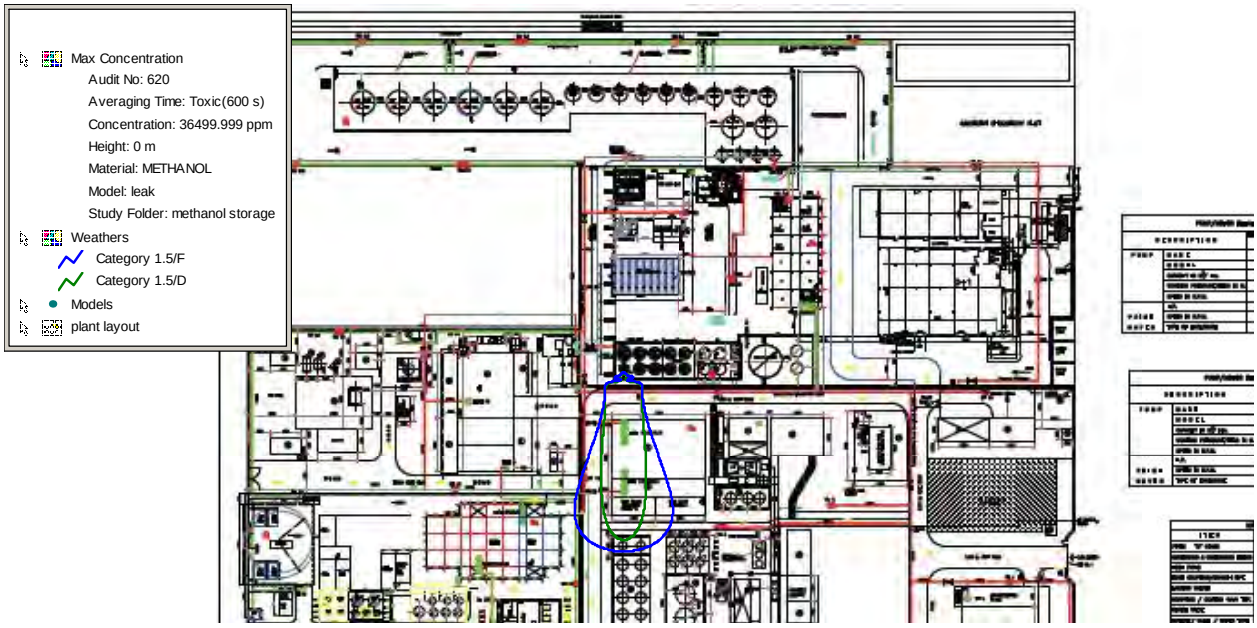

FIG.6.3 INTENSITY RADII FOR LATE POOL FIRE- METHANOL TANK LEAK

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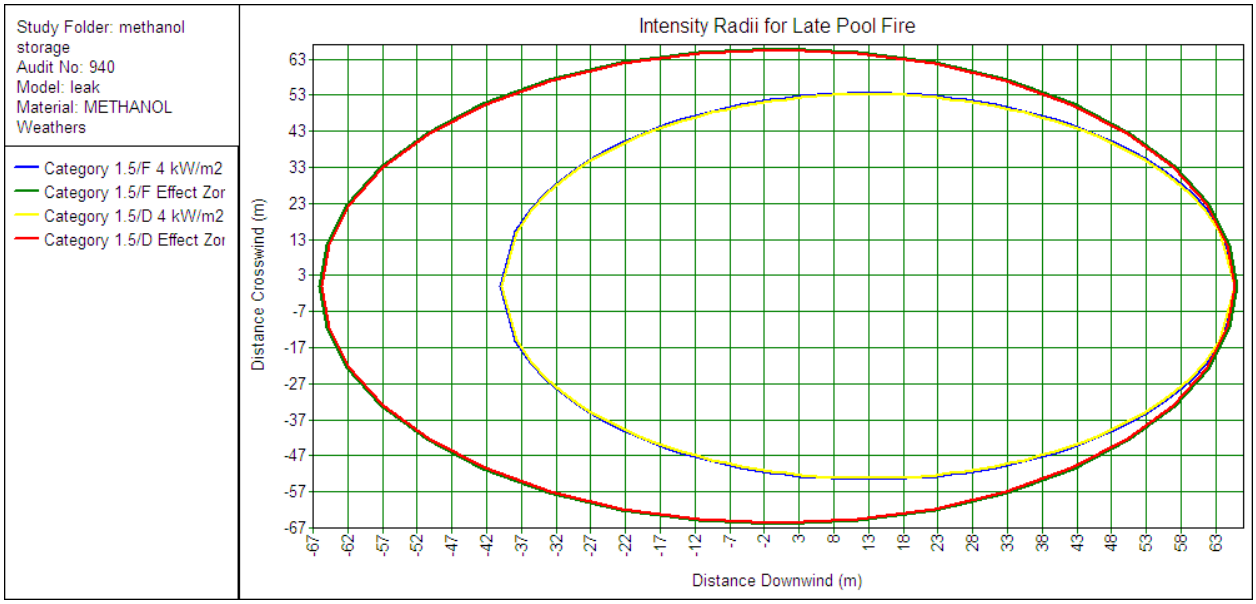

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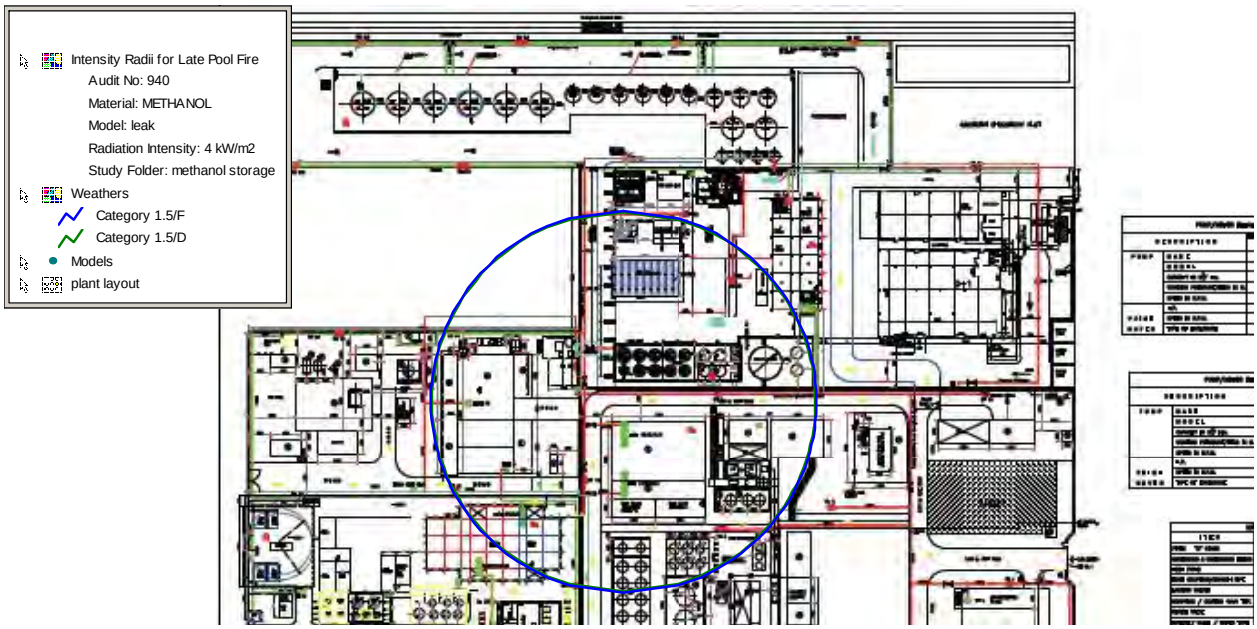

FIG.6.4 INTENSITY RADII FOR JET FIRE- METHANOL TANK LEAK

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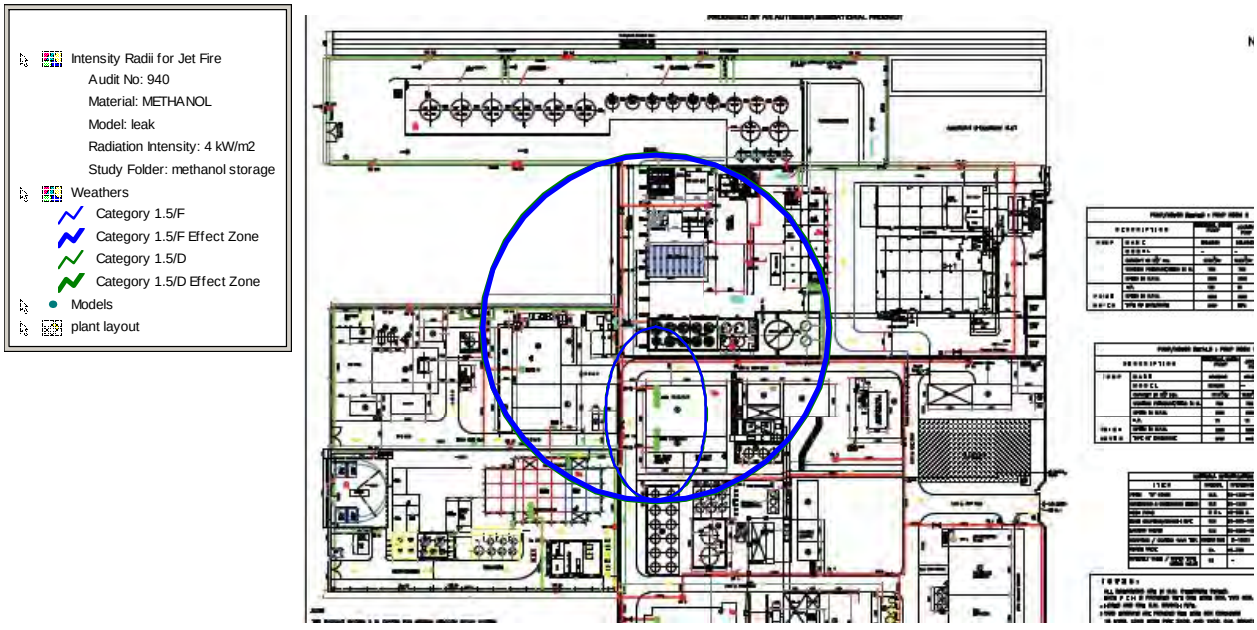

FIG.6.5 FLASH FIRE- METHANOL TANK LEAK

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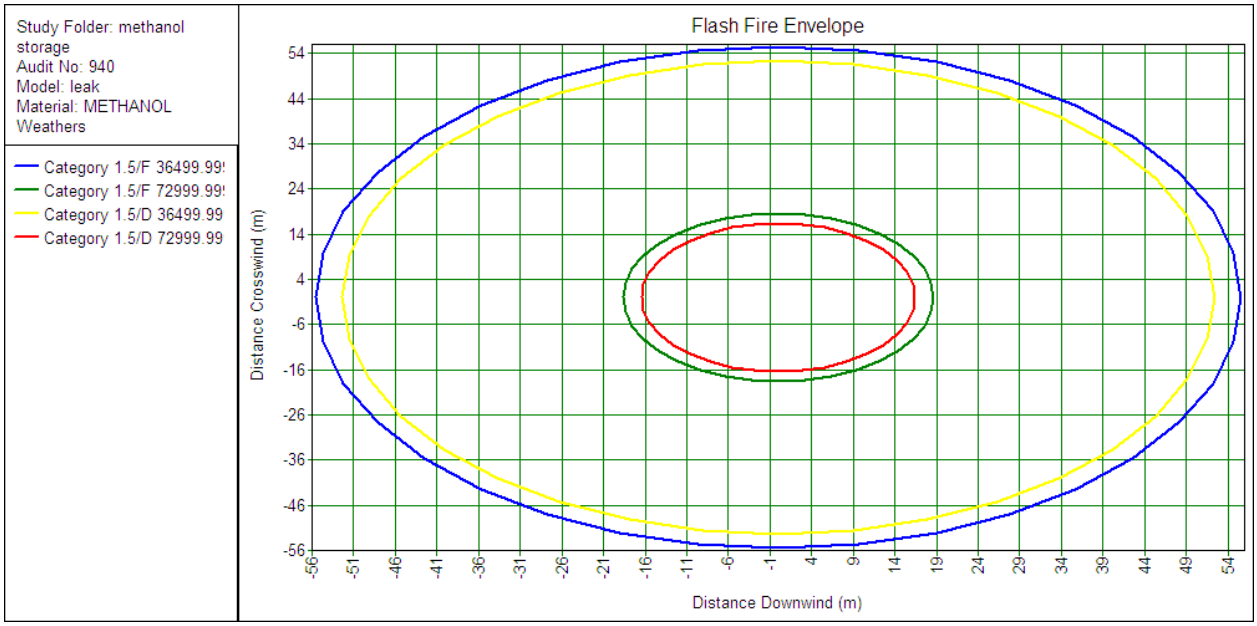

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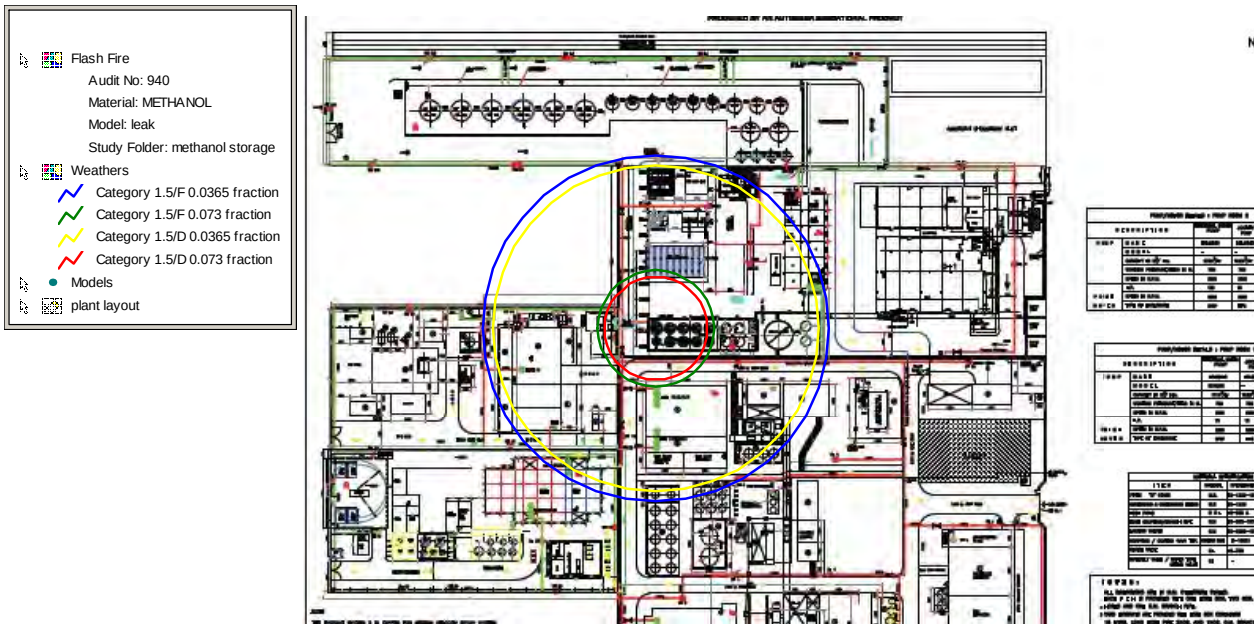

FIG.6.6 MAXIMUM CONCENTRATION- METHANOL TANK RUPTURE

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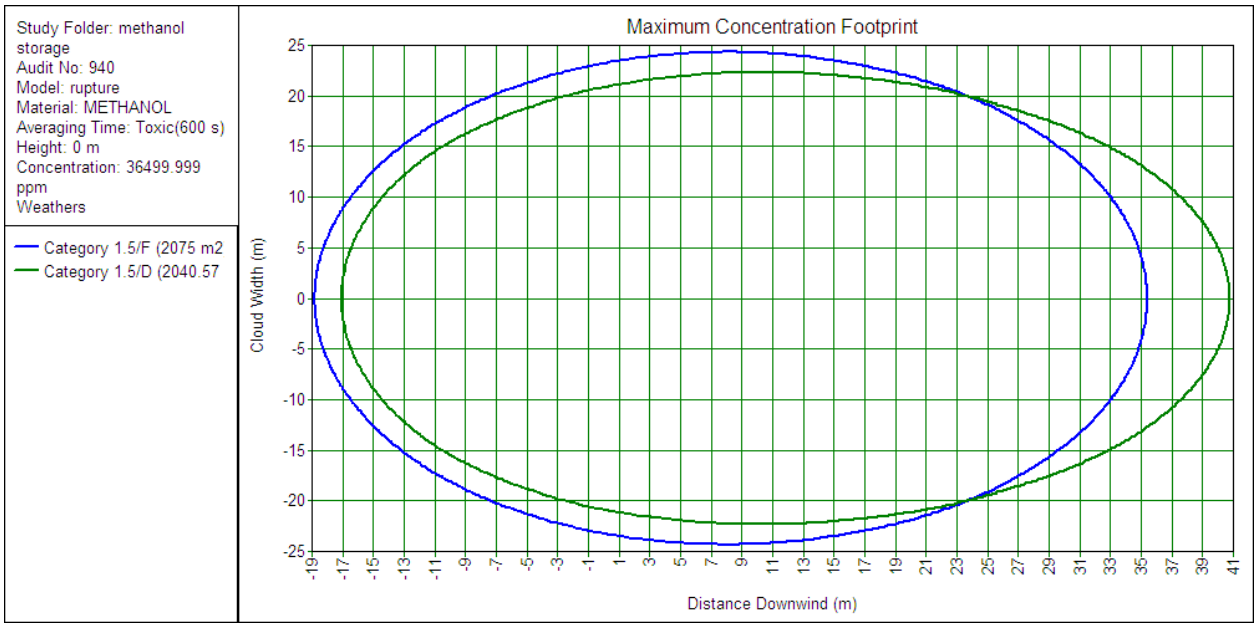

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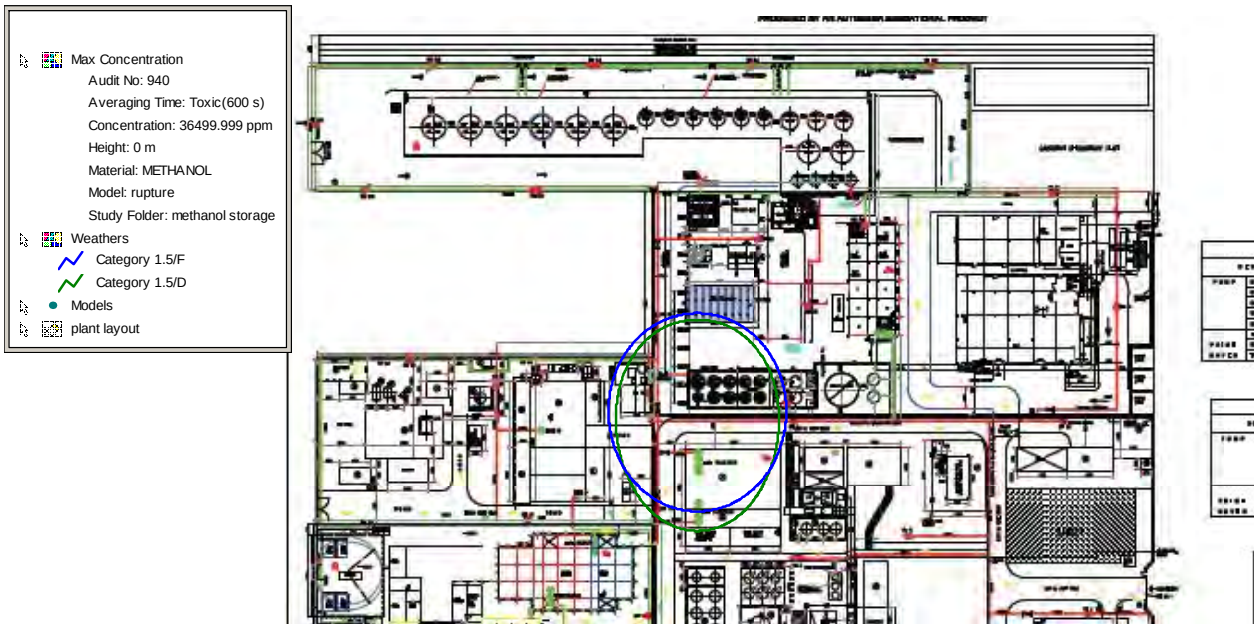

FIG.6.7 INTENSITY RADII FOR LATE POOL FIRE- METHANOL TANK RUPTURE

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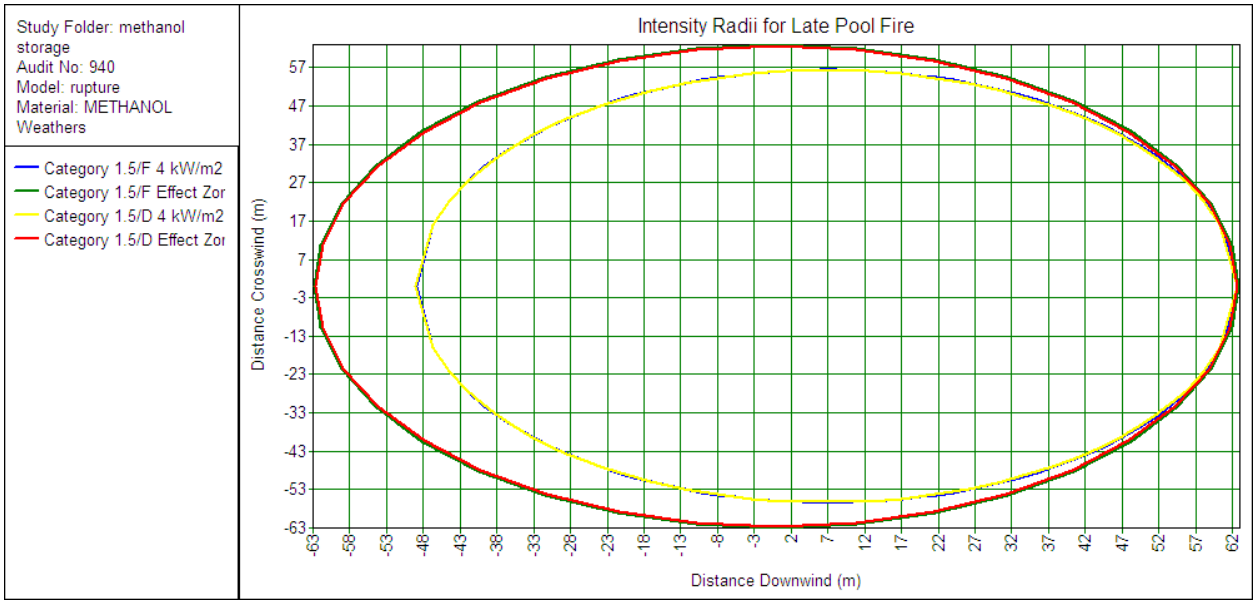

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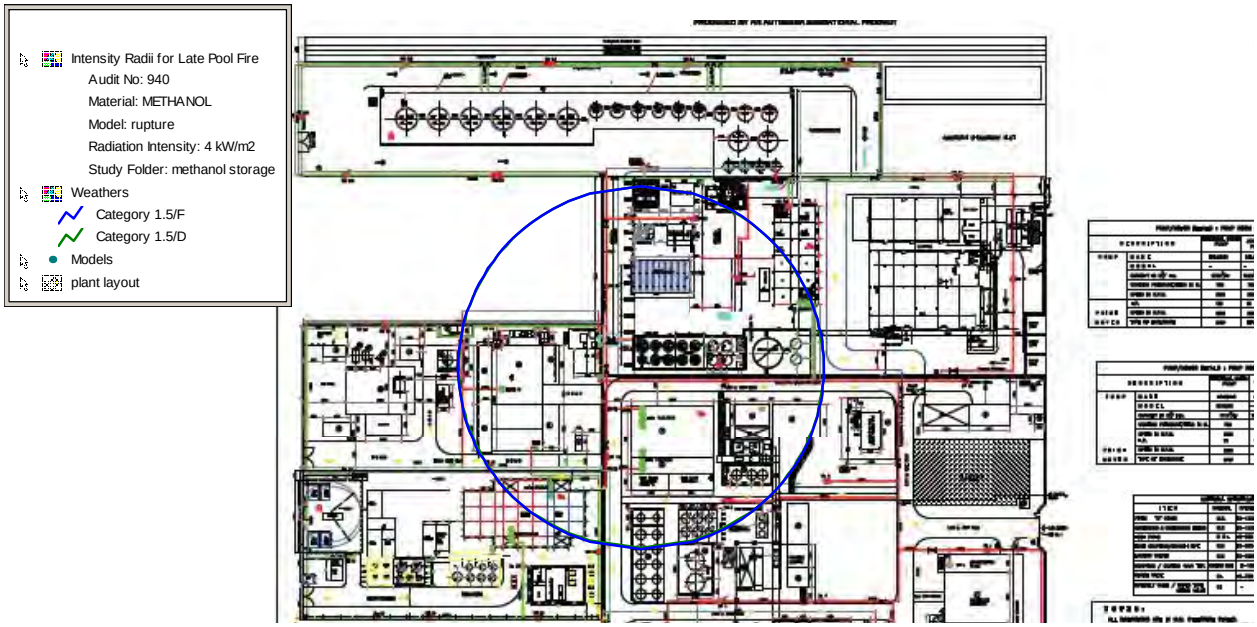

FIG.6.8 FLASH FIRE- METHANOL TANK RUPTURE

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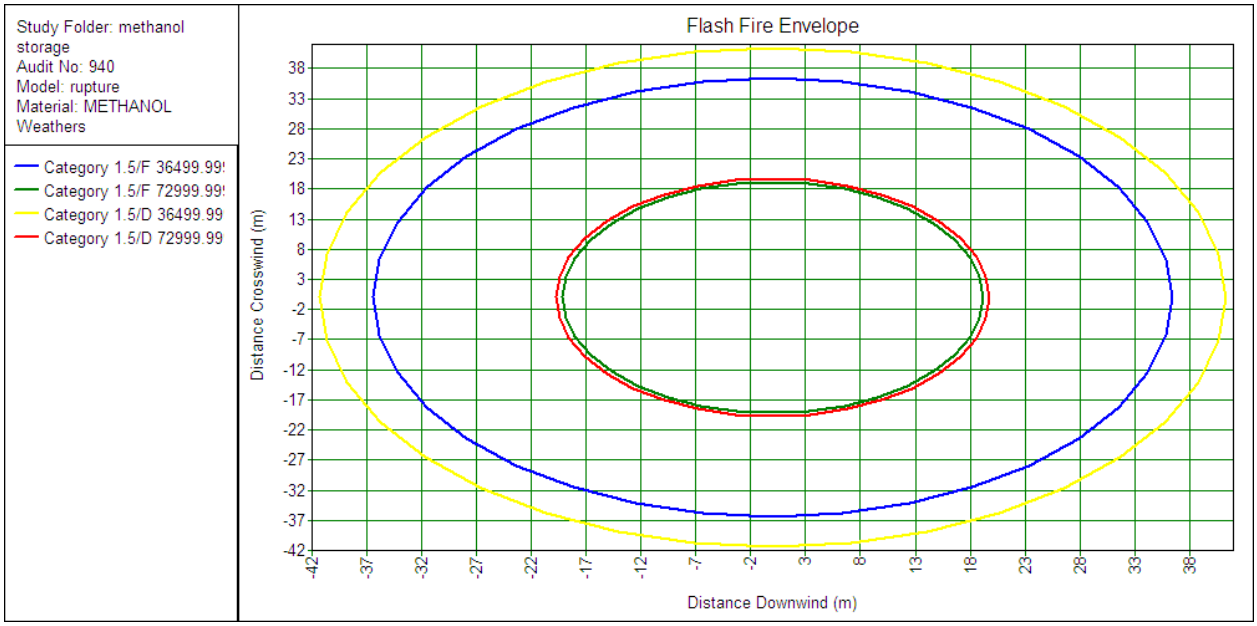

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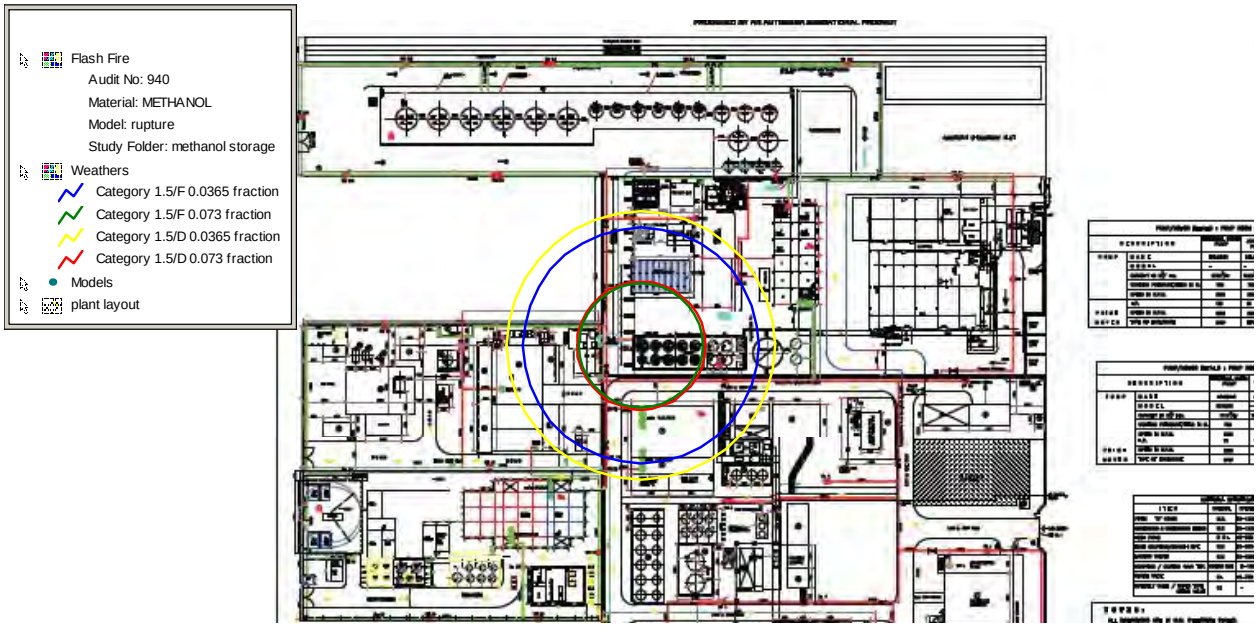

Table- 6.6 CONSEQUENCE RESULTS FOR HYDROGEN REFORMER FAILURE

Sr. No.	**3**		
Scenario description	**Leakage (Hydrogen Reformer)**		
	Weather data	**1.5 m/s F**	**1.5 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	0.396255	0.395863
	LFL	26.1399	24.7515
	LFL Fraction	34.4637	33.2864
Jet Fire (kW/m2)	4	26.5565	26.5565
	12.5	19.5374	19.5374
	37.5	4.8685	4.8685
Overpressure (bar)	0.02068	89.7985	85.8467
	0.1379	45.4833	44.4601
	0.2068	41.9806	41.1889
Pool fire (kW/m2)	4	NA	NA
	12.5	NA	NA
	37.5	NA	NA

Table- 6.7 CONSEQUENCE RESULTS FOR Hydrogen Reformer Rupture

Sr.No	**4**		
Scenario description	**Rupture (Hydrogen Reformer)**		
	Weather data	**1.5 m/s F**	**1.5 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	4.23091	4.22998
	LFL	19.5669	19.7159
	LFL Fraction	26.3157	26.4582
Jet Fire (kW/m2)	4	NA	NA
	12.5	NA	NA
	37.5	NA	NA
Overpressure (bar)	0.02068	243.117	242.771
	0.1379	77.7705	77.681
	0.2068	64.7015	64.6323
Fire ball (kW/m2)	4	124.502	124.502
	12.5	68.4023	68.4023
	37.5	31.5308	31.5308

FIG.6.9 MAXIMUM CONCENTRATION- HYDROGEN REFORMER LEAK

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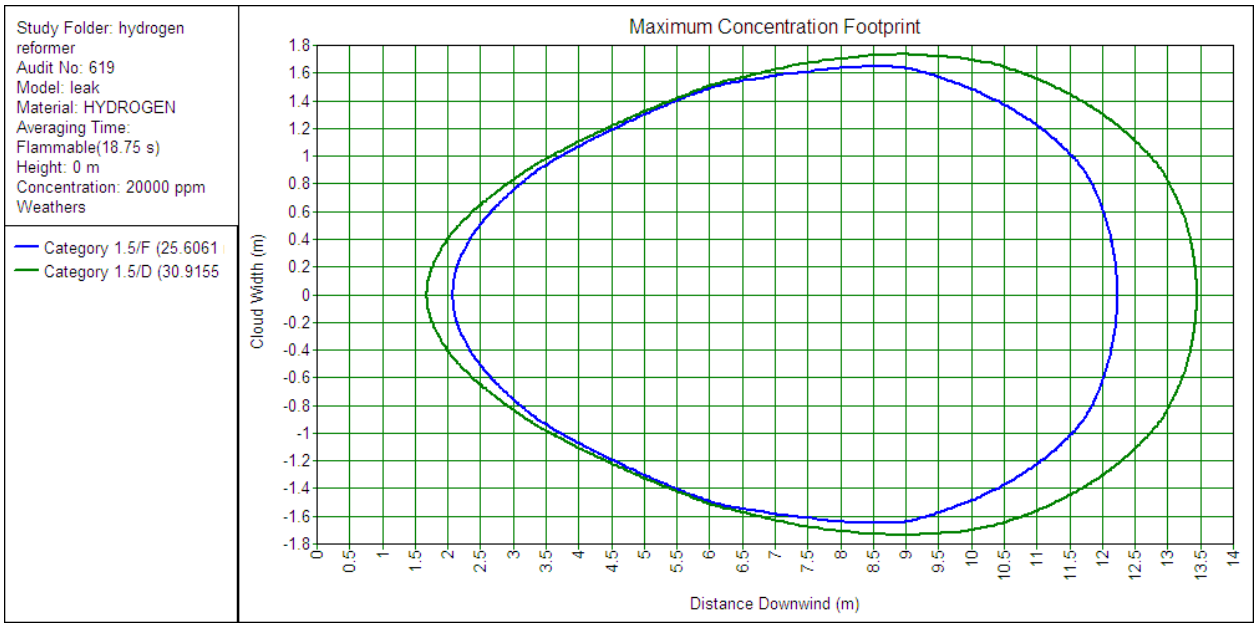

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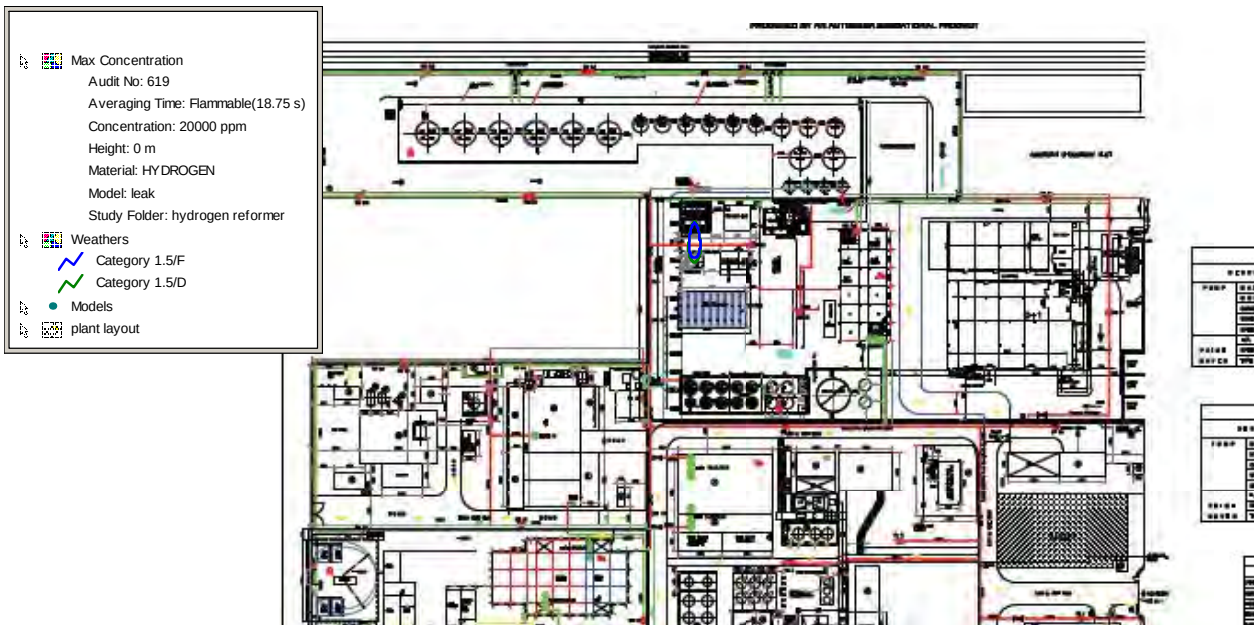

FIG.6.10 LATE EXPLOSION OVERPRESSURE- HYDROGEN REFORMER LEAK

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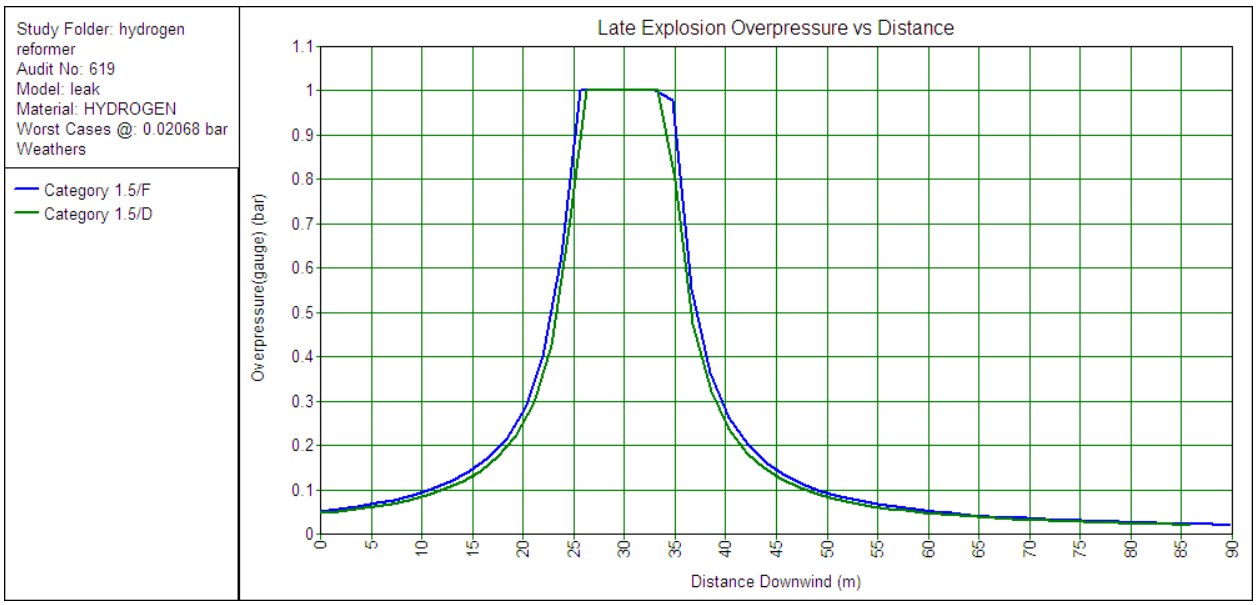

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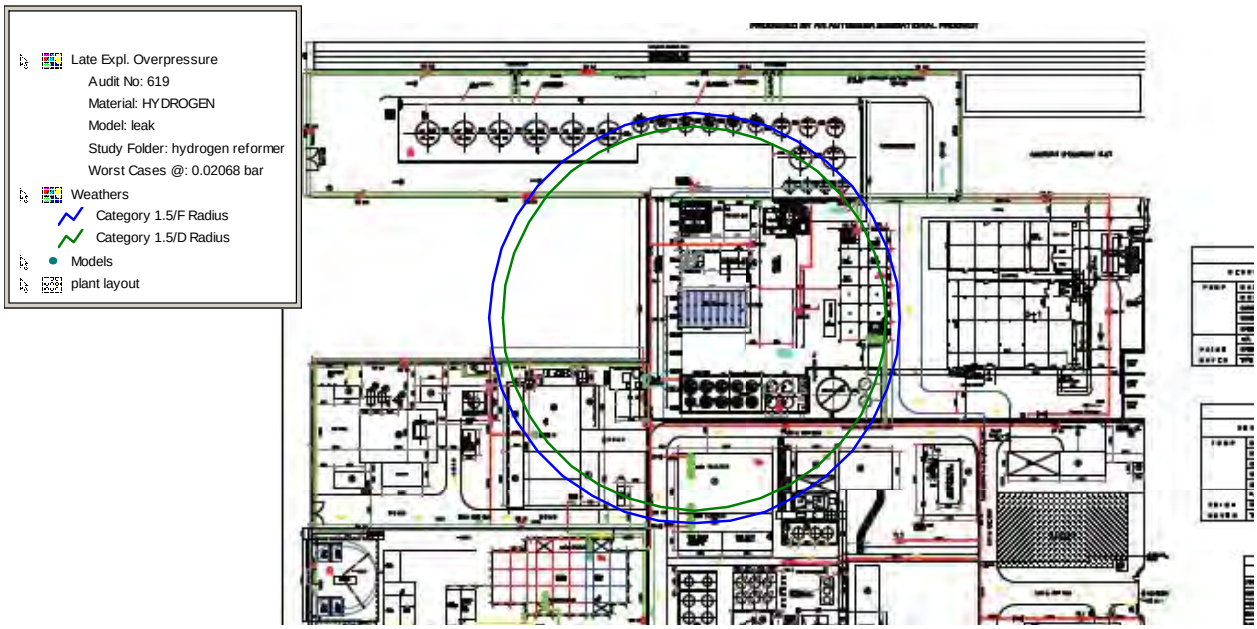

FIG.6.11 INTENSITY RADII FOR JET FIRE- HYDROGEN REFORMER LEAK

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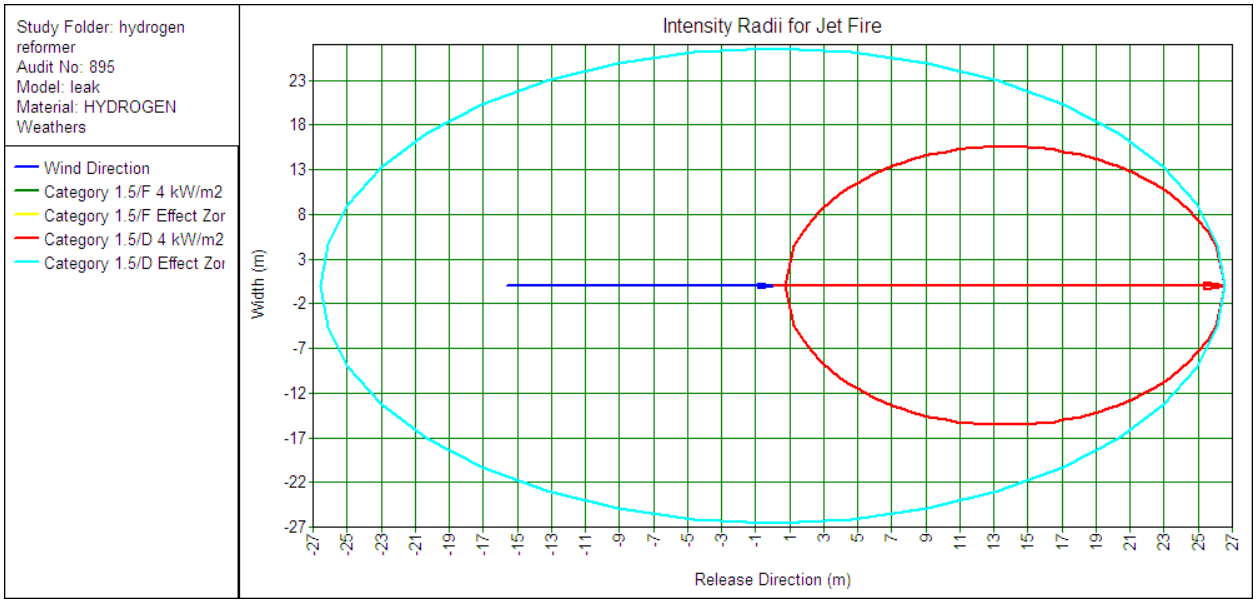

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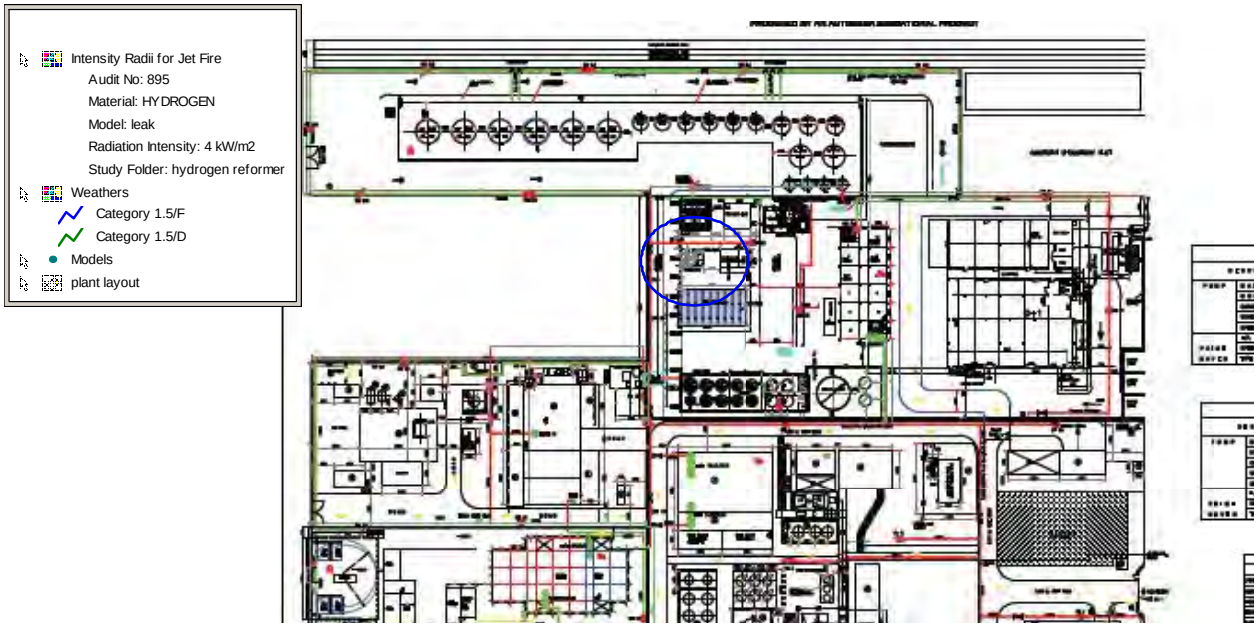

FIG.6.12 FLASH FIRE- HYDROGEN REFORMER LEAK

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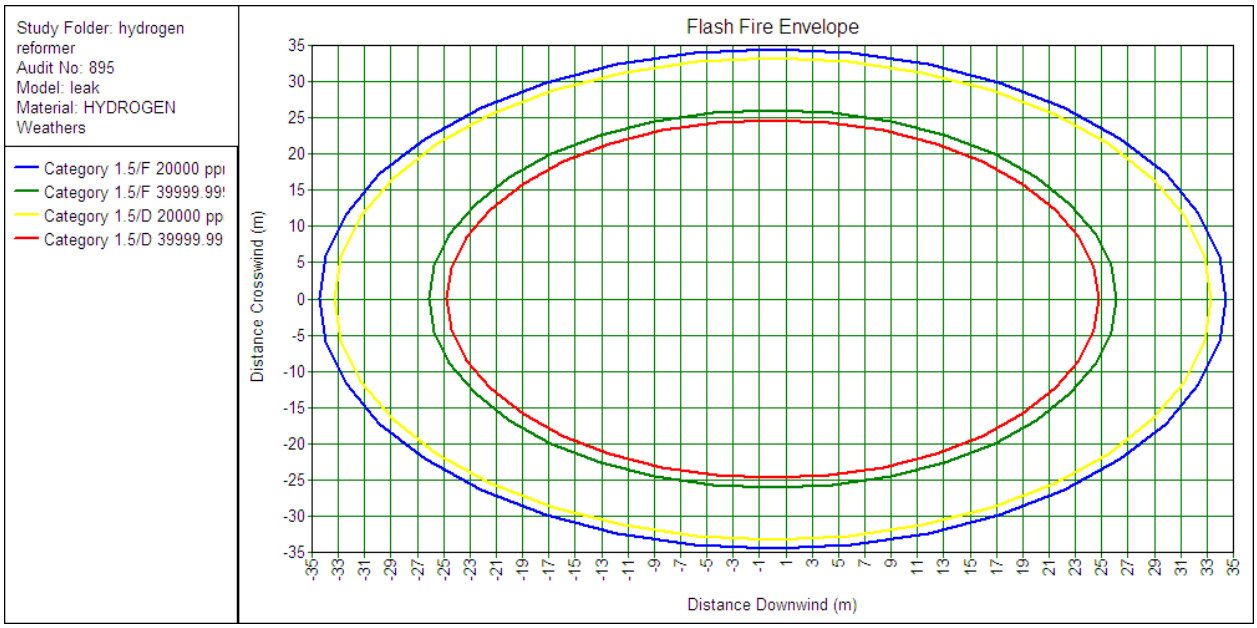

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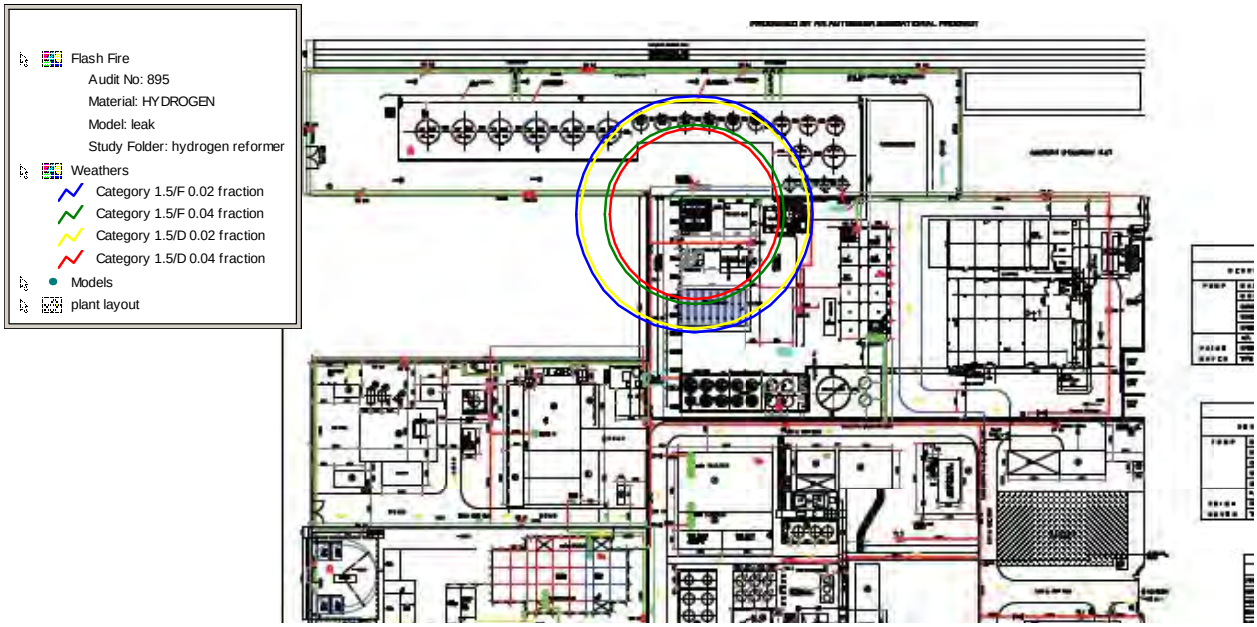
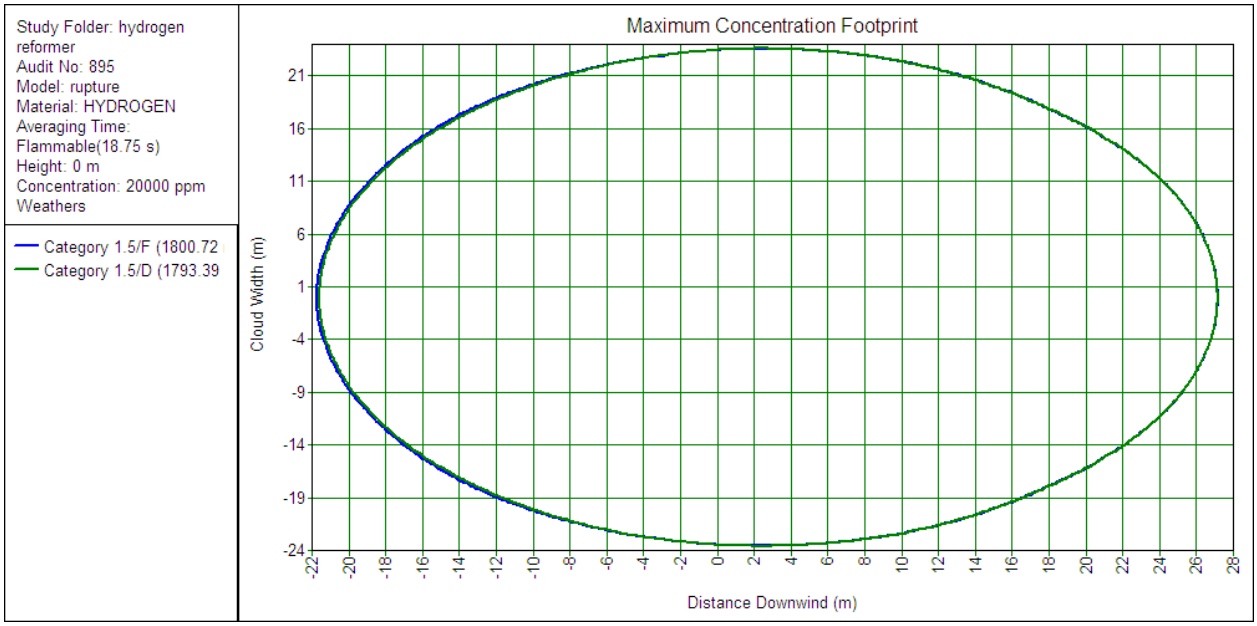


FIG.6.13 MAXIMUM CONCENTRATION- HYDROGEN REFORMER RUPTURE

GRAPH



MAP

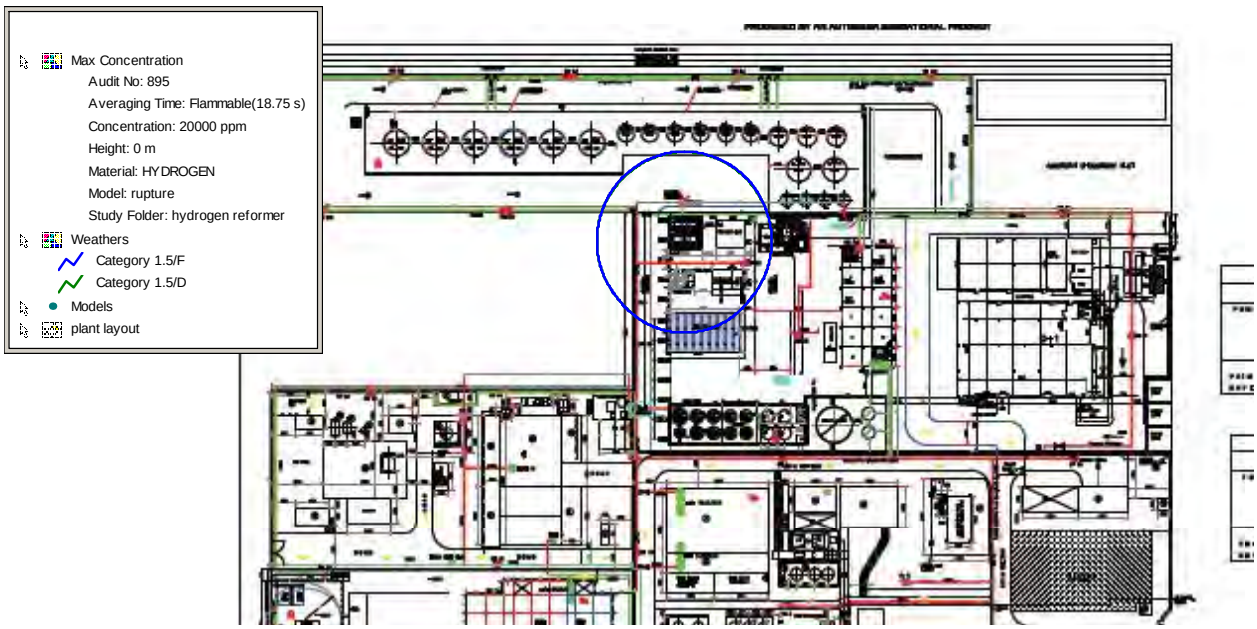
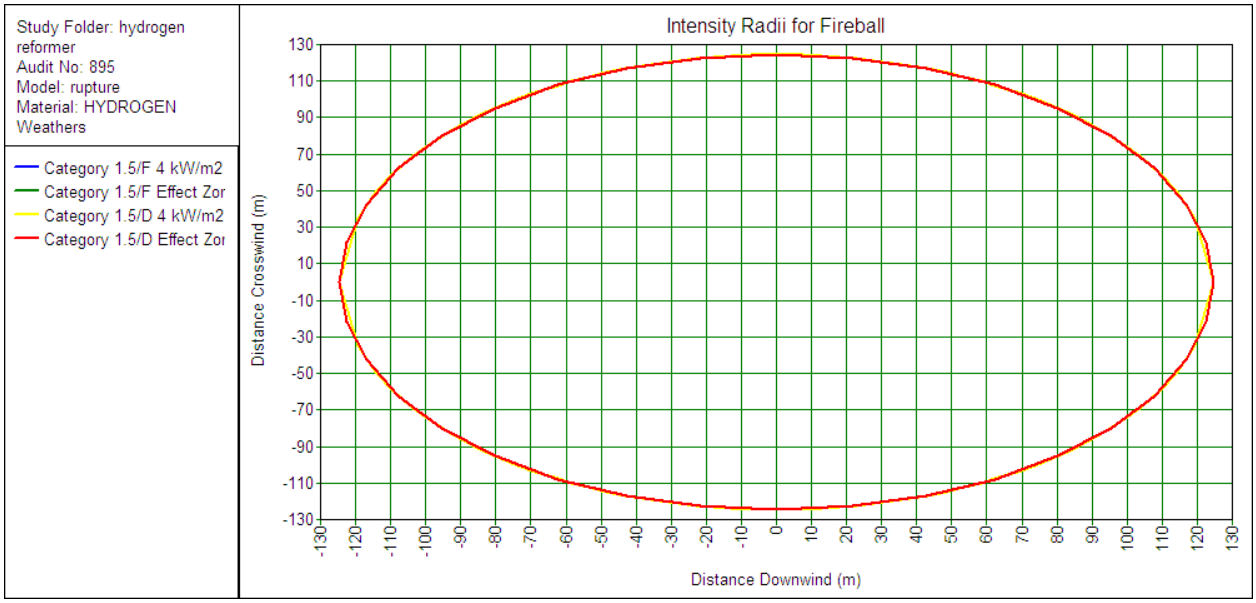


FIG.6.14 INTENSITY RADII FOR FIREBALL- HYDROGEN REFORMER RUPTURE

GRAPH



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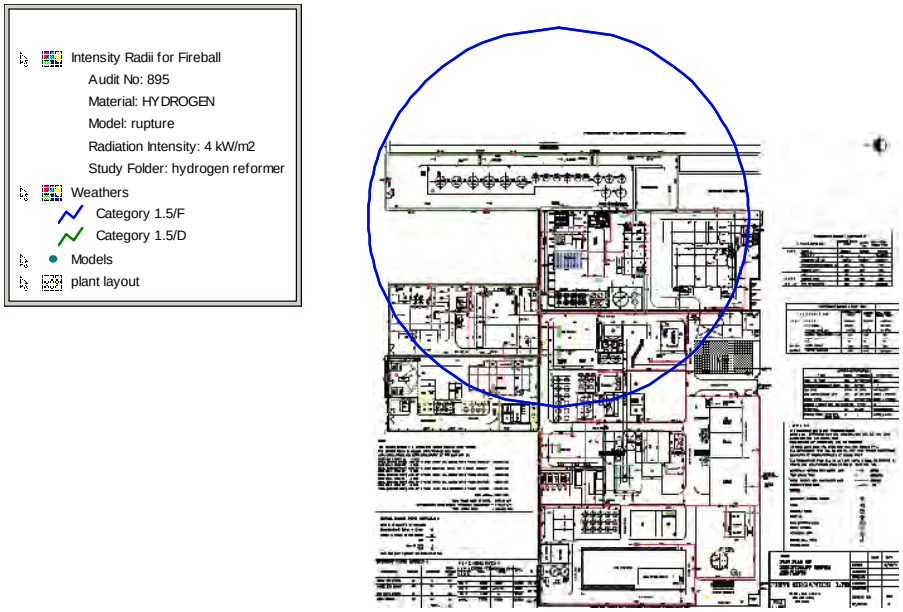
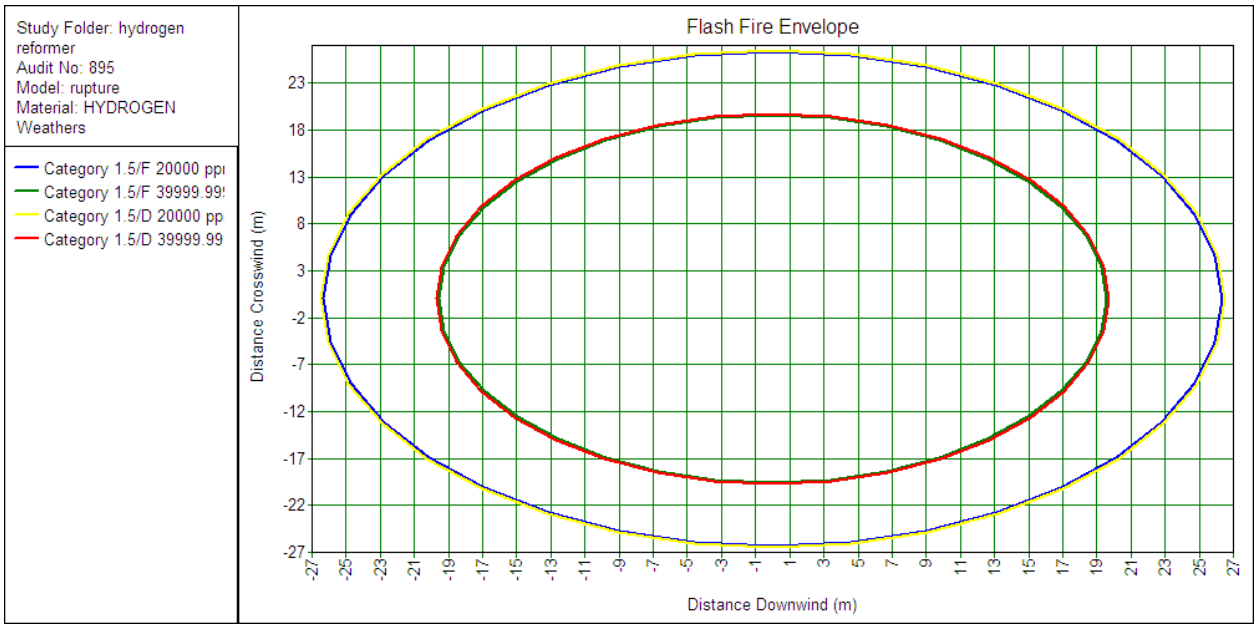


FIG.6.15 FLASH FIRE- HYDROGEN REFORMER RUPTURE

GRAPH



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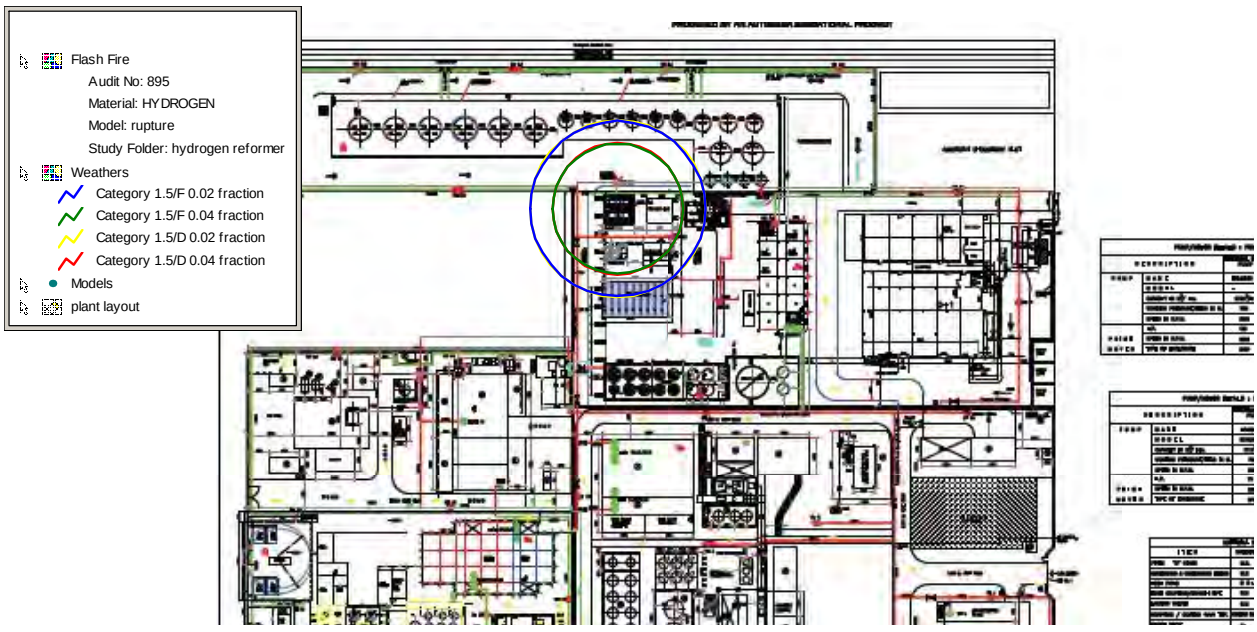


Table- 6.8 CONSEQUENCE RESULTS FOR HYDROGEN CYLINDER FAILURE

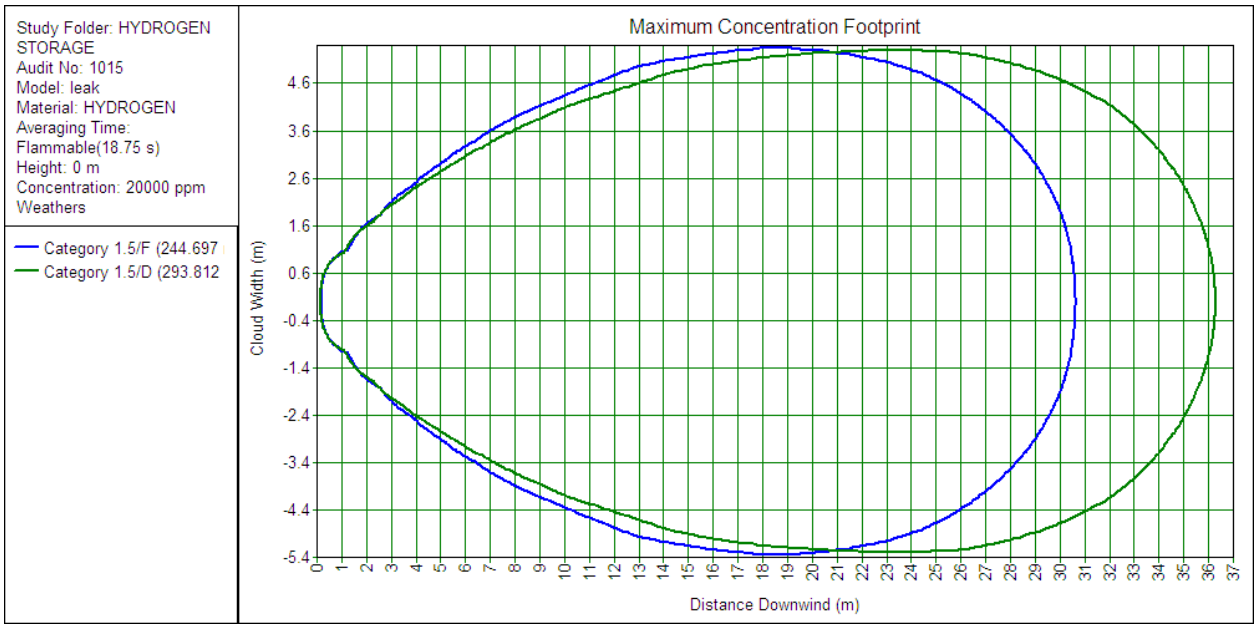
Sr. No.	**5**		
Scenario description	**Leakage (Hydrogen Cylinder)**		
	Weather data	**1.50 m/s F**	**1.50 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	1.93278	1.94202
	LFL	74.4431	78.6842
	LFL Fraction	115.981	100.949
Jet Fire (kW/m2)	4	94.009	94.009
	12.5	66.0313	66.0313
	37.5	48.3514	48.3514
Overpressure (bar)	0.02068	283.892	279.159
	0.1379	140.204	137.425
	0.2068	128.846	128.94
Fire ball (kW/m2)	4	136.329	136.329
	12.5	74.8986	74.8986
	37.5	34.4107	34.4107

Table- 6.9 CONSEQUENCE RESULTS FOR HYDROGEN CYLINDER RUPTURE

Sr.No	**6**		
Scenario description	**Rupture (Hydrogen Cylinder)**		
	Weather data	**1.50 m/s F**	**1.50 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	2.98358	2.98289
	LFL	21.4738	21.6119
	LFL Fraction	28.8708	28.9638
Jet Fire (kW/m2)	4	NA	NA
	12.5	NA	NA
	37.5	NA	NA
Overpressure (bar)	0.02068	269.022	268.581
	0.1379	84.478	84.3638
	0.2068	69.8917	69.8033
Fire ball (kW/m2)	4	136.329	136.329
	12.5	74.8986	74.8986
	37.5	34.4107	34.4107

FIG.6.16 MAXIMUM CONCENTRATION- HYDROGEN CYLINDER LEAK

GRAPH



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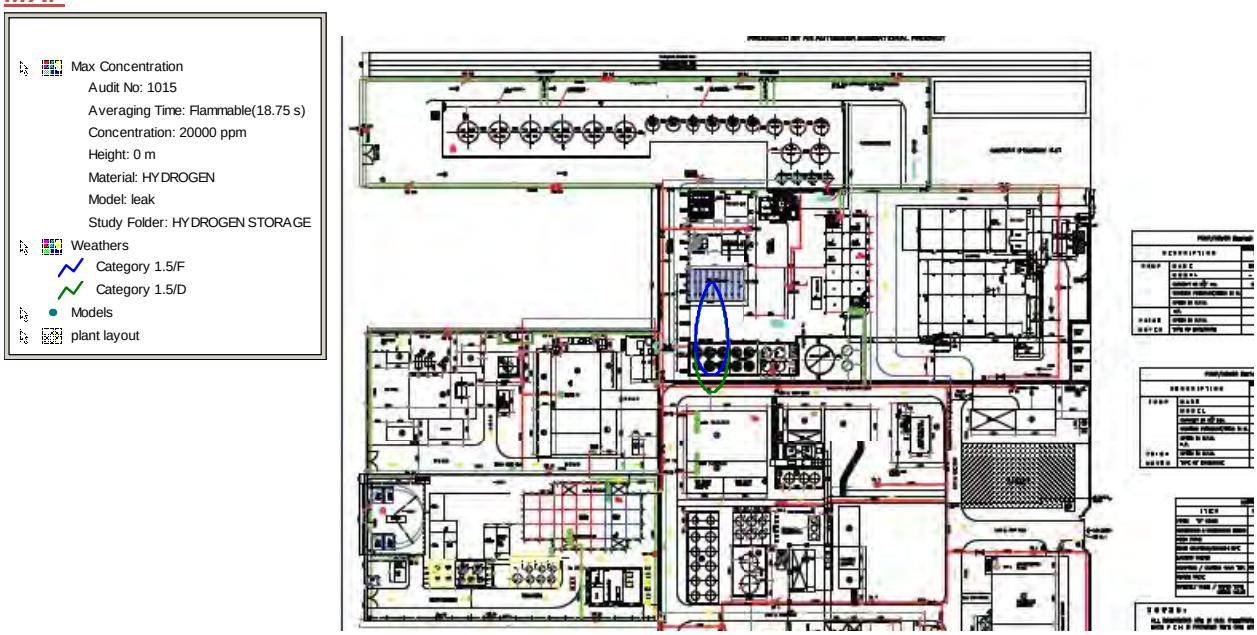
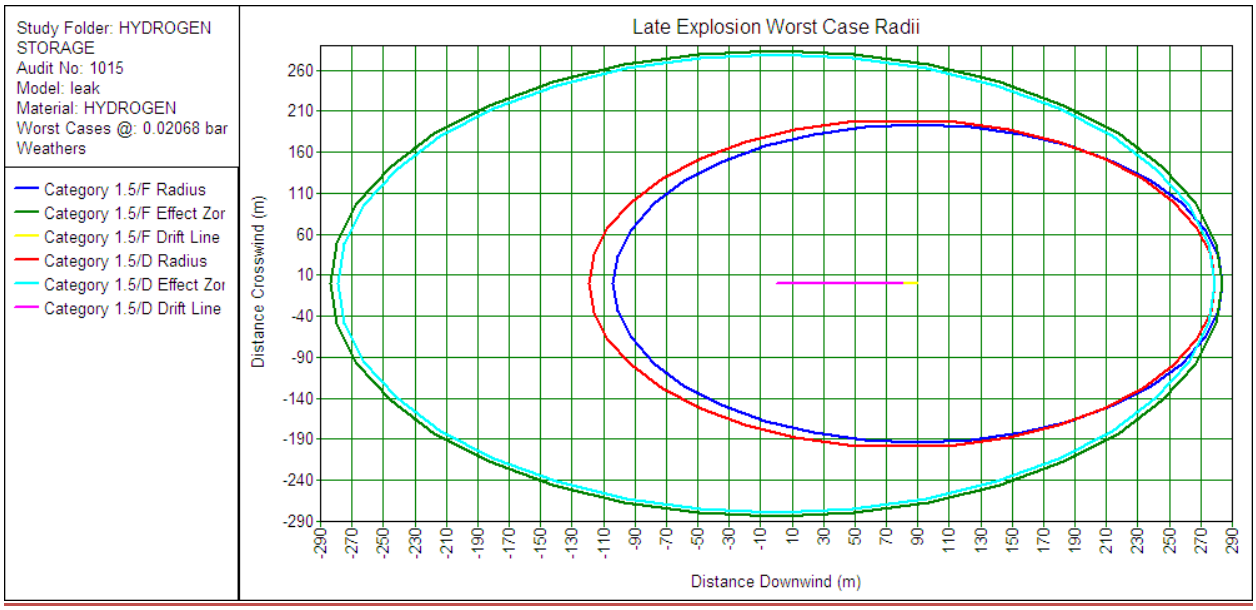


FIG.6.17 LATE EXPLOSION WORST CAST RADII- HYDROGEN CYLINDER LEAK

GRAPH



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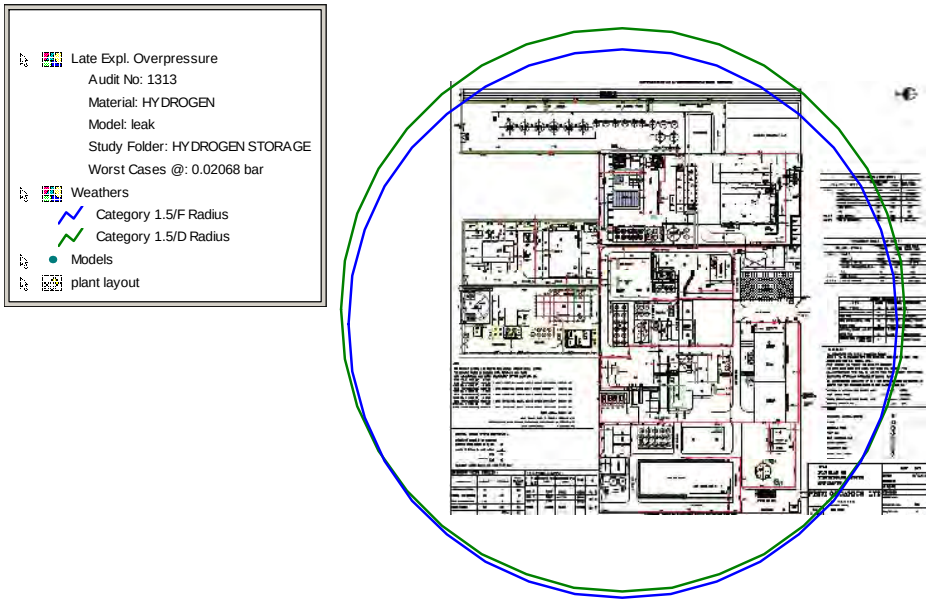
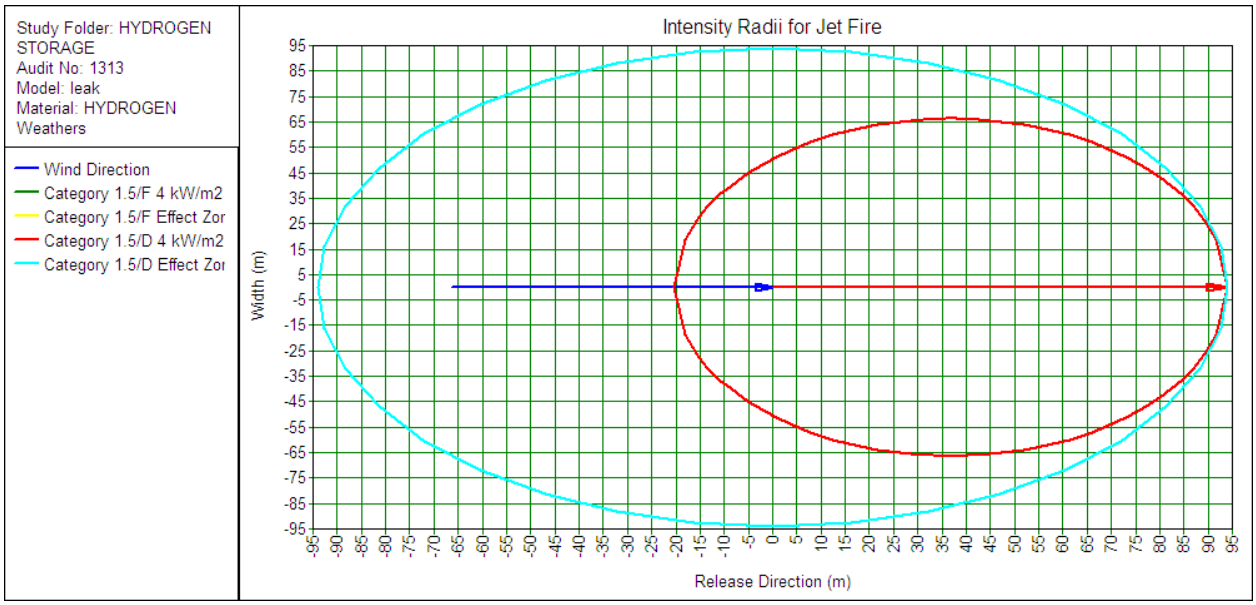


FIG.6.18 INTENSITY RADII FOR JET FIRE- HYDROGEN CYLINDER LEAK

GRAPH



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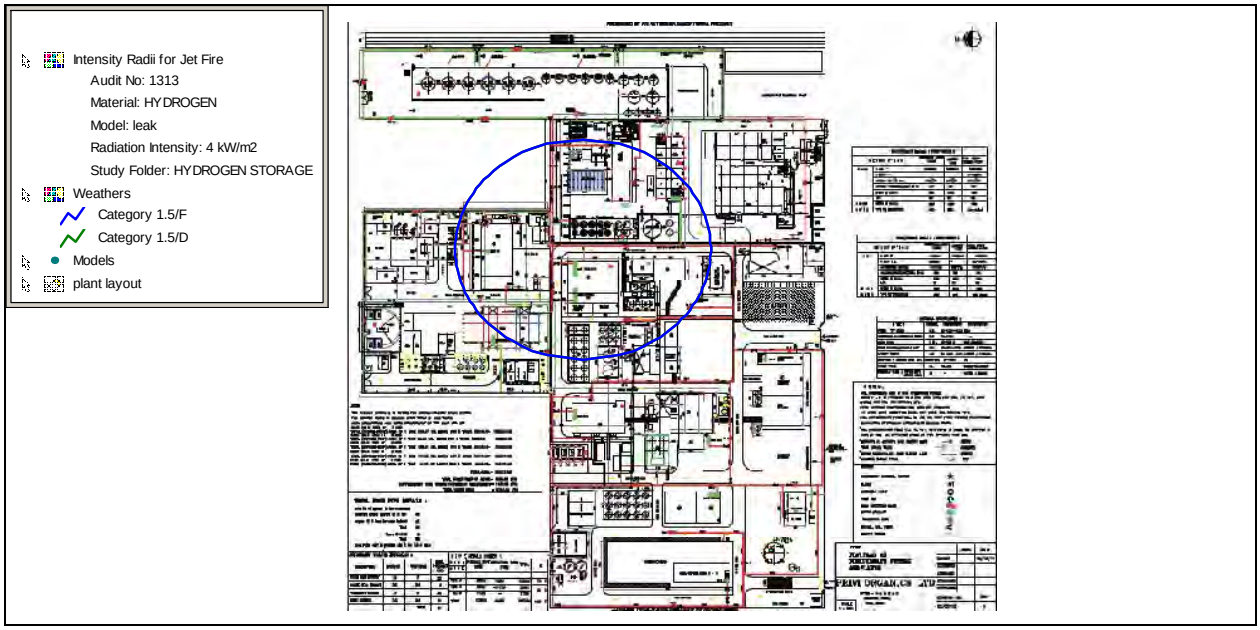
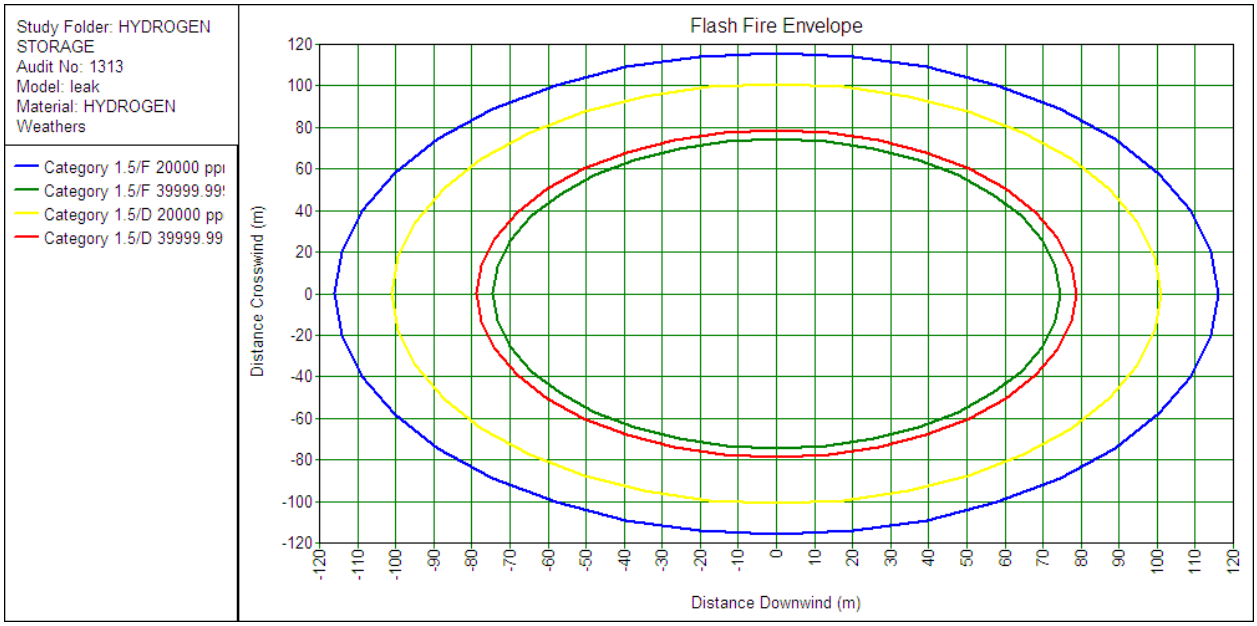


FIG.6.19 FLASH FIRE- HYDROGEN CYLINDER LEAK

GRAPH



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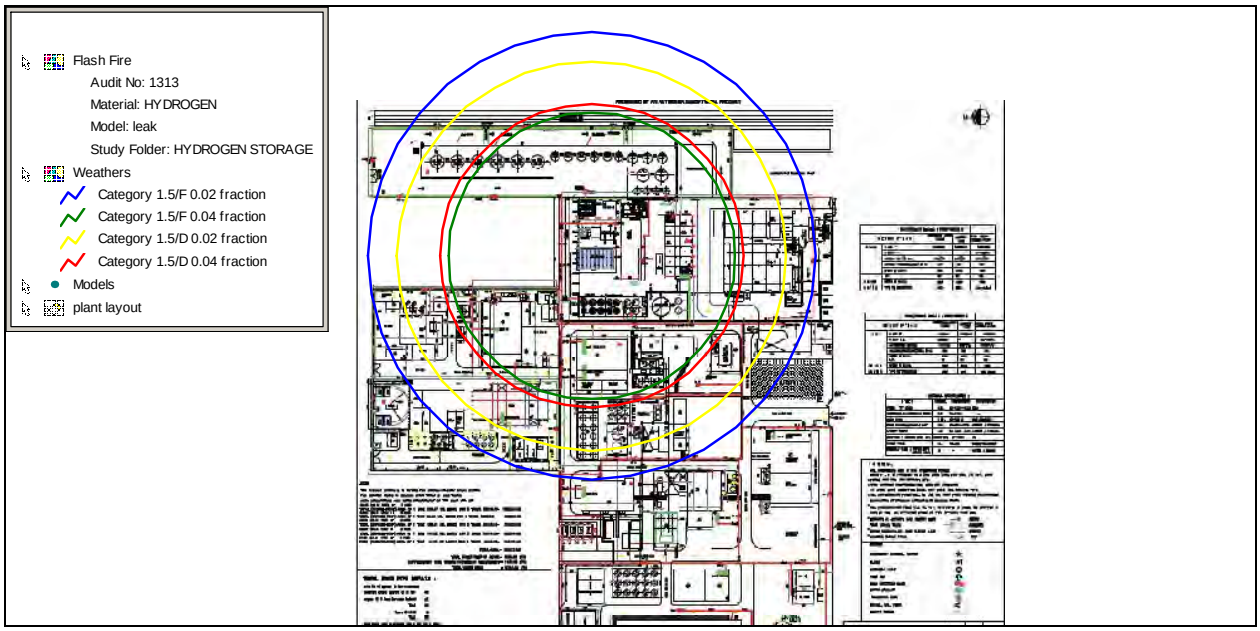
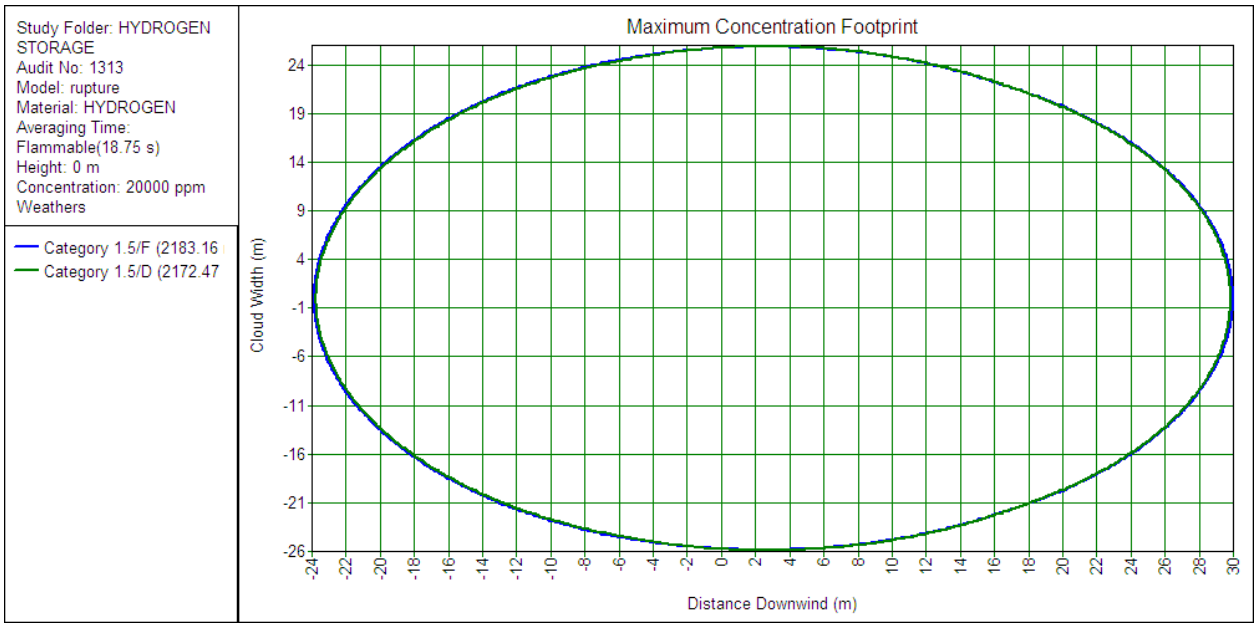


FIG.6.20 MAXIMUM CONCENTRATION- HYDROGEN CYLINDER RUPTURE

GRAPH



MAP

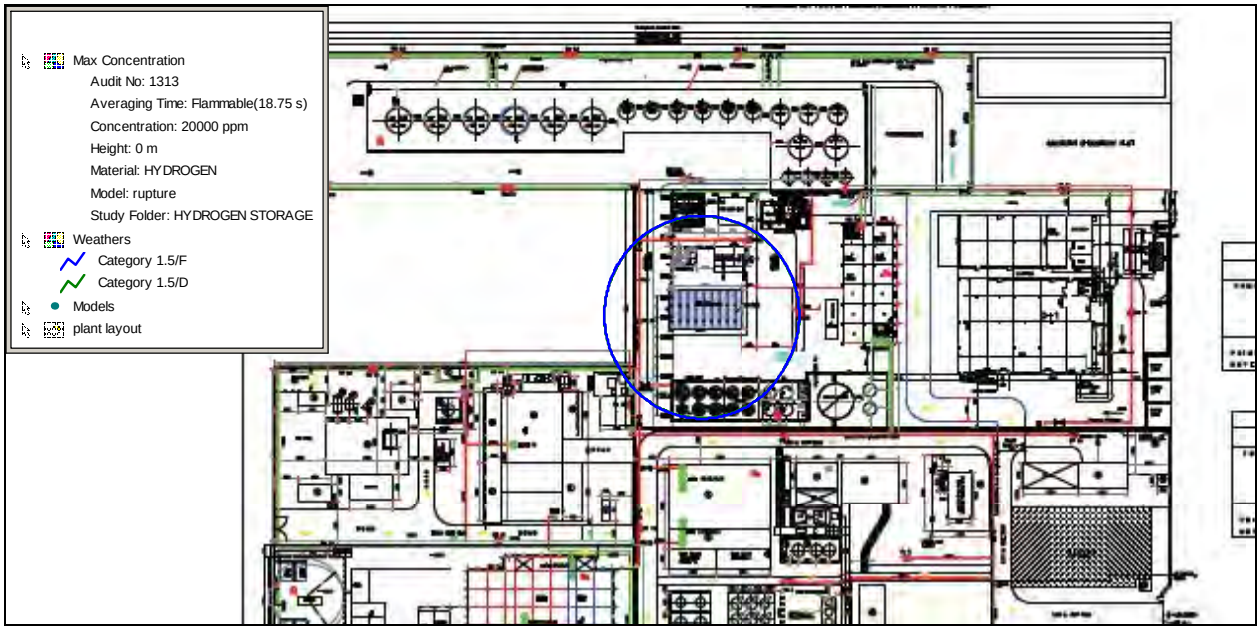
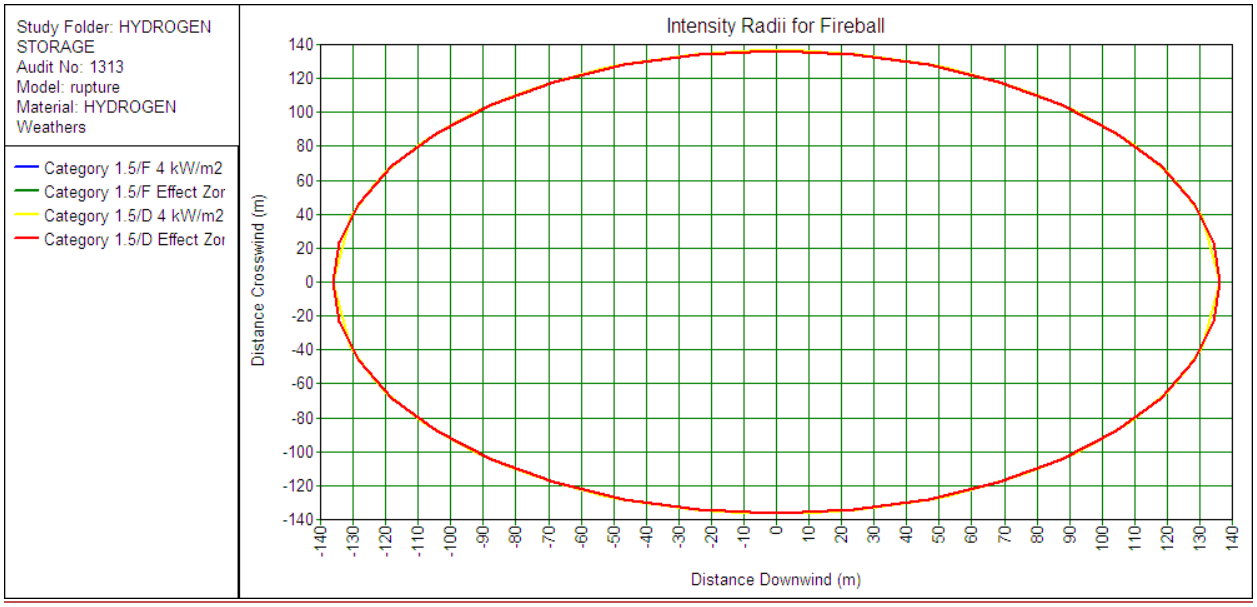


FIG.6.21 INTENSITY RADII FOR FIREBALL- HYDROGEN CYLINDER RUPTURE

GRAPH



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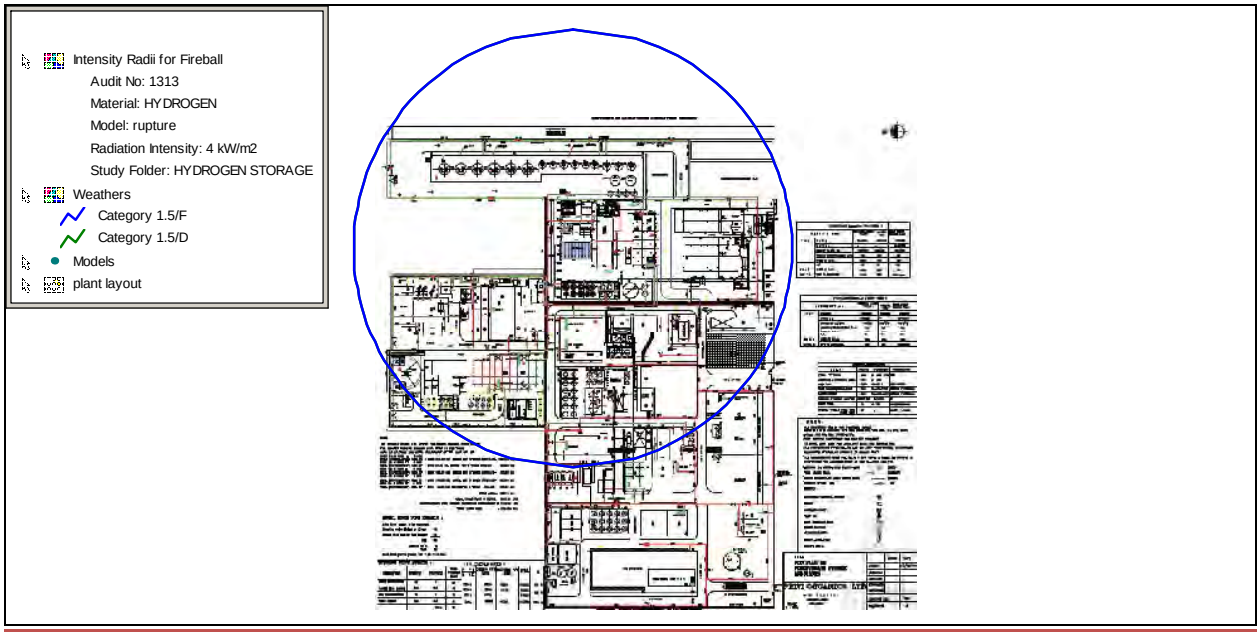
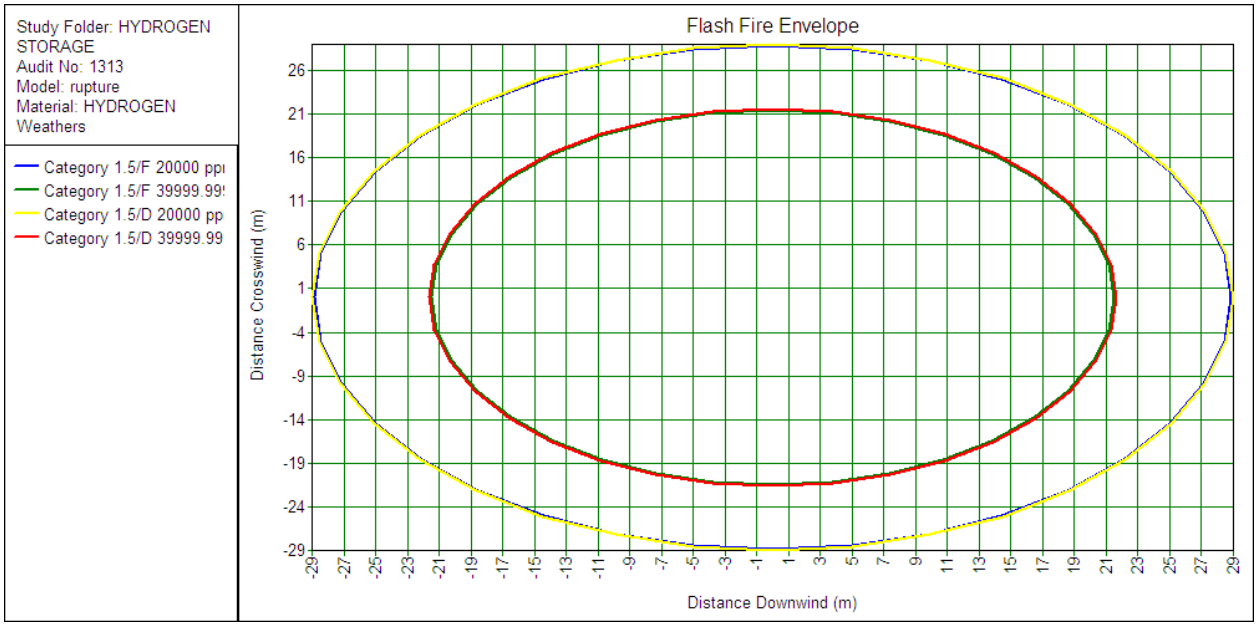


FIG.6.22 FLASH FIRE HYDROGEN CYLINDER RUPTURE

GRAPH



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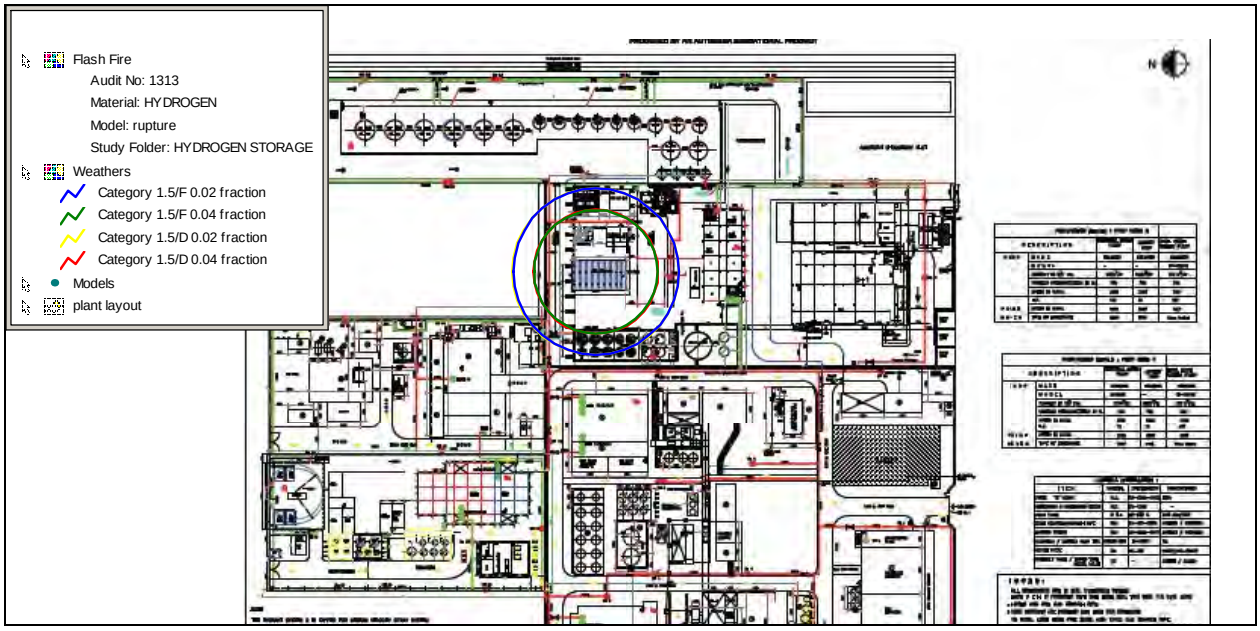


Table- 6.10 CONSEQUENCE RESULTS FOR CST TANK FAILURE

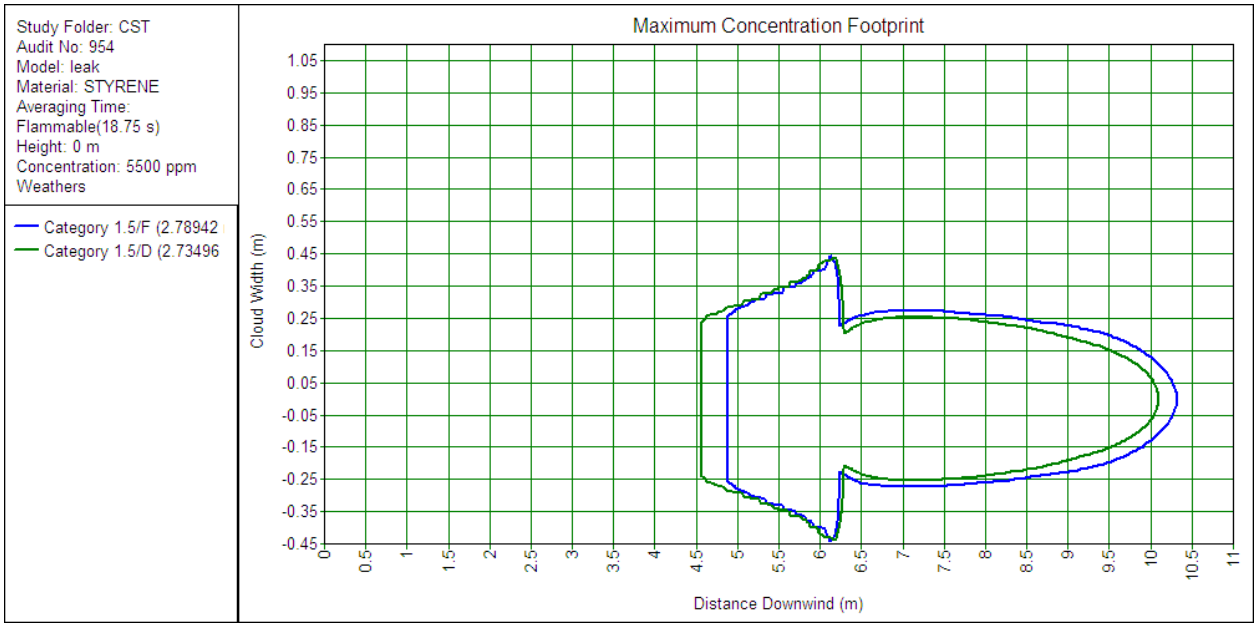
Sr. No.	**7**		
Scenario description	**Leakage (CST Tank)**		
	Weather data	**1.50 m/s F**	**1.50 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	6.20652	6.20701
	LFL	6.22954	6.23047
	LFL Fraction	10.5003	10.4007
Jet Fire (kW/m2)	4	26.5143	26.7942
	12.5	21.0631	21.2837
	37.5	17.361	17.544
Overpressure (bar)	0.02068	14.3321	14.6873
	0.1379	11.1217	11.2137
	0.2068	10.8679	10.9391
Pool fire (kW/m2)	4	26.5718	26.5696
	12.5	17.9751	17.9746
	37.5	10.4595	10.4602

Table- 6.11 CONSEQUENCE RESULTS FOR CST TANK Rupture

Sr.No	**8**		
Scenario description	**Rupture (CST Tank)**		
	Weather data	**1.50 m/s F**	**1.50 m /s D**
		Damage Distances (m)	
Flash Fire	UFL	1.00029	1.01386
	LFL	1.00915	1.0228
	LFL Fraction	1.62843	2.05013
Jet Fire (kW/m2)	4	NA	NA
	12.5	NA	NA
	37.5	NA	NA
Overpressure (bar)	0.02068	No Hazard	No Hazard
	0.1379	No Hazard	No Hazard
	0.2068	No Hazard	No Hazard
Pool fire (kW/m2)	4	20.4614	20.4702
	12.5	11.8284	11.8374
	37.5	4.28534	4.29441

FIG.6.23 MAXIMUM CONCENTRATION- CST TANK LEAK

GRAPH



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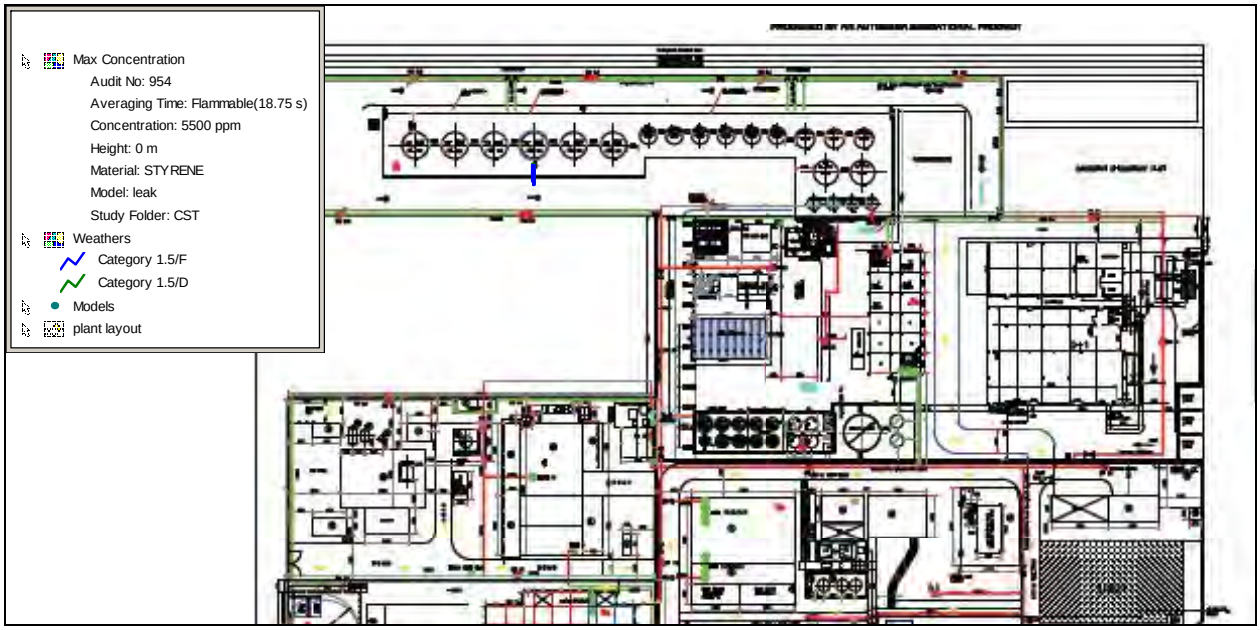
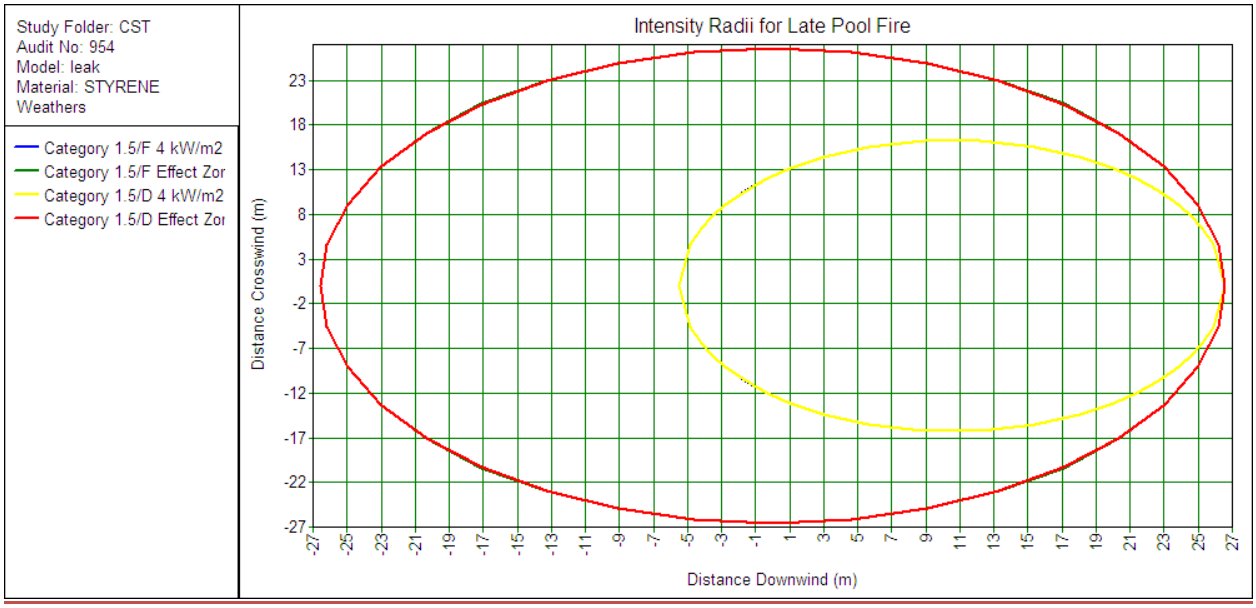


FIG.6.24 INTENSITY RADII FOR LATE POOL FIRE- CST TANK LEAK

GRAPH



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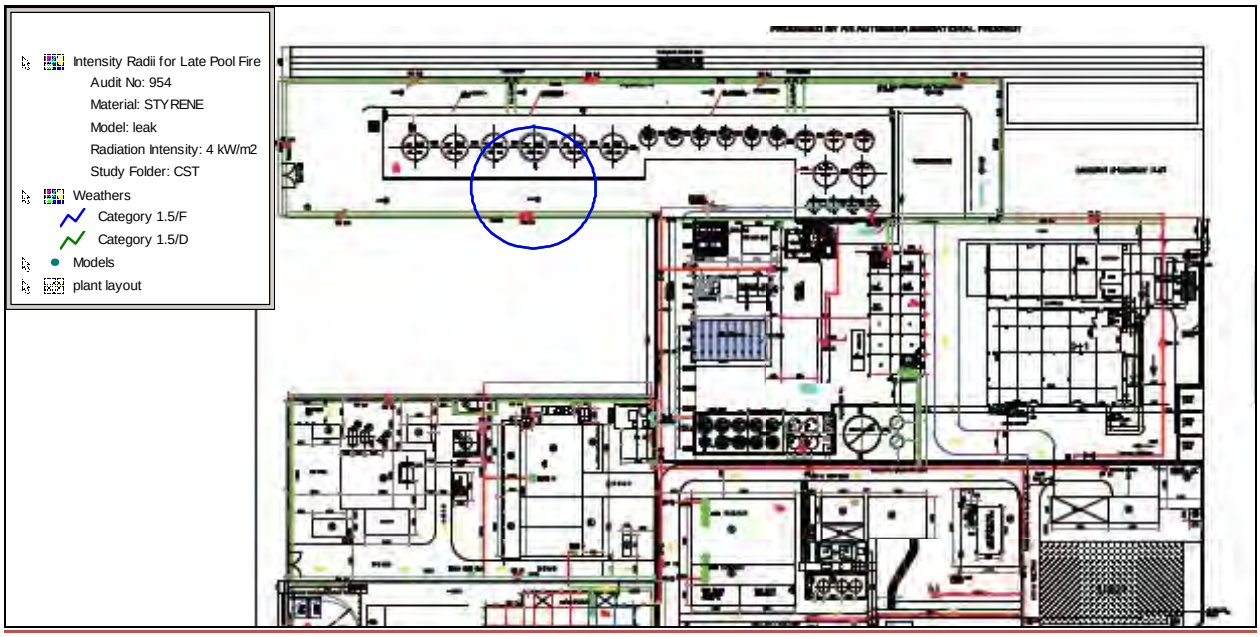
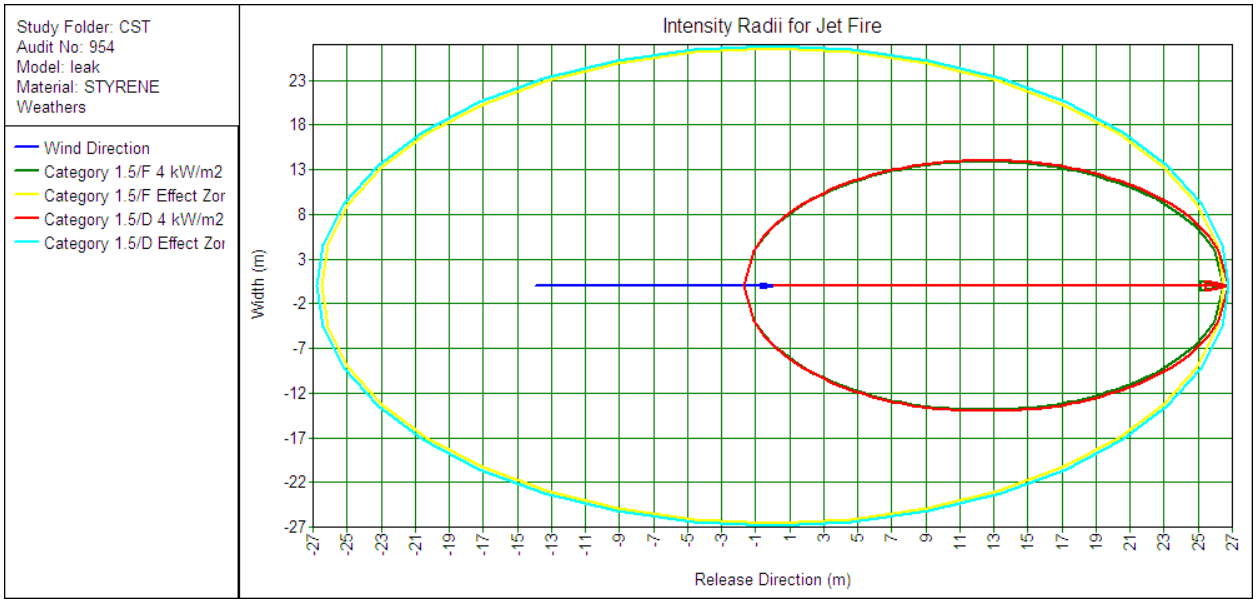


FIG-6.25 INTENSITY RADII FOR JET FIRE- CST TANK LEAK

GRAPH



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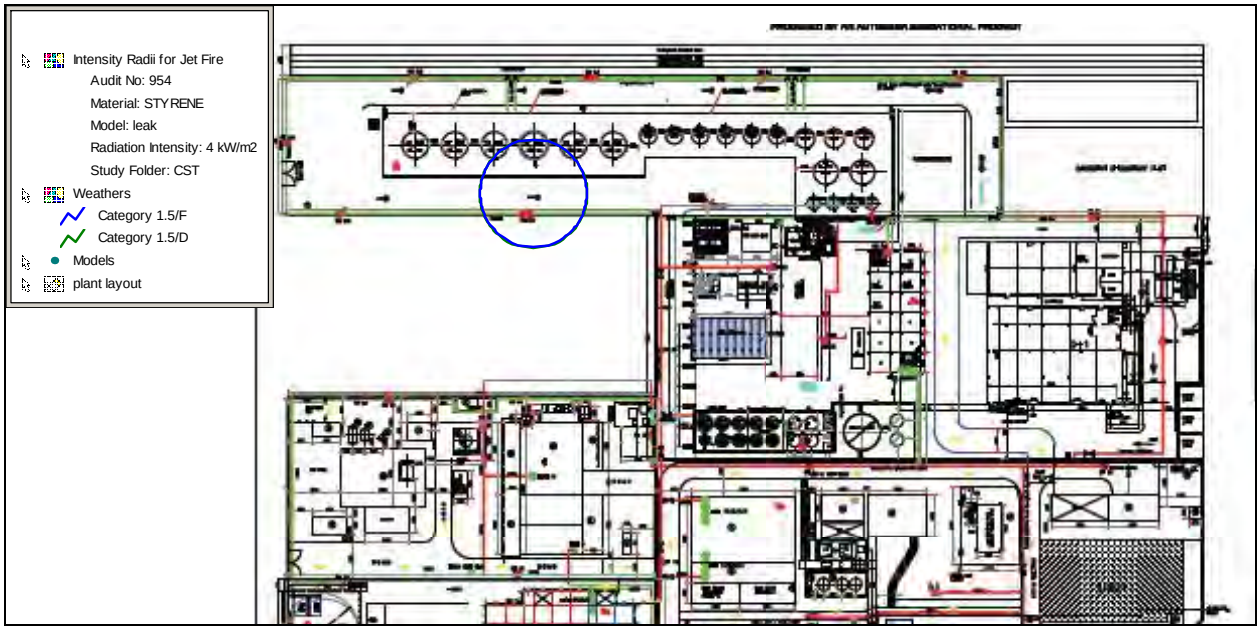
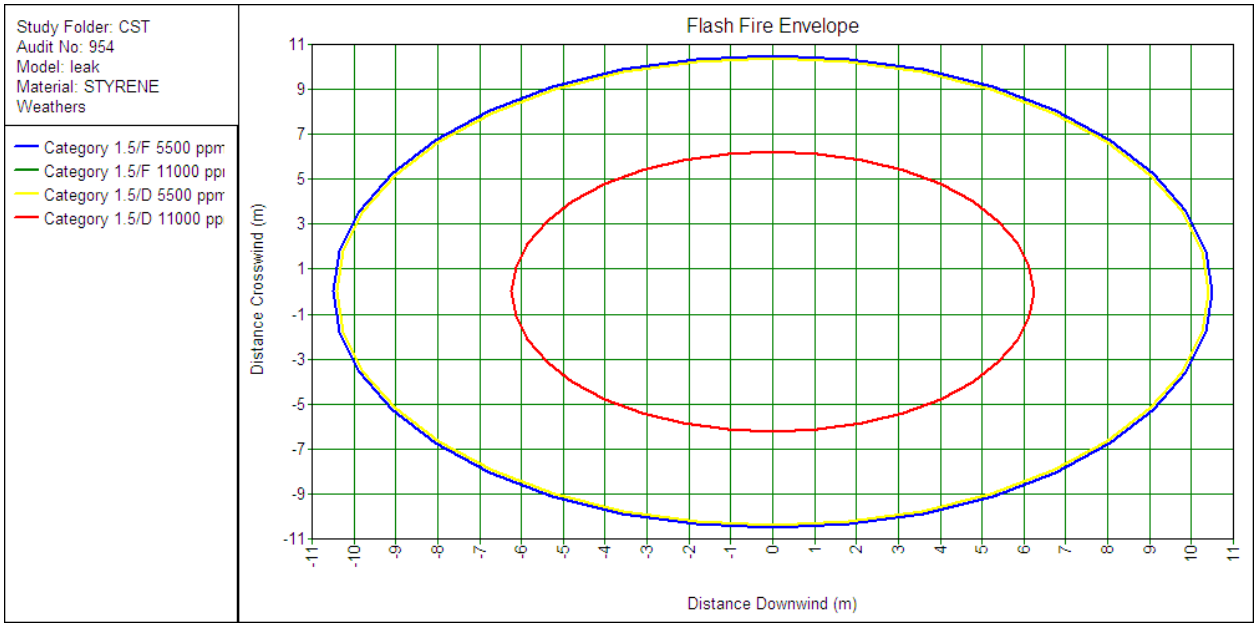


FIG.6.26 FLASH FIRE- CST TANK LEAK

GRAPH



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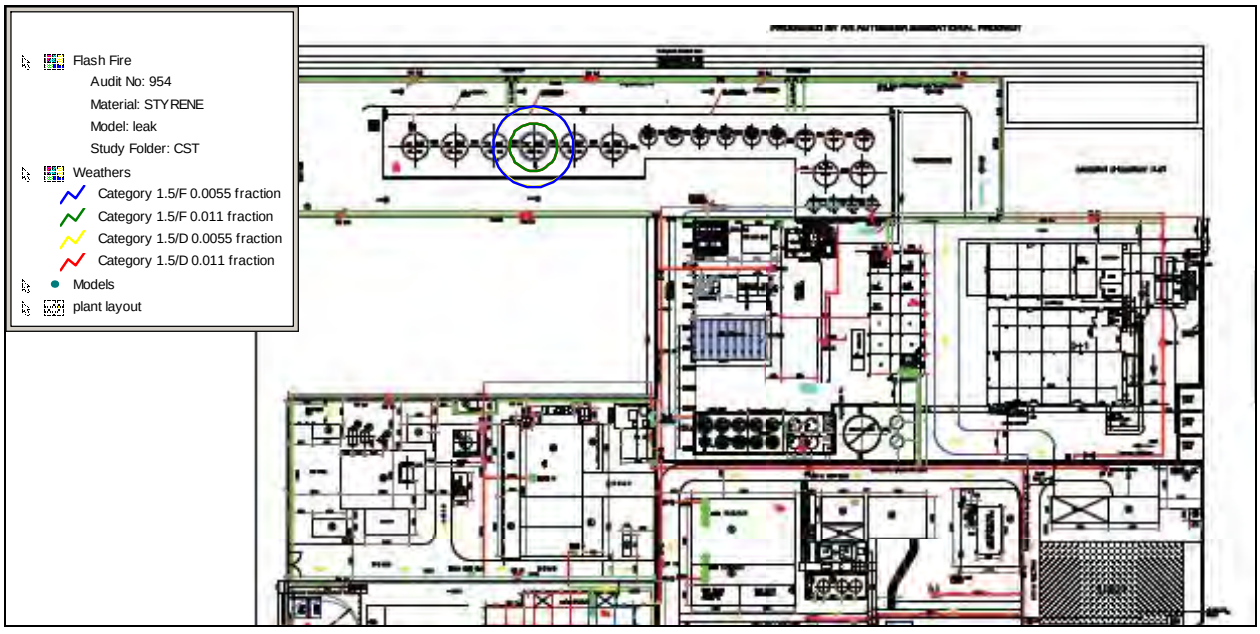
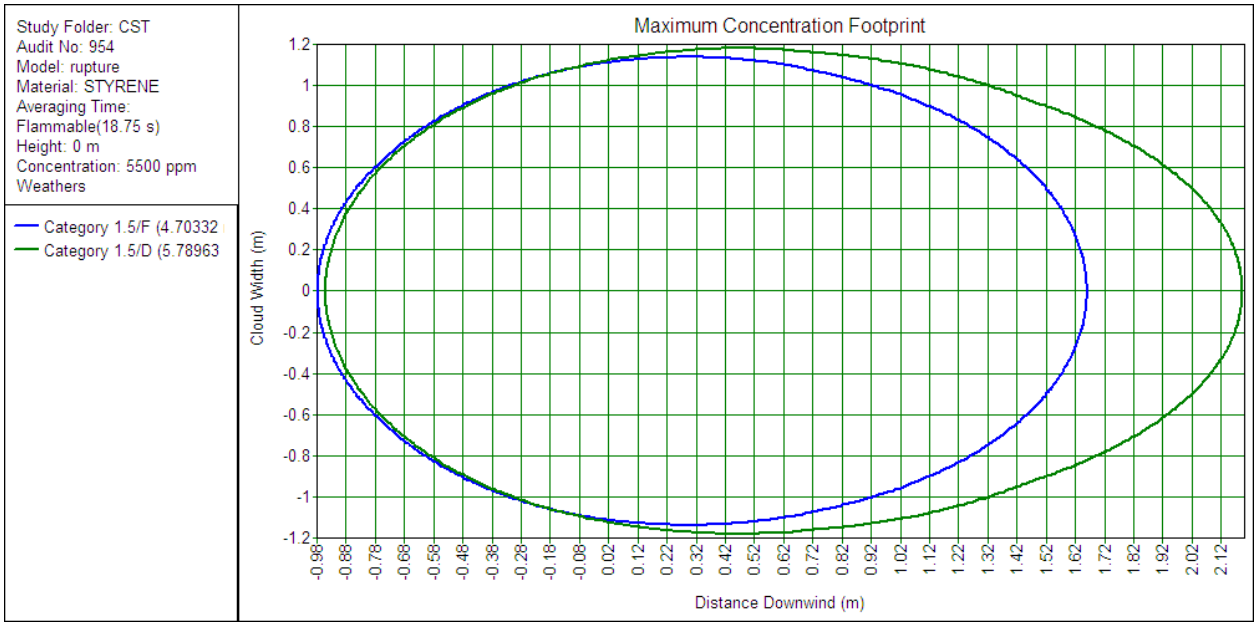


FIG.6.27 MAXIMUM CONCENTRATION- CST TANK RUPTURE

GRAPH



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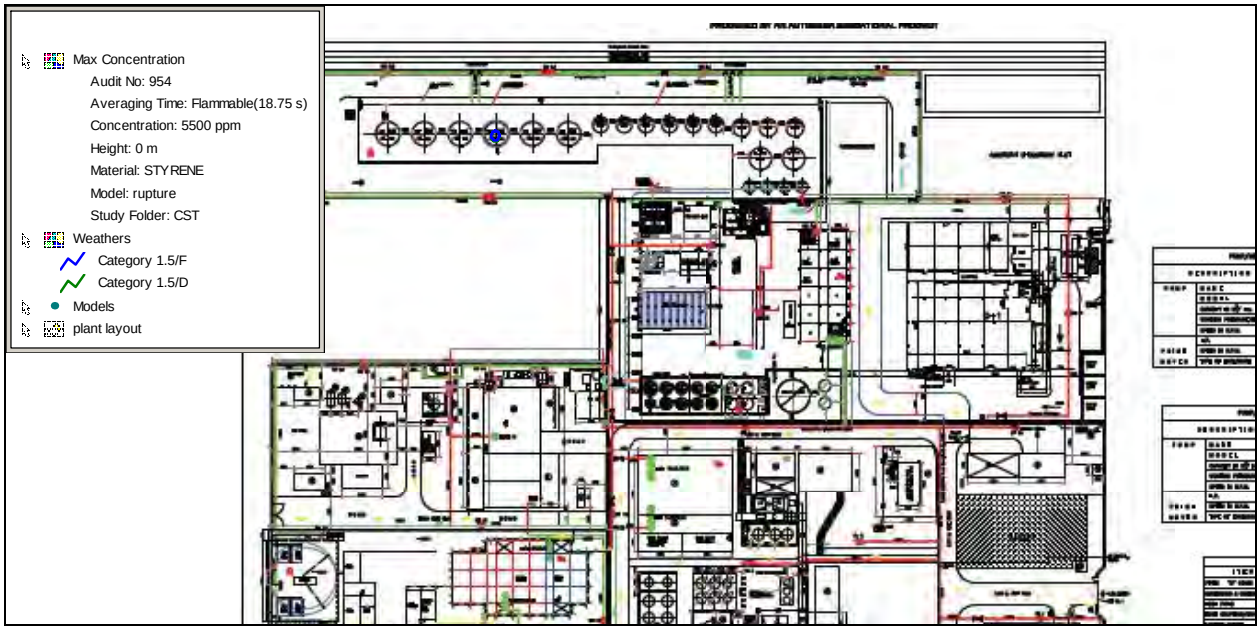
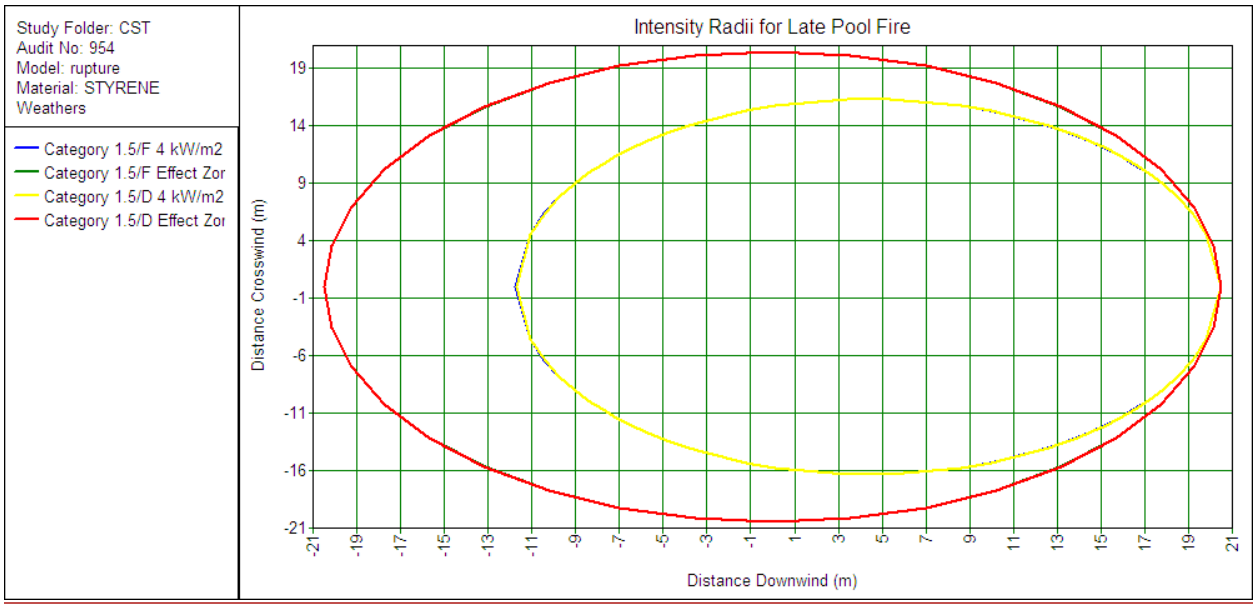


FIG.6.28 INTENSITY RADII FOR LATE POOL FIRE- CST TANK RUPTURE

GRAPH



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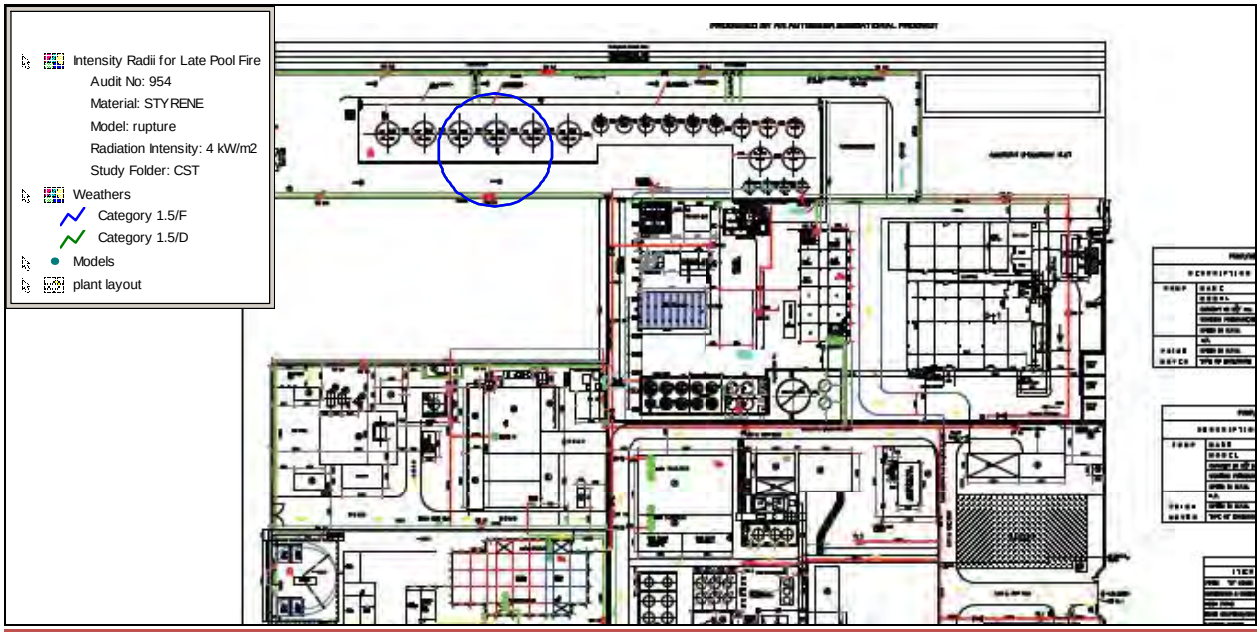
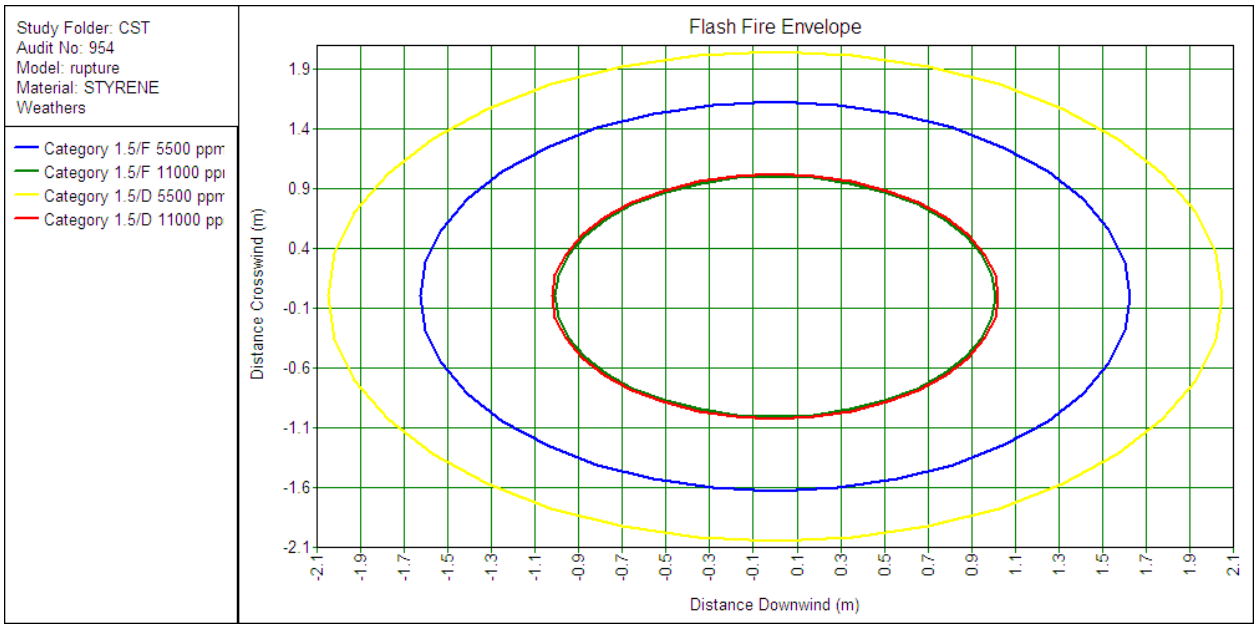


FIG.6.29 FLASH FIRE CST TANK RUPTURE

GRAPH



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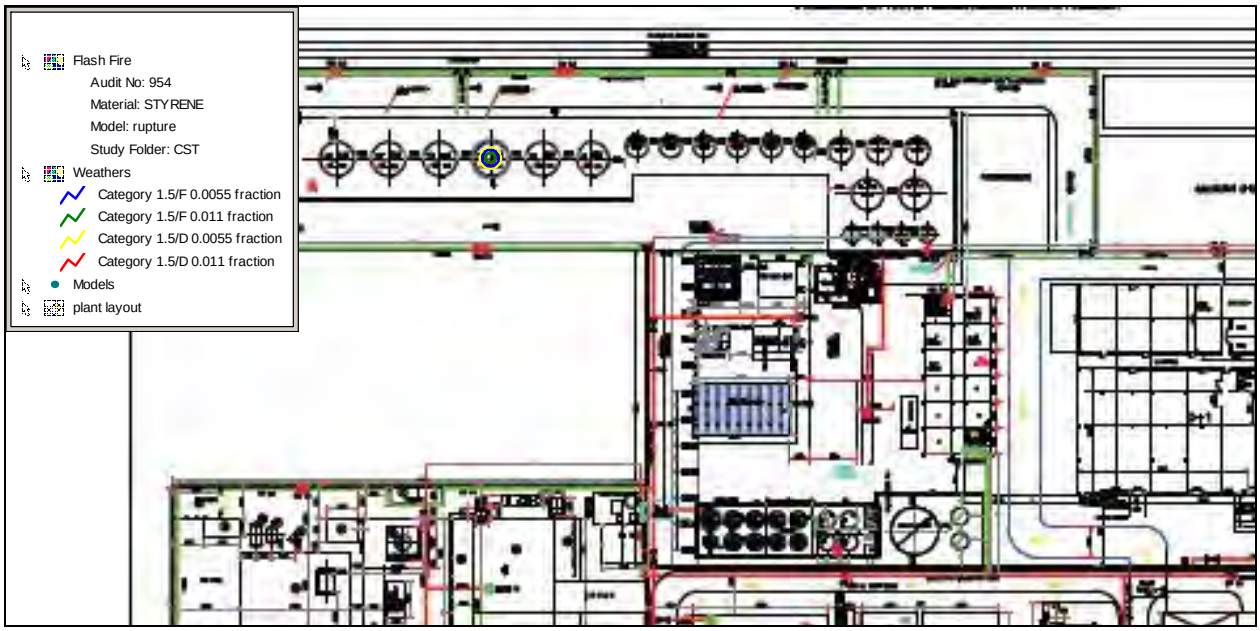

6.7 MITIGATION MEASURES

GENERAL

Measures and Recommendations are as follows:-

- Adherence of international/National engineering standards in the Design, Construction and testing of the storage tanks, equipments and other hardware.
- All storage tanks to have level indicators, flame arrestors, breather valves and foam injection system wherever required.
- The pumps used for transferring the solvents shall be not in the main dyke but in a separate dyke.
- All pumps used to have mechanical seal to prevent leakages and fugitive emission.
- Spillages and leaks from the storage tanks can be collected and transferred out and treated for safe disposal.
- Storage areas shall be free from accumulation of materials.
- All electrical and instrumentation equipment used in the tank farm area to be rated for the solvent present as per ATEX standards.
- There should be good communication system available near tank farm area to the control room, and it should be flameproof.
- A good layout should provide for adequate fire fighting access, means of escape in case of fire and also segregation of facilities so that adjacent facilities are not endangered during a fire.
- Routine Inspection of Flame arrestor and breathing valve should be done.
- At every tank farm its license number, storage capacity & name of the chemicals should be displayed at the entrance.
- Flameproof Motors for unloading near flammable storage tank should be provided with double earthing.
- A fixed foam pouring arrangement to tackle any duke spillages should also be considered. The foam blanket prevents surface evaporation form liquid pool
- Develop detailed maintenance/contractor procedures requiring physical identification of tank vents during walk-through and other devices which haven't cover during maintenance activities.
- Emergency cupboards containing self contained breathing apparatus, fires suits and chemicals masks and suits to be kept near the tank farm areas.
- A telephone should be provided which is freely available and readily accessible for the reporting of accidents or emergency situations. The emergency telephone numbers should include the fire department, ambulance service, emergency response team, hospital and police.

- Non-freeze safety showers and eyewash fountains shall be provided, clearly marked, well lit and with unobstructed access. They should be installed close, not more than 30 meters or ten seconds walking distance from any location in the storage area. Provide alternative sources of water supply.
- Leak detector system should be installed.
- Plant should meet provisions of the Manufacture, storage & Import of Hazardous Chemicals Rules, 1986 & the factories Act, 1948.
- Periodic On Site Emergency Mock Drills and occasional Off Site Emergency Mock. Drills to be conducted, so those staffs are trained and are in a state of preparedness to tackle any emergency.
- Emergency handling facilities to be maintained in tip top condition at all time.
- Safe operating procedure to be prepared for hazardous process and material handling process.
- Safety devices and control instruments to be calibrated once in a year.
- Proper color work as per IS 2379 to plant pipeline and tank, equipments to be done once in a six month to protect from corrosion.
- Preventive maintenance schedule to be prepared for all equipments.
- Permit to work system to be implemented 100 % for hazardous work in the plant.
- Safety manual as per Rule-68 K & P and Public awareness manual as per 41 B & C needs to be prepared and distributed to all employees and nearby public.
- As per Scenario for Catastrophic Failure of Methanol tank, evacuation plan needs to be prepared for nearby plants in wind direction in case of extreme accident scenario.
- Fire & Safety organization setup to be planed and implemented for better plant process safety.
- Water Sprinkler system needs to be provided in storage area.
- Static earthing interlocking with pump facility to be provided in tank farm area to avoid static hazard during tanker unloading work.

CHEMICAL WISE

MITIGATION MEASURES FOR THE STORAGE OF METHANOL

- No flammable material should be placed near by the plant. No welding or cutting to be done in nearby area.
- There are chances of explosion in the presence of mechanical impact. There should be no mechanical work done on the tank.
- Proper earthing of the tank to be done.
- Tank area is to be cool and well ventilated.

- Storage tank of methanol in large volumes uses internal floating roof tanks to minimize methanol vapor space within the tank and to reduce the amount of air that is available to mix with the vapor.
- Tank vents must be equipped with flame arresters if vapor space of the tank is not padded with an inert gas. Inert gas blanketing or padding adds an additional level of protection against ignition within the tank vapor space
- Dry nitrogen is the preferred gas for blanketing.
- The outside of methanol tanks should be painted with heat reflecting paint. This measure will reduce vapor losses from the tanks.

MITIGATION MEASURES FOR HYDROGEN REFORMER AREA

- PPE's are recommended while handling hydrogen.
- Check valve should be used in piping or lining of hydrogen, in order to prevent reverse flow.
- Leak check system & leak detectors should be used for hydrogen lining.
- Always use CGA connections.
- No ignition source should be near hydrogen generator.
- All electrical equipment should be explosion proof in reformer, generator area.

MITIGATION MEASURES FOR THE STORAGE OF HYDROGEN STORAGE AREA

- Hydrogen gas cylinders should be stored outside and away from doors, windows, and building air intakes. Indoor storage of hydrogen requires specially designed facilities.
- Cylinders must be protected against heat, corrosive atmospheres, rain, snow accumulation, and direct sunlight.
- The storage area should be paved and easily accessible to delivery trucks and users with cylinder carts. Cylinder storage areas should drain readily, which may require that cylinders be placed on pallets or otherwise raised above surrounding surfaces.
- Prevent cylinders from toppling by securing them with chains,
- Hydrogen must be separated from oxidizing gases when stored.
- Avoid corrosive chemicals including salt and fumes.
- Storage cylinders must be segregated into "FULL" or "EMPTY" groups at locations or in racks for each category.
- Flammable gas cylinders whether full or empty must not be located near an exit or any location which could block an exit.
- All cylinders whether full or empty must comply with NFPA and DOT labeling requirements and OSHA hazard communication requirements.

- There must be adequate space for personnel and carts to allow delivery and removal of cylinders. Floor surfaces must be in good condition. Cylinders that are moved to allow access to other cylinders must be secured to prevent accidental falling or damage.
- Before entering hydrogen storage area check for flammable or oxygen-deficient atmosphere.
- Storage area should have natural ventilation or explosion proof ventilation. So as it does not reach its LEL of 4%
- Hydrogen cylinder should not be connected to any electrical circuit.
- Cylinder should be placed away from incompatible material E.g. oxygen cylinder, flammable and combustible liquids, Toxic gas cylinders or other oxidizers by minimum distance of 20 ft.
- Cylinder should be stored upright.
- Cylinder should not be rolled, dragged, slide or dropped.
- Post "No Smoking or Open Flames" signs in storage area.
- Storage area should meet national electric codes for class-1 hazardous area.

MITIGATION MEASURES FOR THE STORAGE OF CST (CRUDE SULPHATED TERPENTINE)

- CST should be stored in well ventilated& cool place.
- Storage tank should be tightly sealed to exclude air.
- Tanks should be well earthed to avoid explosion due to static charge.
- Eye wash station and safety showers must be readily available.
- All sources of heat and ignition near storage area must be avoided.
- Storage area must be at a distance from oxidizing agent.
- Storage tanks should be protected from physical damage.
- Fire extinguishers such as Carbon dioxide (CO_2), Dry chemical, Foam & Water spray should be used at the event of fire. Does not use a solid water stream as it may scatter and spread fire.

6.7 REFERENCES

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8. PHAST v 6.53-Software
9. Overall plot plan

CHAPTER 7
DISASTER MANAGEMENT PLAN

7.0 OBJECTIVE

The objective of the plan is to down steps to handle emergency situation that may arise due to leakage/spillage, explosion and fire of the various chemicals, fuels in the plant and any adverse effect on employees and public at large is minimized and normalcy is restored within shortest possible time.

This Disaster Management Plan is prepared to meet such grave emergency which can occur due to big fire in the plant missile hit due to air raid, heavy leakage of flammable liquid or gas or explosion (internal or external cause) in any plant.

Emergency Response Plan (action plan) has been drawn to fix responsibility & actions to be taken by various groups to meet & contain the emergency within shortest possible time & with minimum loss to men, materials, machines & property. It is responsibility of all individuals in their respective areas to ensure success of this plan. This plan is circulated for benefit / training of all individuals working in **M/s. Privi Organics Ltd, MIDC Area, Mahad-Raigad.**

The major functions & objectives to formulate the plan are:

(I.) To mobilize the available / trained manpower and handle the emergency from:

- On-site (within factory)
- Off-site (through outside agencies).

(II.) To ascertain urgently likely area of influence and take actions for warnings, control of disaster with minimum damage to men, material, machines and evacuation of employees / public, identify the persons affected / dead, arrange first aid / medical help to the victims.

(III.) Inform relatives of the casualties provide authoritative information to News Media & others; preserve relevant records & equipments needed as evidence in any subsequent inquiry.

(IV.) Appraise District Administration / Civil authorities etc. order to ensure prompt relief for execution of Emergency Response Plan.

This document sets out the emergency plans for all levels of accident ranging from a local incident within the site boundary to a situation that requires outside support. The objectives of the emergency plan are:

- To protect lives of working personnel and nearby population.
- To contain the hazards and to control their spread.
- To minimize the impact on the environment.
- To minimize the loss to plant and production.

7.1 DEFINITION AND SCOPE

A major emergency is defined as one, which may affect one or several sections of the plant and possibly extend beyond the factory boundaries. It may cause serious injuries, loss of life or extensive damage to property. The potential hazards may be due to following:

- Spillage / Leakage of solvents/ gas.
- Leakage or Toxic Release of Gas.
- Fire or explosion in the plant or storage area.

The Disaster Management Plan has been prepared in order to provide proper guidance to plant operating personnel to confidently handle any accidental leakage / spillage of the solvents or fire / explosion / bursting of vessel or any natural calamity or sabotage. With this objective comprehensive information has been assembled in the following pares on the solvents, fuel oil and chemicals used (Hazardous) about its properties, fire hazards, safety appliances, safety measures incorporated in the plant, emergency procedures and finally regarding the constitution & responsibility of Emergency Rescue Team (Emergency Response & Management Team / Task Force).

7.2 METHODOLOGY

A major emergency occurring at a plant is one that may cause serious injuries, loss of life, extensive damage to property or environment or serious disruption inside or outside the plants. This may demand the rescue and relief measures on a war footing to handle it effectively and quickly. Within the high-risk technology industries, the need for well-planned measures should be self-evident.

No matter how well a process is controlled and safeguarded by instruments and process safety procedures, it is inevitable that there is a residual risk, which is capable of causing a variety of emergencies.

The Factories Act, 1948 as amended in the year 1987 under section 41B requires that every occupier shall draw up a Disaster Management Plan and detailed disaster control measures for his plant and make them know to the employees and to the general public living in the vicinity of the plant. According to MFR, it is statutory for the industries to submit Disaster Management Plan with relevant details.

Its objective is to reduce the severity of loss following particular hazardous incidents. At the same time, must be clearly understood that it is not a substitute for maintaining good standards for working consistence with the requirements of safety and health inside the plants.

7.3 INTRODUCTION

The Disaster Management Plan describes the Organization & procedures for dealing with potential accidents arising from the operations of M/s. PRIVI ORGANICS LIMITED

Experience of accidents that have occurred in various other chemicals manufacturing plants was considered in the preparation of this Plan especially storing & handling the hazardous chemicals identical to this plant. This plan is need periodic review & modification following emergency exercise, or include any new information relating to changes to the facilities.

The workforce inside the plant is exposed to various systems, pipelines & vessels and process equipments which, if not properly operated & maintained could cause serious accidents affecting life & properties in the vicinity of accident site. In addition to these, the inventory and transportation of the chemicals may create chance of accidents. This Plan is needed to respond to a variety of emergencies / disasters:

I) Disasters due to emergency on account of:

- Fire
- Bursting or Explosion
- Oil spillage
- Spillage or leakage of toxic materials
- Release of toxic gas
- Electrocution

II) Disaster due to natural calamities such as:

- Flood
- Earth quake
- Storm / cyclone

- Cloud burst / lightening

III) Disaster due to external factors such as:

- Food poisoning / water poisoning
- Sabotage
- Civil Riots or War
- Terrorism, air raid, etc.

The action plan responding to an emergency situation depends very much on the level of the emergency which, itself is defined by the consequences arising from the types of hazard identified. The organization & duties of the Emergency Team & the action plans for each of the disaster levels is included in this document.

The plant is provided with various safety & disaster control facilities to prevent & control any disastrous occurrences. Measures for preventing & controlling disaster are outlined in following sections. It also includes information on the plant facilities & its location.

This Disaster Management Plan describes the organization and procedures for dealing with potential accidents arising from the operations of **M/s. Privi Organics Ltd, MIDC Area, Mahad-Raigad.**

This plan is need periodic review in case of modification following emergency exercises, or to include any new information relating to changes to the plant facilities.

7.4 DETAILS ABOUT SITE:

M/s. Privi Organics Ltd, MIDC Area, Mahad-Raigad.

The site is not in the 'Major Accident Hazard' category.

The site operates in three shifts.

The total manpower strength is 360.

7.5 PLANT LAYOUT AND DETAILS (Refer Annexure-1)

STORAGE AREA

All storages are above ground. All chemicals are either flammable or corrosive.

UTILITY

Utilities required are steam, Power and water. Company is planning following activities at the new Project to demonstrate its total commitment to the environment by reducing the carbon footprints:

- **Rain Water Harvesting**
- **Effluent Treatment Plant**
- **Use of Solar Energy**
- **Landscaping**

7.6 EMERGENCY ORGANIZATION

This chapter is devised to suggest the organization for emergency preparedness. Key personnel to combat emergency are nominated with specific responsibilities according to set procedures and making best use of the resources available and to avoid confusion. Such key personnel include Chief Emergency Controller, Site controller, other key personnel such as First Aiders, Fire fighting staff, support staff and communication staff, advisory staff.

All such key personnel **(Annexure – 2)** shall be available in all the office timings and shall be called during emergency in holidays.

ROLE OF KEY PERSONNEL

7.6.1 SITE MAIN CONTROLLER

He has overall responsibility for direction operation and calling outside help for emergency control center. As he is required to take decisions by collaboration between all processes heads, the factory manager (Leader- Conversion Processes) of the M/s. Privi Organics Limited shall act as the **Site Main Controller**.

The duties and responsibilities of **Site Main Controller** are as follow. Being aware of the emergency immediately he is go to the emergency control room. (Security cabin)

I. Over all in-charge of the situation and takes responsibility for overall control.
II. He will proceed to the Emergency Control Room at main gate security office.
III. He will nominate two persons as Communication Officers from the available management staff (already identified as Communication Officer)
IV. Decide whether a major emergency exist and on declaration of a major emergency in consultation with the Incident Controller. Ensure that the outside emergency services and mutual help are called, the off-site plan gets activated and if necessary, nearby factories and population are informed. Inform about the situation to other manufacturing locations.
V. Ensure that the key personnel are called in.

I. Exercise direct operational control of those parts of the works outside the affected area. Continually review and assess possible developments to determine the most probable course of events.
II. If necessary, direct for evacuation of neighboring population.
III. Ensure that casualties are receiving adequate attention. Arrange for hospitalization of victims and additional help if required. Ensure that the relatives are communicated.
IV. Inform and liaise with the Chief Officers of the Fire and Police Services, District Emergency Authority and with the Factory Inspectorate and experts on health and safety. Provide advice on possible effects on areas outside the factory.

V. In the case of prolonged emergencies involving risk to outside areas by wind blown materials, contact the local Meteorological Office to receive early notification of impending changes in weather conditions.
VI. Review the authorized statements prepared for the news media.
VII. Direct for the preservation of evidence.
VIII. Control rehabilitation of affected areas and victims on cessation of the emergency. Do not restart the research activities unless it is ensured safe to start and cleared by the authorities.
IX. Determine what investigations and reporting should be carried out, and by whom, to determine the cause and (if appropriate) prevention of recurrence.
X. Instruct to Security personnel to raise all clear siren after confirmation of head count and emergency is over.
XI. Site Main controller shall wear white Helmet with two red bands (Florescent) for getting identified prominently during emergency situation.

7.6.2 INCIDENT CONTROLLER

A. His primary duty is to take charge at the site of the incident. In the initial stages he is take decisions involving the operation of the other plants or to stop or continue any process and take decisions to control the incident.

Site- SHE representative may be appointed as Site Controller for all the 24 hours of working and holidays. Shift supervisor is appointed as Alternative (Deputy) Site Controller and would take the charge in the absence of the Site controller. In case the emergency occurs at more than one place the alternative site controller would take charge as Site Controller in their respective places/ areas to prevent the danger of a disaster.

- He will proceed to the scene immediately on being aware of the emergency and its location.
- Assess the scale of emergency and decide whether a major emergency exists or is likely. On his decision, he will activate the on-site plan and if necessary the off-site emergency plan.

B. Assume the duties of the **SITE MAIN CONTROLLER** till his arrival. For this purpose he is depute his alternative (deputy) Site controller at the site of scene and he is go to the control center.

- Will announce the emergency by giving instruction to Security Officer/ Security Guard to raise Emergency Siren and will give an order for evacuation if felt necessary.
- Direct and evacuation of all personal likely to be affected by the emergency.
- Ensure that the outside emergency services, including mutual aid, have been called in if necessary.
- Ensure that key personnel have been called in.

C. Direct all processes/ functions within the affected areas with the following priorities.

- Secure the safety of personnel.
- Minimize damage to property and the environment.

D. Ensure all other hazardous or flammable material storages or equipments are protected in emergency due to fire by making following provision:

i. Isolate the area by removing supply or providing fire retardant blanket or water curtain arrangement.

ii. Cool the equipment or storages by spraying water or sprinkler system.

E. Direct rescue and fire fighting operations until the arrival of the outside Fire Brigade, when he is relinquish control to the Head of the Fire Brigade.

F. Search for casualties.

G. Evacuate non-essential workers to the assembly points.

H. Set up a communications point and establish telephone / messenger contact as appropriate with the emergency control center.

I. Report on all significant developments to the communication officer/ Site Main Controller.

J. Give advice and information as requested to the Head of Safety & Fire and other emergency services.

K. Brief the main Incident Controller and keep informed of developments.

L. Preserve evidences that are necessary for subsequent inquiry into the cause of the emergency and concluding preventive measures.

M. Incident controller shall wear white Helmet with one red band (Florescent) for getting identified prominently during emergency situation

7.6.3 FIRE FIGHTING STAFF

These task forces known as Fire fighting staffs is trained to handle various fire fighting equipments during emergency situations. They shall report to the Site controller for fire extinguishing related task.

On hearing of Emergency Siren, before leaving the work place inform to concerned executive & give the charge of activity then leave the place.

- Fire fighting team shall rush to the incident spot and get the feedback from the Site controller.
- As per instruction from Site Main Controller one of the fire Team member should must go to fire pump house and take the following action:
- Check the pressure of hydrant system.
- Check the Main pump is ON.
- Check the water level of fire water tank.
- Start make of water to the tank by opening the MIDC water inlet valve.
- If any abnormality observed it should be reported to the Site Main Controller.
- For communication utilize telephone system available in the EHS Dept.
- The team determines the origin and causes of fires. They collect evidence, interview witnesses and decide the plan.
- Report to Incident Controller.
- Take quick action as per the instructions from Incident Controller such as by cooling effect, starvation of fuel by removing supply or blanketing the material by fire retardant material to protect storages and equipment.
- Select correct fire extinguisher for fire fighting.
- Fighting fire/ gas leak and spill control till fire brigade takes the charge.
- To help to the fire brigade and mutual aid terms if it is so required.

- Keeps all fire fighting equipments in order after emergency over.
- Not leave process / equipment in UNSAFE CONDITION.
- Not leave emergency site unless ALL CLEAR siren blown.
- Not use improper fire extinguisher.
- Not be panicky.
- All Fire Fighters shall wear RED colour Helmet for getting identified prominently.

7.6.4 SUPPORT TEAM –MAINTENANCE OPERATOR

This task force known as Support team is helps the personal during emergency situations. The roles and responsibilities of the team are:

- Direct the personal to go to the Emergency assembly points.
- Search, Evacuation, rescue and welfare.
- Planning of assembly points to record the arrival of evacuated personnel. Planning for outside shelters and welfare of evacuated persons there.
- Assistance of causalities reception areas to record details of causalities.
- Moving cars or other vehicles away from areas of risk or from the scene of the incident.
- To have a head count of personal at both the assembly point and tally with the total persons at the time of the emergency.

7.6.5 TRAINED FIRST AIDER

This task force known as First Aid staffs are trained for emergency handling shall be available all the times in duty hours to assist the personal during emergency. They shall report to the Site controller for first aid related task (**Annexure - 6** for details). On hearing of Emergency Siren, before leaving the work place inform to concerned executive & give the charge of activity then leave the place.

- First Aid team shall rush to the assembly point and get the feedback from the Site controller about the emergency
- As per the instruction, they rush to the area of emergency and assess the situation.
- Approach emergency site quickly with BA set and First Aid box.
- Diagnoses the situation and decides whether the causality shall be moved to the safe area.
- The injured personal are moved to the safe place and give first aid as required by the situation.
- Follow instructions of Incident Controller.

- Move / transport the causalities to the ambulance / nearby medical center for necessary medical assistance.
- Render first-aid to the injured person, hospitalize, if required.

7.6.6 COMMUNICATION TEAM

This task force known as Communication team is helps the personal and organization. This task force known as Communication team helps the personal and organization during emergency situations. The roles and responsibilities of the team are:

- Inform all the employees about the emergency and ask them to come to the assembly point.
- Asking for the ambulance / fire brigade as directed by the Chief Emergency Controller.
- Informing surrounding factories and the public as directed by the site main controller.
- Planning of works entrances in liaise with the police to direct emergency vehicles entering the work, to control traffic leaving the work and to turn away or make alternative safe arrangements for visitors, contractors and other traffic arriving at the works.
- Assistance at communications centers to handle out going and incoming calls and to act as messengers if necessary.

7. 6.7. ADVISORY TEAM (QA PERSONNEL)

This task force known as Advisory team helps the personal and organization during emergency situations. The roles and responsibilities of the team will be:

- Assist chief controller or site controller in their work.
- Guide site controller to take emergency shout down in case of emergency.
- Guide rescue team to first Aid by referring MSDS.
- Guide fire fighting team to used correct fire extinguisher to extinguish fire.

7. 6.8. RESPONSIBILITY OF ENGINEERING TEAM

On hearing of Emergency Siren, before leaving the work place inform to concerned Executive & give the charge of activity then leave the place.

Engineering Team will:

- Report to ECC at main gate security office.
- Find out emergency location. Approach emergency site immediately.

- Report to Incident Controller.
- Take quick action as per the instructions from Incident Controller
- Maintenance Executive and the shift electrician will report to the scene of incident and close down the services, electric supply as requested by Incident Controller.

7. 6.9. RESPONSIBILITY OF EMERGENCY VEHICLE DRIVER

On hearing of Emergency Siren or communication on phone or announcement on PA system,

- Immediately start vehicle and reach to incident spot.
- Rescue Team members to emergency site.
- Take vehicle near to emergency site as directed.
- Take note of wind direction.
- Reverse the emergency vehicle for quick transports of injured, if any.
- Keep vehicle engine running.
- Always be on driver's seat of the vehicle.
- Take the injured to the hospital as directed.
- Do not leave the vehicle.
- Do not take the vehicle very near to the site.

7.6.10 RESPONSIBILITY OF SPILL CONTROL TEAM:

On hearing of Emergency Siren, before leaving the work place inform to concerned executive & give the charge of activity then leave the place.

- Report to ECC at main gate security office.
- For minor spills, clean the spill using absorbent material and put the
- Contaminated material in the drums & mark it as a hazardous waste.
- For major spills, report immediately to the concerned Executive, Department Head, ETP Operator and EHS team.
- Try to contain the spill material in the PETP by providing bunds at outlet of the PETP. Before entering the spill area recommended PPEs to be used.
- Warn other employees about the spill.
- Eliminate combustible material or other source of ignition.
- Incident Controller of the affected area shall initiate evacuation [of employees] if applicable.

7.6.11. RESPONSIBILITY OF EHS

- On hearing the Emergency Siren report to Site Main Controller.
- On demand of Site Main Controller provide necessary help such as the technical information, MSDS, dispersion calculations, outside help etc.
- Work as per the Site Main Controller instruction.
- EHS Team will arrive at site and guide in the use of protective and other emergency safety appliances.
- He will mobilize Personal Protective Equipments & other safety appliances from stores / Mutual Aid Industries members.
- He will assist Incident Controller to ensure safety of the people and the plant.
- He will help in monitoring the hazards in case of leakage.
- If felt necessary, he will ask Liaison Officer to call the assistance from the member establishments under MARG scheme

7.7 EMERGENCY CONTROL CENTRE (ECC)

The centralized emergency control center is situated at the security cabin near the main gate from which the operation to handle the emergency are directed and coordinated. The center is equipped to receive and transmit information and directions from and to the incident controller and areas of the works as well as outside.

The emergency contact numbers for the mutual aids like nearest police station, fire station, hospital, ambulance service etc. is displayed at the required location along with emergency control centre and security gate.

7.7.1 Emergency Control Centre Is Containing the Following Facilities:

a) A copy of ON-SITE EMERGENCY PLAN.

b) Internal and external communication.

c) Daily attendance of workmen employed in factory.

d) List of important telephone numbers such as Police, Fire Brigade, Hospitals, and other outside Emergency Services, etc.

e) List of key Personnel with addresses and telephone numbers etc.

f) List of Mutual Aid Scheme Members

g) List of Fire and Rescue Squad Members

h) Plan of the plant showing-

i. Storage area of hazardous materials.
ii. Storage of safety equipments.
iii. Fire fighting system and additional source of water.
iv. Site entrance, roadway and emergency exist.
v. Assembly points.
vi. Truck parking area.
vii. Surrounding location.

i) Fire Extinguisher etc.

j) Fire Fighting System (layout of Fire Hydrants), List of Personal Protective Equipment.

k) Storage of hazardous material records and their Material Safety Data Sheets – (M.S.D.S.)

l) List of employees with address, telephone numbers, blood groups etc.

m) Torches.

n) Note Book, Pad and Pencil

Trained personnel are always available in these areas who can rush to the emergency point in shortest time. Warning system is always be kept in working order.

7.8 MEDICAL ARRANGEMENTS

FIRST AID BOXES

First aid box is located at Emergency Control Room, Hydrogenation plant, DHMOL Plant, Pilot Plant-I, R&D, QC , Maintenance, Ionone , CST plant & Environmental Lab. The first aid box or cup boards contain the equipments as prescribed.

LIST OF EVACUATION /FIRST AID TEAM

Refer Annexure No.6

COMPANY DOCTOR

A qualified doctor is appointed on part time basis.

Dr. Mr. Faizal Deshmukh (M.B.B.S.; A.F.I.H)

ANTODOTES

Antidotes are available at Occupational Health Center with company doctor.

HOSPITALS

There is adequate arrangement with local hospitals for any medical emergency.

SN	NAME OF HOSPITAL	DOCTOR IN CHARGE	PHONE NOS.
1.	Deshmukh Nursing Home, Mahad	Dr. F.A.Deshmukh/ Dr. Ansari	223086
2.	MMA Hospital	Doctor	232562/233879
3	Govt. Hospital, Mahad	Doctor	223047

7.9 TRANSPORT AND EVACUATION ARRANGEMENTS

In a major emergency, it is necessary to evacuate personnel from affected areas and to further evacuate non-essential workers from areas likely to be affected should the emergency escalate.

A common siren (wailing) is provided for the evacuation of people. On hearing the siren, people is disperse from the work area. Proper instruction will be given to all the employees about the rising of siren and the emergencies.

The employees would proceed to the predetermined assembly points on hearing the siren and the support staff / security forces would be instructed to divert the people away from the affected area and towards the assembly points.

7.10 OUTSIDE ORGANIZATIONS IF INVOLVED IN ASSISTING DURING DISASTER

Type of Accidents: Major Accidents, which may require outside help are follows:-

- Leaks/Spillage of: Solvents, Chemicals.
- Bursting at: Process area and Storage area.
- Fire or Explosion at: Reactors, Storage tanks, Utilities and Transformer / Substation.

7.11 OUTSIDE HELP

- Fire brigade of the nearest area shall help the plant fire control team during fire at site.
- Police station personnel & DSP shall help the company to maintain law & order, Traffic control & evacuation operations.

- Nearest Hospital or Nursing home shall render emergency medical services to the company for the first aid & medical treatment during emergency.
- District supply officer shall ensure continuous supply of essential items, medicines (Govt. Quota) and other emergency materials during emergency.

7.12 INFORMATION ON RISK EVALUATION PRELIMINARY HAZARD ANALYSIS

Following types of hazards exists in the factory as:-

- Storage Hazard (Solvents)
- Material Handling
- Operating Hazards (Process)
- External Hazards

• Natural	:	Storm, Wind, Flood, Earthquake ,Lightening
• Deliberate	:	Sabotage, Terrorism, Civil Commotion / Armed conflicts, Air raid
• Unsafe Acts and Situations	:	Corrosion, Equipment failure, Design deficiency , Abnormalities in operation or maintenance, Fire / Emergency in neighborhood

7.13 HAZARDS/FORESEEABLE SCENARIOS

Though it is an impractical to describe all the foreseeable scenarios involving hazardous chemicals and the suggested action for the same, some important ones are discussed here briefly. Even in identical incidents the right course of action may not necessarily be the same every time as the actual action is depend on the several factors, such as the place of incident, quantity of chemical involved, the amount of release, the nature of chemical, the wind direction, the wind velocity, temperature of surrounding, time of day, prevailing season and weather condition.

At the Site Disaster could be of the following type,

- Fire / Explosion
- Large Spillage of hazardous chemicals.
- Release of flammable or gas resulting in fire, explosion, or gas cloud, and other forms of air pollution, thermal radiation and smoke.
- Toxic gas release from neighboring factory.

- Overturning of road tanker containing flammable / toxic materials
- Failure of piping containing flammable / toxic materials
- Fall of structure or building.
- Release of high velocity fragments of ruptured equipments due to overpressure conditions.

SAFETY RELEVANT COMPONENTS

- Pressure : PG , SRVs , Sprinkler, Interlocks & Alarm
- Fire : Fire Hydrant System, FEA,
- Spill : LI , Dyke , Interlocks , Alarm , Spare Capacity , Pumping , ETP Arrangement
- Gas release : Leak detectors, CABA.

A) In case of Fire to the Flammable Liquid / Solvents:

In case of declaration of onsite emergency (Hearing of emergency siren), evacuate the area as per evacuation plan & exit signs on instruction of shift in-charge / incident controller as quickly as possible after safe shutdown of the plant. See that the wind direction is in opposite direction of assembly point by wind direction indicator. If not, change the assembly point.

Following are the general guideline for emergency action.

- Raise the alarm through nearest MCP
- Inform security and shift in charge.
- Carry nearest fire extinguisher & try to extinguish if possible.
- Assemble emergency team and inform other emergency members.
- Check the wind direction, then decide the assembly point and inform accordingly.
- Warn the people nearby.
- Attempt to isolate /extinguish the fire with the help of others with available appropriate extinguishers.
- Arrange fire hydrant hose and try to cool surrounding
- Cordon the area and try to shift the drum of flammable material.
- Used foam generating nozzle and create foam to extinguish fire.
- If fire beyond control call fire brigade after consultation with chief controller.

- Cool the surrounding or remove flammable material if possible.
- Take head count at site and inform to the chief controller.
- Also take head count at the assembly point and tally.
- Search for missing person if any.
- Call for mutual aid members for help, if require.
- Arrange for rescue, if required.
- Give first aid to the injured person and check for further treatment is required.
- Give priority to saving life and preventing further injuries.
- Confirm the massage of incident attend to the main controller & raise the all clear siren.
- Collect the photograph and other evidence to cause fine.

B) In Case of release of Solvents/Chemicals from Tankers/Tanks inside the factory premises:

This area is focused on Materials which are stored at plant site. Special instruments for storing, Handling & emergency actions in case of release of toxic & flammable material are given separately in MSDS.

Following are the general guideline for emergency action:

- Use PPE's like SCBA/Gas mask/Respirator & evacuate the area.
- If possible shift the tanker from storage area to parking area (due to limited space availability elsewhere).

In case of declaration of onsite emergency (Hearing of emergency siren), evacuate the area as per evacuation plan & exit signs on instruction of shift in-charge / incident Controller as quickly as possible after safe shut down of the plant. See that the wind direction is in opposite direction of assembly point by wind direction indicator. If not, change the assembly point.

C) In case of Flood / Earthquake:

In case of natural calamity like flood, Strom or earth quake (remote possibility) or war like situation the management may seek outside help. The help may be for fire fighting, Evacuation (of surrounding population), Medical treatment, shelter, food, transport or communications.

The responsibilities of outside organization is to render services as follows during emergency.

Following are the general guideline for emergency action:

- Close main valve
- In case the cylinders are on the ground the same be shifted to storage shed to ensure that the floodwater shall not carry the cylinders.

- Switch off electricity (main).
- Assemble outside the office, away from Electric Poles & Wires.
- Evacuate the areas after initiating (communication in working condition) off site organization.

D) In case of War/Civil riots:

Following are the general guideline for emergency action:

- Intimate nearest police station & stimulate off site emergency plan
- Stop unloading / loading operations (if any)
- Intimate civil defense dept. about the situation
- Security persons shall protect & control law & order.

E) Solvents Storage & handling:

Following are the general guideline for emergency action:-

- All storage tanks shall equipped with contact DP/non-contact radar type level transmitters with feedback to main PLC/SCADA.
- All storage tanks shall equip with level switch which is stop the respective transfer pump on activation at high level.
- Local temperature and pressure gauges is provided wherever applicable.
- Leakage or spillage of this solvent may lead to health hazards or fire / Explosion or toxic release.

7.14 POWER SUPPLY INTERRUPTION

In case of major electrical system failure, DG set is provided for emergency plant operations and emergency lighting in the premises.

7.15 HAZARD IDENTIFICATION AND RISK SUMMARY

7.15.1 Major Hazards

A brief description of the possible hazards at in handling hazardous materials is given in this section.

HAZARD	AREA	PROBABLE CAUSE OF THE ACCIDENT
Explosion	Hydrogenation/ Hydrogen Generation Plant / Pyrollysis/ Boilers / Transformers / Receivers for the air compressors	Malfunctioning of the Safety Valve
	Flammable / Petroleum product storage tank / drum storage shed	External fire causing pressure built up in the tanks / barrels
Fire	H.S.D. / FO Storage Area	Flammable vapour / air mixture and source of ignition.
	Flammable /Petroleum product storage tank / drum storage shed/ DG/ CST tank farm /PCC/MCC/Transformer yard	Formation on pool in the dyke wall and source of ignition.
		External fire → Built up of internal pressure → Failure of the top cover → Tank on Fire
Spillage	Sulphuric Acid / alkali storage area/ manufacturing area/	Spillage of acid / alkali due to rupture of the pipe line, collapse of the storage tank
Toxicity	Ammonia Tonner	Leakage of Ammonia Tonner

Pool Evaporation:

If the fluid, which escapes from the containment, is a liquid, then vaporization must occur before a vapor cloud is formed. The rate at which vaporization takes place determines the formation of such a vapor cloud.

7.16 OTHER AREAS OF HAZARDS AND CONTROL

7.16.1 Water Drainage

In order to avoid difficulties of storm water distribution proper drainage to the storm water/rain water runoff system shall be designed so as to protect the plant equipments, Building & offices. No area is submerge in the flood as adequate height has been provided to all installations such as utility block, office building, Process plant, warehouses & storage area has been provided with individual dyke.

7.16.2 Electrical Supply

As the fire protection system is safety related, it is mandatory that any electrical power supply for the control, Operation or instrumentation of the system shall be from an assured supply. During monsoon season the electrical circuit (conduit wiring) sometimes comes in contact with wet or structure (in case of any breakage, loose fittings), in such case there is probability of current leakage.

7.16.3 Fire or Bursting of Tanker

In case any vehicle/tanker/truck catches fire or burst/explodes on the road or similar events occurs inside the plant area during unloading of materials, the impact of such event shall have on the entire plant. Smoke cloud, fire, considerable heat radiation is take place apart from destabilizing civil & mechanical structures.

7.16.4 Leak/ Spillage of Toxic Liquid on Road

In case of spillage or leakage of liquid on the road, the same affect the employees of plant . In such case fire fighting system shall be kept ready near reception as well as the employees may be asked to assemble at backyard of the plant as the front area shall be directly exposed to such release. After clearing the emergency, the employees could be asked to absorb/neutralize the toxic chemicals by suitable absorbent/neutralizers.

7.16.5 Storage Hazards and Control

Storage area in the complex known as Tank farm consisting of storage of Caustic lye, Isopropyl alcohol, Toluene, Raney Nickel, Phosphoric acid and other chemicals.

Storage facility is situated away from the manufacturing plants and fulfilling all the rules and regulations, all storage tanks of hazardous substances is located within the boundary wall, constant watch by security & plant personnel round the clock.

As prescribed in the relevant regulation, the entire electrical fittings shall be of fireproof (FLP) fittings. Proper enclosures in the form of bund walls is provided for all the storage tanks. All necessary fire fighting arrangements have been provided near the storage area to combat fire emergencies. Material Safety Data Sheets (MSDS) for all the raw materials, intermediates and final products is prepared and attached. WI for loading & handling of chemicals is properly be displayed in English & Local language near the area.

7.16.6 Process Hazards

In this section Plant- wise hazards of processes, operations and controls provided to cope up with all kinds of abnormalities. The details regarding various controls like exhausts, scrubber, vents and other operating control etc. have been mentioned.

The consequences arising from the release of a toxic material would be time dependent and would vary according to the point of release. The major difference between release of toxic and flammable materials is that toxic clouds and therefore may remain hazardous over greater distance.

Scrubbers for control of Vapor / Non-Condensable gases & fines from dryer units is installed in the plant.

All MSDS are enclosed as **Annexure - 4**

7.16.7 Trade Waste Disposal

Organization ismore concerned for environment protection and pollution abatement at all times. In a cohesiveness endeavor irrespective of costs involved, the company has been trying to reduce and abate pollution to its ultimate end.

The trade effluent streams from all different plants are collected in effluent plant and it is properly treated by primary, secondary & Tertiary treatment methods.

Provision is made to dispose Solid wastes. The company is dispose off all solid waste in safe manner.

7.16.8 Disaster Management

This chapter highlights the Organization for disaster preparedness. No plan is succeed without effective Disaster Management. Disaster Management Plan is a part and parcel of a good ON-SITE and OFF-SITE emergency plan, without which all resources, facilities etc., event available with us, can not be put into services at a right time is the key factor in tackling an emergency.

It is not possible to envisage and detail every action which should be taken in emergency and to harness the basic elements of emergency preparedness such as Gravity of emergency, Communication of information, on-site action for process and emergency controls, Mobilization of internal and external resources for fire and toxicity control etc. Emergency Organization is set up specifying duties and responsibilities of all to make best use of all resources and to avoid confusion while tackling the emergency.

Disaster Management Plan / On-Site Emergency Plan highlight the flow of information and co-operation among various action groups within the factory. Off-site Emergency Plan

indicates various action groups at district levels which is get engaged in case of off-site emergency.

Emergency organization and arrangement include:

- Incident Controller
- Alternate Incident Controller
- Site Main Controller
- Emergency Teams
- Assembly Points
- Emergency Control Centre
- Fire & Toxicity control arrangements
- Medical arrangements
- Transport control arrangements
- Pollution control arrangements
- Other arrangements.

7.17 SAFETY AND MITIGATING MEASURES

7.17.1 Equipments and Process safety:

- All Storage tanks is located in Dykes and equipped with high and low level indicator wherever indicated.
- Spillages and leaks from the storage tanks can be collected and transferred out and treated for safe disposal.
- Storage tank containing hazardous storage is located away from the main plant.
- All tanks is protected against overpressure by pressure relief valve
- Floor washing is collected and treated in effluent treatment plant.
- Fugitive emissions are prevented by providing single mechanical seal for pumps.
- All storage tanks is equipped with contact DP/non-contact radar type level transmitters with feedback to main PLC/SCADA
- All storage tanks is equipped with level switch which is stop the respective transfer pump on activation at high level.
- Local temperature and pressure gauges is provided wherever applicable.
- The hazardous reactors are provided with seal arrangements, which are preventing leakage of fugitive emission in case of seal failure.

7.17.2 Fire Protection and Fire Fighting System

The plant is equipped with a comprehensive fire protection system. Following facilities is provided for the fire protection:-

- Fire Water Supply
- Fire Hydrant system, Fire sprinkler system with smoke/fire detectors
- Portable Fire Extinguishers

7.18 HAZARD CONTROL AND EMERGENCY SHUT-DOWN

7.18.1 Spillage Incident Emergency Reporting

- Location
- Name of material (spilled)
- Equipment from which the spillage occurred
- Spill control media

7.18.2 Emergency Action in Case of Spillage

- Assess the situation and blow siren depending upon the situation.
- Stop tower operation if required.
- Stop hot jobs in surrounding area; suspend operations which are likely to create sparks.
- Check wind direction and approach from upward direction.
- Inform effluent treatment plant about the possibility of hydrocarbons coming into the effluent plant.
- Be prepared for fighting if required Start evacuation.
- Cool down surrounding equipments / vessels with water.
- Vapors traveling in down wind direction should be knocked down with the fire water spray.
- Cordon off the area if needed.
- Evacuate non-essential people from the surrounding depending upon the emergency.
- Hydrocarbon fire should be fought with foam and DCP
- In case of liquid pool, advice fire personnel to cover it with foam.

EMERGENCY ACTION

- Check the bund wall valve for its close position.
- All personnel handling the emergency should wear PVC suit / alkali suit, gumboot, PVC hand gloves, PVC goggles.

- Isolate the sources of supply.
- Cordon off the area.
- Avoid the entry of unnecessary people.
- Start barricading the spillage area with sand / earth.
- Spilled caustic is to be collected in sealable container if possible or divert to effluent plant, neutralize the same with dil. HCL.
- Flush the affected body parts with plenty of water and seek medical help.

7.18.3 Fire to Methyl Chloride Tonner:

- Stop purging of Methyl Chloride.
- Inform to superior immediately.
- Wear necessary PPEs like breathing apparatus, PVC suit, safety helmet, safety shoes, hand gloves etc.
- If small fire try to extinguish the fire by fire extinguisher.
- Ensure isolation and protection of other equipments by providing barricading or spraying water and water curtain.
- Evacuate the people if necessary.
- Isolate the power supply.

7.18.4 Leakage of Methyl Chloride Tonner

- Inform to superior immediately.
- Wear appropriate Personal Protective Equipments like breathing apparatus, PVC suit, safety helmet, safety shoes and hand gloves etc.
- Use dilutes ammonia to detect leakage of Methyl Chloride. Don't put water on leakage.
- Eliminate all sources of ignition and keep well ventilation.
- Use non sparking tool.
- Try to shut off the source of the leak, if possible.
- If leak is from users system, close the cylinder valve, safely vent pressure and purge with inert gas before attempting repair.
- Isolate the area until the gas has dissipated.
- Test the air for concentrations prior to return of workers to the area.
- Decontaminate the area with soap and water.

7.18.5 Leakage of LPG cylinder in Canteen

- Inform to superior such as Admin Manager, EHS Manager or Security Officer immediately.
- Try to stop leakage immediately.
- Keep open all doors and windows.
- Don't make any spark producing activity such as Switch ON/OFF electric supply, if electric supply switched OFF/ON respectively.
- Apply water on cylinder.
- Evacuate the people if necessary

7.19 EMERGENCY LIGHTING AND POWER SUPPLY, ISOLATION MAP

For Emergency, Plant Operations and Emergency Lighting provisions shall be made according to requirements. DG set is provided as backup.

7.20 ALARM AND COMMUNICATION

It is necessary to communicate for (i) Recognizing the emergency, (ii) Raising of the alarm (Siren), (iii) The declaration of the emergency and (iv) The implementation of the evacuation plan, if necessary. Therefore effective signals and procedures should be devised to communicate.

Communication is a critical factor in handling an emergency. To control the situation by the earliest possible action, the practice should be that any employee can raise an emergency alarm.

The choice of a suitable alarm system is depend on local circumstances and is influenced by size of the plant, type of hazard and the existing alarms system. Essential requirements are that there should be an adequate number of readily identified points from where the alarm can be raised and these needs to be clearly indicated by sign boards and by indications in the plans.

In areas where there is high level of noise (as the case here), it may be necessary to install more than one audible alarm transmitted or flashing lights, Automatic alarms may be considered appropriate on sites.

7.20.1 ALARM / SIREN

Presently there is one siren installed in the factory premises as marked on the site plan.

7.20.2 CODIFICATION OF SIRENS

Sr.	SIRENS	INDICATES	AUTHORITY
1.	30 Sec. Continuous	Testing	Sr.Manager - EHS
2.	90 Sec. Wailing Pitch	Emergency	Site Main Controller
3.	120 sec. Wailing Pitch	Off Site Emergency	Site Main Controller
3.	1 Min. Continuous	Emergency Controlled (all clear)	Site Main Controller

Note: 1) Emergency siren to be sounded only if required.

2) All employees in areas other than affected to continue work unless disaster siren is blown.

3) No emergency organization member will leave the emergency spot unless `all clear' siren blown.

7.20.3 TESTING OF ALARM

Every Sunday at 11.00 Hrs continuous & wailing pitch siren and every day at 11.00 Hrs 30 sec. continuous siren will be sounded for testing purpose. Emergency siren is located at Administration building as marked on the site plan.

On hearing alarm the Incident Controller will activate the action on disaster control plan by giving proper instructions or predetermined signals.

7.21 ALARM AND DECLARING MAJOR EMERGENCY

In normal fire or emergency in the plant on receiving call or alarm from any plant the crew is rush to point of emergency. On assessing the condition at spot & in consultation with emergency plan coordinator Emergency siren would be sounded.

Disaster siren is given by siren installed in Main Security Gate in continuous wailing sound & instructions from fire / rescue / operations coordinator. The siren is blown as per the code displayed on the Main Gate.

7.22 PLANT ASSEMMBLY POINTS

The assembly points is selected considering the distance from the hazardous place, wind direction, capacity to accommodate the required number of people and availability of the other resources in that area. In case of emergency, it is necessary to evacuate all personnel

from effective area except personnel who indirectly involved in dealing with the incident. On evacuation people is go to pre assigned assembly points.

Location of Assembly Points: i) Assembly Point-01, Near Main gate
ii) Assembly Point-02, Near Unicorn gate
iii) Assembly Point-03, Near Minar gate
iv) Assembly Point-04, Near CST Tank farm Gate

In case of an EMERGENCY the employees should assemble near Assembly Point, as indicated below:-

Engineering Team	Assembly Point No.01
Fire Fighting Team	Assembly Point No.01
First Aid Team	Assembly Point No.01
Evacuation Team	Assembly Point No.01
Spill Control Team	Assembly Point No.01
Others	Safe Assembly Point

Wind direction to be determined by the wind socks installed on top of the Ionone plant, DHMOL plant and Damascone plant building. **THE EMPLOYEES SHOULD RUN PERPENDICULAR TO THE WIND DIRECTION AND NOT AGAINST / ALONG.**

7.23 MEDICAL SERVICES AND FIRST AID

They have set up a First-Aid Centre in the Factory premises. Employees get them-self examined by the Doctor.

A qualified doctor is appointed on part time basis.

The First aid team is play critical role in attending the victims in case of any accident. Antidotes are available at Occupational Health Center with company doctor

First Aid boxes & first-aider list is kept at security cabin. In case of any medical assistance other than first aid, the Admin In-charge/ Site- SHE representative arrange for a vehicle to shift the casualty to the below mentioned hospital, or call an ambulance to mobilize the casualty to the medical center.

7.23.1 FIRST AID / ANTIDOTES

1. Wash affected areas / eyes with copious amounts of water.
2. Remove to fresh air / administer oxygen.

3. Artificial respiration.
4. Give copious drinks of water.
5. Do not induce vomiting.
6. Induce vomiting.
7. Remove contaminated clothing.
8. Eye drops.
9. Analgesic for pain, antibiotic for prevention of infection.

7.23.2 LOCATION OF FIRST AID BOX

1. Emergency Control Room,
2. Hydrogenation plant,
3. DHMOL Plant,
4. Pilot Plant-I,
5. R&D,
6. QC ,
7. Maintenance,
8. Ionone ,
9. CST plant & Environmental Lab

7.23.3 ESSENTIAL WORKERS (FIRST AIDERS)

Annexure -6 List of First Aiders

7.23.4 EMERGENCY STRETCHER LOCATIONS :

Location of Emergency stretcher: 1.OHC
2. CST plant ground floor
3. Minar gate Security Cabin

7.24 HOSPITALS

There is adequate arrangement with local hospitals for any medical emergency.

SN	NAME OF HOSPITAL	DOCTOR IN CHARGE	PHONE NOS.
3.	Deshmukh Nursing Home, Mahad	Dr. F.A.Deshmukh/ Dr. Ansari	223086

4.	MMA Hospital	Doctor	232562/233879
5.	Govt. Hospital, Mahad	Doctor	223047

7.25 FIRE

7.25.1 FIRE / FIRE FIGHTING AGENTS

1 a. Water can be used when applied in the form of spray and to keep exposed material from being damaged by the fire. It can be used to sweep the flames off the surface of liquid.

1 b. Water or foam may cause frothing when applied on flammable liquids having flash point above 100 ^{o}C . Water sprays has to be applied carefully by causing the frothing to occur on the surface and this foaming action blankets and extinguishes the fire.

1 c. Water may be used to blanket fire and accomplish extinguishing. It must be applied gently to the surface of the liquid.

1 d. Water may be ineffective except when applied gently to the surface to blanket and extinguish the fire.

2 a. Alcohol foam.

2 b. Foam.

2 c. Alcohol resistant foam.

3. CO_2

4. Dry chemical powder.

7.25.2 Fire extinguishers for emergency, located at strategic positions at each process floor, storage areas, security office etc. The same are easily accessible, marked properly, and maintained regularly.

Sr.No.	Type of Fire Extinguishers	Qty in Nos
1	Dry Chemical Powder	135
2	Mechanical Foam	17
3	Carbon Dioxide	40

	Total	192 Nos

Location of fire extinguishers shown in plot plan.

7.25.3 FIRE HYDRANT SYSTEM :

- The detailed diagram showing the hydrant system is given in the following page .
- Fire Hydrant System duly approved by Tariff Advisory Committee exists in the Plant.
- Static water tank of 2 x 175 M^3 = 350 cubic meters capacity
- There are 39 hydrant points with 39 hose boxes with 76 Nos. hoses.
- Fire hydrant pumps : Electric Driven - 171 M^3/hour at 7 kg./cm^2 - 1 No; One Stand by pump is provided.
- UPS System ensures that the hydrant pump is kept working.
- Fire tender is available at MIDC fire station.

7.25.4 Essential Workers (Fire Squad Team)

A task force of essential workers is also known as Fire Squad Team. It consists of minimum four persons from each plant Manager. Minimum 2 persons, in each shift shall be available round the clock; they are being trained to help in fire fighting, evacuation, first aid, rescue, mobilization of internal resources as per pre-determined emergency action plan.

- The team is constituted to provide necessary support / help in case of emergency.
- The team members shall gather at accident place in case of On-site emergency, all the member shall gather in ECC.
- All team members shall rush to the site with personal protective appliances on hearing siren.
- One of the fire squad members is start hydrant pump and is stay there to monitor the pump performance.
- Fire squad member is do the following activities:
- To help the plant people in fir fighting, gas leak a spill control.
- To monitor the hydrant pump performance.
- To help in emergency egg. Work e.g. isolating equipment, materials, process, providing temporary by pass lines, safe transfer of materials, urgent repairing or replacement, electrical work etc.
- Mobilization of fire extinguishers and BA sets from other plants.

- Search, evacuation, rescue and welfare.
- First aid and medical help.
- Moving tankers from areas of risk.
- Shifting of solvents / hydrocarbon drums.
- Cordoning off the area.

7.26 TRAINING AND REHEARSING

All employees should know the details of Disaster Management plan and they must receive initial training in emergency procedures. Then, at suitable intervals this knowledge must be exercised and the basic plan reviewed and brought up-to-date. It is essential to establish the necessary confident volunteers and better expertise, so the individuals can carry out their allocated duties. Rehearsal of evacuation should be regularly carried out efficiently and should cause minimum disruption to the normal activities. As per MFR, 1963 Mock Drill should be conducted six monthly.

An after-mock drill report may be prepared detailing the lacunas & strong points so as to make improvements in the emergency action plan.

7.27 ACCOUNTING FOR PERSONEL

It is necessary to know for everyone Disaster Management Plan has been accounted for and that the relatives of casualties if any have been appropriately informed. Holidays and sickness absence is have to be taken into account and adequate personnel for relief is made available including replacement for some others who may be at Off-Site at the time engaged on other work.

Visitors should be accompanied by a responsible members of the works staff, designated to perform emergency duty.

7.28 PUBLIC RELATIONS

Inevitably a major incident is attract the attention of the press, television and radio services and anxious inquiries from friends and relatives is flooding the factory. It is essential to make arrangements for authoritative release of information to them. Manager (P, HR & Stores) who is familiar with procedures of dealing with such situations, shall take charge of public Relations, information etc. He is the sole authoritative source of information to the news media and others.

7.29 DECLARATION OF CESSATION OF EMERGENCY

The Security Officer or Guard (Emergency Fire, Rescue & Security Co-ordinator) is not signal the end of the emergency until he is satisfied that all the spillage / leakages are arrested or fires are extinguished and there is no risk of re-ignition (in case of fire). In the case of gas, the all clear is declared only when the source of emission has been effectively isolated and gas clouds dispersed well below safe level. Even when the all clear Signal has been given, great care is needed while entering affected areas and no work in connection with salvage, collection of evidence should be commenced until a thorough examination of the area has been carried out. The siren code is follow for declaring the cessation of an emergency. Sources of leakage, fire, explosion and so on, until it has been established that no flammable materials remain where they could be ignited. All clear signed shall be given by SMC / Incident Controller.

7.30 ENVIRONMENTAL MONITORING AND ANALYSIS

Generally the gases is analyzed by portable gas detectors as Draggers Tubes.

Portable gas monitors or Detection tubes may be used to detect gas after the accidental release for declaring the environmental quality safe in post-emergency phase.

7.31 POST EMERGENCY PLANNING

- Assess the situation from safety & production angle.
- Re-start the plant in the standard sequence.

** All evidences should be collected & accident should be investigated.*

7.32 PLAN APPRAISAL AND UPDATING

The matters relating to review effectiveness of emergency planning should cover:

Time limit, which is essential for rescuing and evacuating personnel from the scene or confined space for carrying out any emergency measures. It is essential to check whether pre-determined time limit has been met and if not the impediments for it should be identified. For example, if 15 minutes is fixed for evacuating the people from confined space, it may be reduced to 10 minutes, if considered necessary for the safe evacuation.

To check the quantum of emergency, equipments like fire fighting equipment, personnel protective equipment etc. are required to be provided in the critical areas whether it is adequate or not. Any changes made in the plant should also be made known to all.

7.33 EVACUATION PLAN

On hearing the siren all employees shall evacuate the area by safely closing down all operation as per instructions from their Incident Controller or in nighttime Shift supervisor. After gathering at assembly points, shift-in-charge should take the roll call & ensure that no person is left trapped.

The Rescue Coordinator or Guard (who is inside the plant for duty) shall ensure that none is trapped inside the plant. Security guards shall ensure total evacuation.

Main gate is used for movement of personnel, movement of rescue, medical aid.

7.34 TRAFFIC CONTROL

The Security In-charge or Guard shall contact Chief Executive Officer and shall make himself available at main gate for traffic control till local authorities help is available. In case of diverting the traffic of Road or stoppage, Security Guard shall co-ordinate with Chief Executive Officer with outside agencies as Police, etc.

Unwanted traffic and public gathering shall be controlled & avoided by security personnel till local help from police is available.

7.35 OTHER ARRANGEMENTS

The details about fire & toxicity control arrangement, medical Services, Transport and Evacuation Arrangements, Pollution Control arrangements shall be provided. All such key personnel **(Annexure – 2, 3, 5 & 6)** shall be available and shall be called during emergency at any time.

The telephone numbers of the important persons, persons to be contacted in case of emergency along with their duties in case of emergency shall be displayed at different location in the plant area.

7.36 PROCEDURES FOR IMPLEMENTING PLANT MODIFICATIONS

1. Operations Department (Process & Maintenance) is initiate a plant change, work request and attach a proper sketch on a standard tracing as shown in appendix given below.
2. Managing Director is discuss and review the process and safety aspects of plant modifications with Advisor, Production Manager, Shift Supervisor, and Project Manager before endorsing the sketch for safety aspects.
3. Each plant modification shall be recorded in a register showing a date of issue and serial no of job.

4. Production Manager / Factory Manager is make necessary corrections as recommended in safety audit reports & would update operating manuals.

APPENDIX-1

PLANT MODIFICATIONS

Safety Aspects of this plant change reviewed and found acceptable

---------- ----------

Fact Manager Production Manager

_____

Unit: Plant Modification

No. ----------

Date: ----------

List of Rescue / Safety Equipments

(Respiratory & Non-respiratory)

- Safety helmets is procured & issued
- Safety hand gloves is provided
- Safety goggle is provided
- Face shields is provided
- Gum Boots, PVC Shoes

7.37 HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION

Company committed to achieving environmental, health & safety (EHS) excellence. This is a responsibility of management & employer in all function. Company is strive to provide a safe and healthy working environment & the communities in which we do business. Our programs must combine clear leadership by management, the participation of all employees and functions, and the use of appropriate technology in developing and distributing company products & services.

Requirements:

- Comply with applicable environmental, health, & safety laws and regulations.
- Take appropriate measures to prevent workplace injuries & illness, and to provide employees with a safe & healthy working environment. Consider evolving industry practices, regulatory requirements and social standards of care.
- Eliminate unreasonable, risk form facilities, products, services and activities.
- To the extent practicable, reduce the use and release of toxic and hazardous materials.
- Research and where appropriate, implement advanced technology, design and production facilities, products, services & activities.
- Research and where appropriate, implement advanced technology in the design, production and services and to prevent pollution and conserve, recover and recycle raw material.

Safety and Health protection of workers

Health checkup Arrangement

1. First aid Center has been established in the factory premises.
2. Employees get them-self examined by the doctor.
3. A qualified doctor is appointed on part time basis.

Safety measures to prevent the Occupational Health Hazards

- Electrical equipments will be properly earthed & lock out/ tag out, electrical isolation method will be developed & displayed at required locations.
- Proper training will be given to all the employees at regular time period to bring awareness among the employees.
- Employees will be provided with Personal Protective Equipments like earplugs or earmuffs, shoes, gloves wherever required.

Employee responsibility

- Follow the policy and applicable laws and regulation to protect your own health and safety as well as that of other workers, the public and the environment.
- Present ideas that support the goals of policy.
- Promptly report concerns about possible violation of this policy to the persons listed or to your manager.

Additional responsibility of leaders:

MD will make sure this policy is part of an overall policy compliance program as describe. MD is:

- Consult with adequacy of their health, safety and environmental programs.
- Implement monitoring and auditing system at the plant and business levels designed to detect violations & assure compliance with law and this policy.
- Regularly evaluate the effectiveness of managers & other senior employees on their implementation of this policy and environmental, health & safety programs.

Managers responsible for a facility, activity, product or service are:

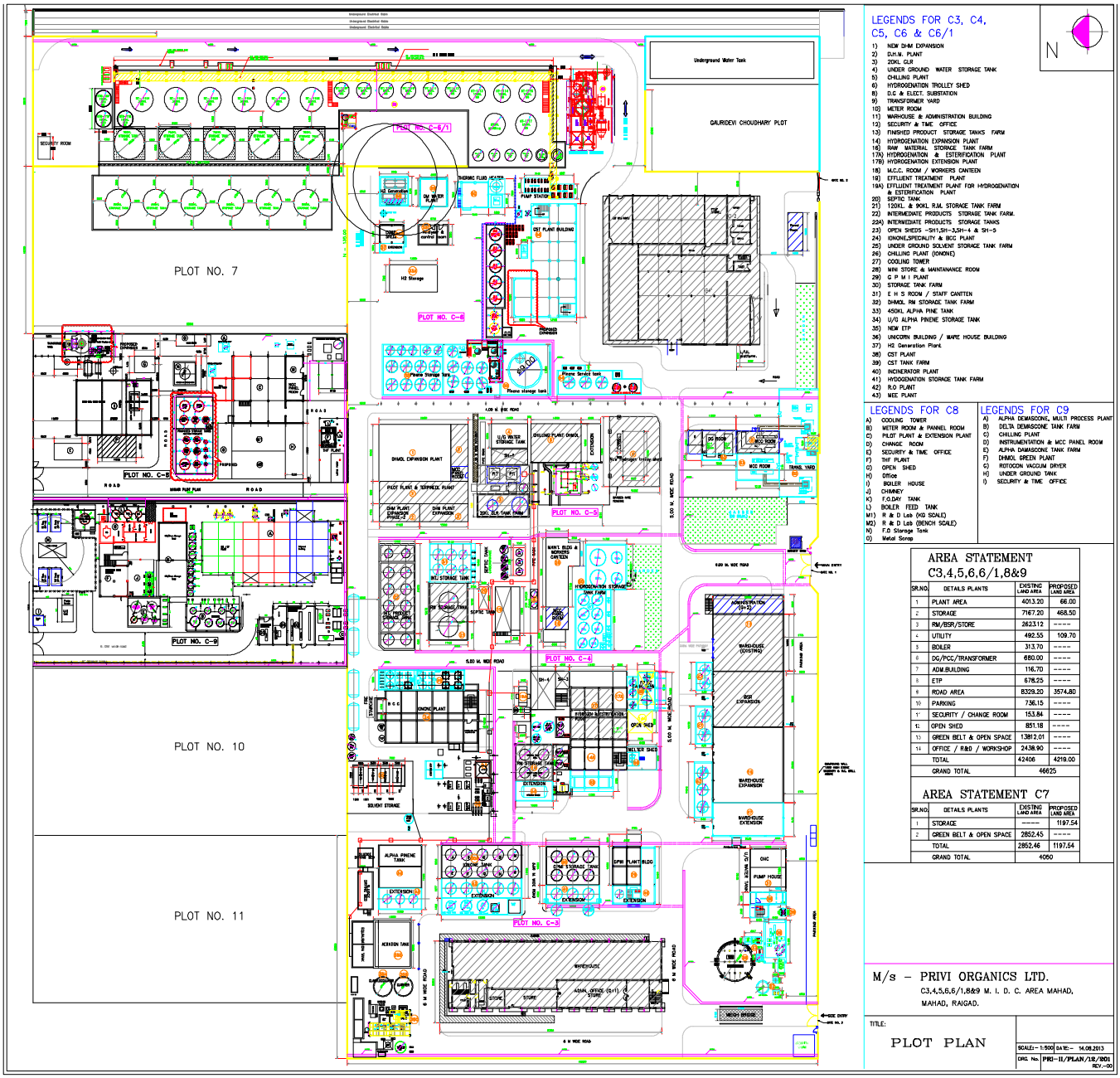
- Communicate responsibility with employees, communities, customers and government agencies regarding environmental health and safety issue.
- Cooperate with the public, government and other interested parties to develop appropriate regulatory and public policies that protect employee and public health and the environment.
- Implement effective programs, training and best practices for health, safety and environment protection and for the elimination or reasonable reduction of toxic and hazardous materials.
- Regularly assess plant operations & management. Establish measurements to ensure compliance with this policy and applicable laws & regulations, when appropriate; review assessment results with environmental programs.
- Ensure that an employee with EHS responsibilities is appropriately screened before appointment and that continued appropriateness for their position is periodically reviewed.
- Develop appropriate program for safety reviews of new and redesigned products prior to sale and distribution to customers. Monitor after-sale safety performance to identify and address significant product safety issues.

- Work cooperatively with, contractors, business partners & suppliers to ensure that our relationships with them are supportive of this policy.
- Promptly report to medical Services, Environmental Program & your assigned legal counsel any,
- Emergency evacuation, communicable disease or other serious health indent which may have exposed employees to health hazardous.
- Work related employee facilities & other serious safety incidents requiring a report to a governmental agency.
- Information regarding a report to a governmental agency or any governmental allegations of substantial violations of environmental laws or regulations.
- Legal proceedings alleging significant property damage or personal injury from environmental contamination or exposure to hazardous substances & other information requested by medical services or Environmental programs.

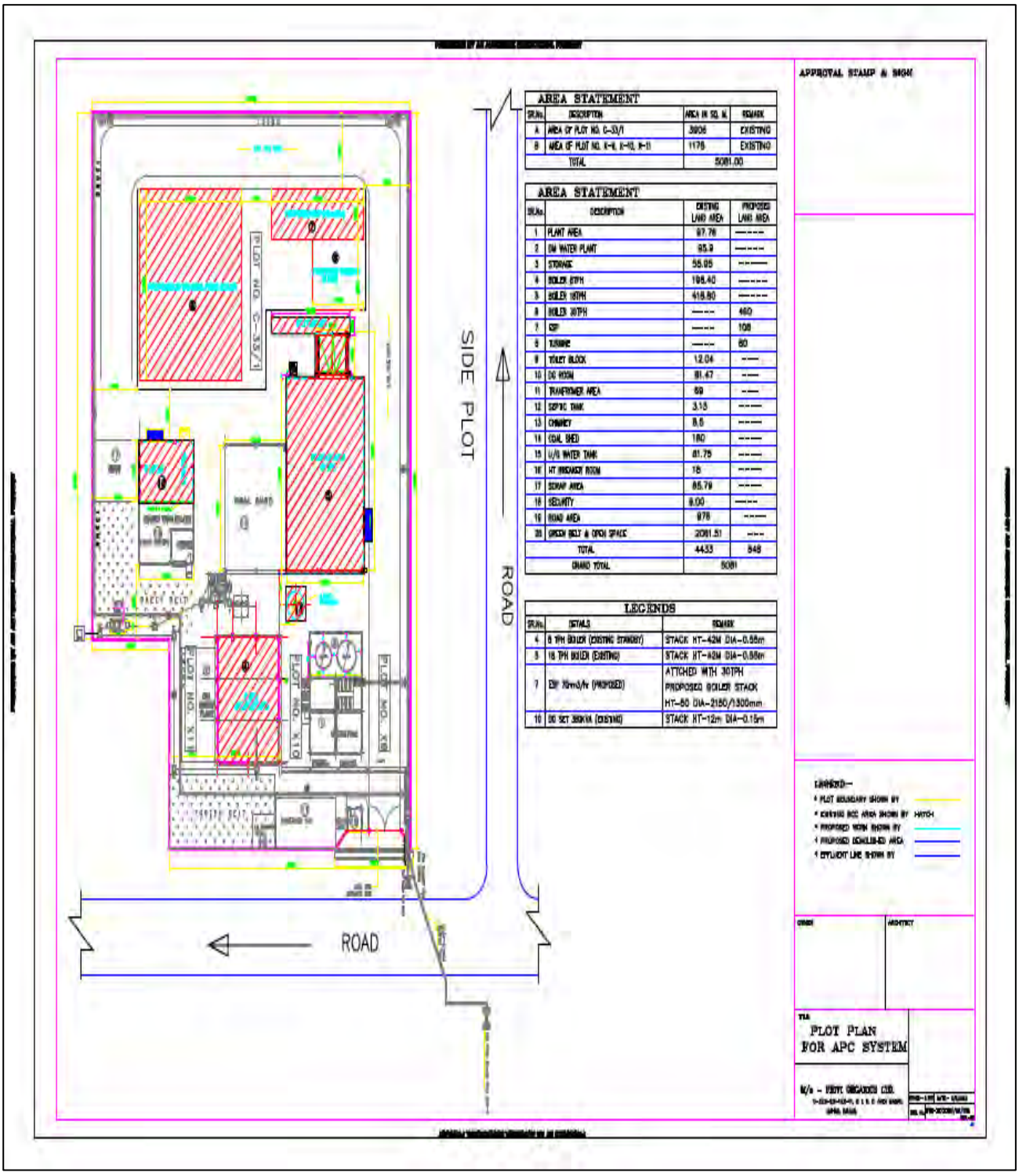
List of Annexure:

S. No.	Annexure No.	Details
1.	Annexure-1	Plant Lay out
2.	Annexure-2	Emergency Organization
3.	Annexure-3	Important Telephone Numbers
4.	Annexure-4	MSDS of Chemicals
5.	Annexure-5	List of Fire Fighting Team & Spill Control Team
6.	Annexure-6	List of First Aiders
7.	Annexure-7	Emergency Mutual Aid
8.	Annexure-8	List of Personal Protective Equipments

Annexure 1-Plant Layout



Plant Layout of proposed expansion project: Plot no- C-3, 4, 5, 6, 6/1, 7, 8, 9



Layout Plan of proposed expansion project: Plot no C33/1, X-9, 10, 11

LEGENDS FOR C3, C4 & C5

1) NEW DMM EXPANSION
2) D.M.M. PLANT
3) 20KL GLR
4) UNDER GROUND WATER STORAGE TANK
5) CHILLING PLANT
6) HYDROGENATION TROLLEY SHED
8) D.G & ELECT. SUBSTATION
9) TRANSFORMER YARD
10) METER ROOM
11) WARHOUSE & ADMINISTRATION BUILDING
12) SECURITY & TIME OFFICE
13) FINISHED PRODUCT STORAGE TANKS FARM
14) HYDROGENATION EXPANSION PLANT
16) RAW MATERIAL STORAGE TANK FARM
17A) HYDROGENATION & ESTERIFICATION PLANT
17B) HYDROGENATION EXTENSION PLANT
18) M.C.C. ROOM / WORKERS CANTEEN
19) EFFLUENT TREATMENT PLANT
19A) EFFLUENT TREATMENT PLANT FOR HYDROGENATION & ESTERIFICATION PLANT
20) SEPTIC TANK
21) 120KL & 90KL R.M. STORAGE TANK FARM
22) INTERMEDIATE PRODUCTS STORAGE TANK FARM.
22A) INTERMEDIATE PRODUCTS STORAGE TANKS
23) OPEN SHEDS –SH1,SH–3,SH–4 & SH–5
24) IONONE,SPECIALITY & BCC PLANT
25) UNDER GROUND SOLVENT STORAGE TANK FARM
26) CHILLING PLANT (IONONE)
27) COOLING TOWER
28) MINI STORE & MAINTANANCE ROOM
29) G P M I PLANT
30) STORAGE TANK FARM
31) E H S ROOM / STAFF CANTEEN
32) DHMOL RM STORAGE TANK FARM
33) 450KL ALPHA PINE TANK
34) U/G ALPHA PINENE STORAGE TANK
35) NEW ETP
36) UNICORN BUILDING / WARE HOUSE BUILDING
37) H2 Generation Plant
38) CST PLANT
39) CST TANK FARM
40) INCINERATOR PLANT
41) HYDOGENATION STORAGE TANK FARM
42) R.O PLANT
43) MEE PLANT

BUILT–UP AREA STATEMENT

BLOCK NO.	NAME OF STRUCTURE	BUILT–UP AREA IN SQ. M. PLINTH AREA	FIRST FLOOR	SECOND FLOOR	THIRD FLOOR	FOURTH FLOOR	FIFTH FLOOR	UPPER FLOORS	TOTAL AREA IN SQ.M.	APPROVAL No. & DATE
A	PREVIOUS APPROVED AREA PLOT No.–C3	2281.59	816.66	115.36	45.36	—	—	—	3258.97	PLAN APPROVED VIDE LETTER No. DL/DM/PLAN/740, DT.29/07/2010
B	PREVIOUS APPROVED AREA PLOT No.–C4&C5	2105.26	1134.94	933.32	572.08	319.95	114.90	56.02	5236.47	PLAN APPROVED VIDE LETTER No. DL/DM/PLAN/741, DT.29/07/2010
C	PREVIOUS APPROVED AREA PLOT No.–C6	2538.87	1034.92	115.48	—	—	—	—	3689.27	PLAN APPROVED VIDE LETTER No. DL/DM/PLAN/742, DT.29/07/2010
D	TOTAL PREVIOUS APPROVED AREA (A+B+C)	6925.72	2986.52	1164.16	617.44	319.95	114.90	56.02	12184.71	
	DEMOLISHED AREA									
—	PLANT BUILDING (30x21)+(13x6) = 708.00SQ.M.	708.00	—	—	—	—	—	—	708.00	
10	PANEL ROOM (3.23x3.23) = 10.43SQ.M.	10.43	—	—	—	—	—	—	10.43	
13	F.P. STORAGE TANK FARM(4.96x4.96)=44.44SQ.M.	44.44	—	—	—	—	—	—	44.44	
14A	OPEN SHED (7.0x6.0) = 42.00SQ.M.	42.00	—	—	—	—	—	—	42.00	
E	TOTAL DEMOLISHED AREA	804.87	—	—	—	—	—	—	804.87	
F	TOTAL RETAINED BUILT–UP AREA (D–E)	6120.85	2986.52	1164.16	617.44	319.95	114.90	56.02	11379.84	
	BUILT–UP AREA									
37	USAB DIGESTER AREA	28.06	—	—	—	—	—	—	28.06	
38	R. O. PLANT	82.17	—	—	—	—	—	—	82.17	
39	EXTENSION TO EHS OFFICE & CANTEEN	15.84	34.65	—	—	—	—	—	50.49	
40	EXTENSION TO GPMI PLANT BUILDING	103.60	103.60	103.60	190.96	148.96	106.96	—	757.68	
41	EXTENSION TO GPMI STORAGE TANK FARM	74.69	—	—	—	—	—	—	74.69	
42	EXTENSION TO INONE STORAGE TANK FARM	225.46	—	—	—	—	—	—	225.46	
43	EXTENSION TO ALPHA PINENE STORAGE TANK FARM	71.87	—	—	—	—	—	—	71.87	
44	EXTENSION TO RM STORAGE TANK FARM	58.53	—	—	—	—	—	—	58.53	
45	EXTENSION TO HYDROGENETION PLANT BLDG.	60.29	70.90	60.29	—	—	—	—	191.48	
46	MELTER SHED	53.76	—	—	—	—	—	—	53.76	
47	EXTENSION TO WEARHOUSE & BSR	354.81	—	—	—	—	—	—	354.81	
48	FINISH PRODUCT STORAGE TANK FARM	87.92	—	—	—	—	—	—	87.92	
49	INONE STORAGE TANK FARM	135.85	—	—	—	—	—	—	135.85	
50	HYDROGENETION STORAGE TANK FARM	314.87	—	—	—	—	—	—	314.87	
51	INT. STORAGE TANK FARM	137.80	—	—	—	—	—	—	137.80	
52	TRANSFORMER YARD (EXEMPTED)	–(339.13)	—	—	—	—	—	—	–(339.13)	EXEMPTED
53	EXTENSION TO DG ROOM & MCC ROOM	108.17	—	—	—	—	—	—	108.17	
54	ALPHA PINENE SERVICE TANK FARM	176.97	—	—	—	—	—	—	176.97	
55	ALPHA PINENE STORAGE TANK FARM	665.57	—	—	—	—	—	—	665.57	
56	CST PLANT BUILDING	469.83	321.36	400.86	321.36	400.86	321.36	558.36	2793.99	
	50% ADDITIONAL AREA AS PER DC RULE	(39.75)	—	(39.75)	—	(39.75)	—	—	119.25	
57	EXTENSION TO COMPRESSOR SHED	18.20	—	—	—	—	—	—	18.20	
58	H2 GENERATION SYSTEM	69.60	—	—	—	—	—	—	69.60	
59	DM WATER PLANT	60.90	—	—	—	—	—	—	60.90	
60	THERMIC FLUID HEATER	94.60	4.50	—	—	—	—	—	99.10	
61	COOLING TOWER	19.36	—	—	—	—	—	—	19.36	
G	TOTAL BUILT–UP AREA	3827.85	535.01	564.75	512.32	549.82	428.32	558.36	7095.68	
H	NET TOTAL BUILT–UP AREA (F+G)	9948.70	3521.53	1728.91	1129.76	869.72	543.22	614.38	18475.52	

AREA STATEMENT C6/1

SR.No.	DESCRIPTION	DIMENSION	AREA IN SQ. M.	REMARK
39	CST TANK FARM AREA	125.45m x 15m	1881.75	EXISTING
40	INCINERATOR BUILDING	7m x 17.3m	121.1	EXISTING
		PLINTH AREA–C6/1	2002.85	

AREA STATEMENT C3,4,5,6,6/1,8&9

SR.No.	DESCRIPTION	AREA IN SQ. M.
A	AREA OF THE PLOT No.–C3	8100.00
B	AREA OF THE PLOT No.–C4 & C5	16200.00
C	AREA OF THE PLOT No.–C8	8100.00
D	AREA OF THE PLOT No.–C8/1	4081.00
E	AREA OF THE PLOT No.–C8	4050.00
F	AREA OF THE PLOT No.–C9	4050.00
1	TOTAL AREA OF THE PLOT (A+B+C+D+E+F)	44581.00
2	EXISTING BUILT–UP AREA (C3,C4,C5,C6)	12184.71
2a	DEMOLISHED AREA	804.87
2b	BUILT–UP AREA	7095.68
3	TOTAL BUILT–UP AREA (2 –2a)+2b+C8/1+C8+C9	24153.93
4	EXISTING PLINTH COVERAGE AREA (C3,C4,C5,C6)	6925.72
4a	DEMOLISHED PLINTH COVERAGE AREA	804.87
4b	PLINTH COVERAGE AREA (C3,C4,C5,C6)	3827.85
5	UPTO DATE PLINTH COVERAGE AREA(4–4a)+4b+ C6/1+C8+C9	15627.11

AREA STATEMENT C–8

SR.No.	DESCRIPTION	DIMENSION	AREA IN SQ. M.	REMARK
A	COOLING TOWER	3m x 2.5m	7.5	EXISTING
B	METER ROOM & PANNEL ROOM	12m x 5m	60	EXISTING
C	PILOT PLANT & EXTENSION PLANT	18mx15m+8mx6m	306	EXISTING
D	CHANGE ROOM	6.69m x 3.46m	23.14	EXISTING
E	SECURITY & TIME OFFICE	8m x 4.5m	36	EXISTING
F	THF PLANT	5.5m x 4.3m	23.65	EXISTING
G	OPEN SHED	4m x 15m	60	EXISTING
H	OFFICE	5m x 15m	75	EXISTING
I	BOILER HOUSE	21.3m x 14.73m	313.74	EXISTING
J	CHIMNEY	ø 1680	2.2	EXISTING
K	F.O. DAY TANK	3m x 1.6m	4.8	EXISTING
L	BOILER FEED TANK	4.4m x 2.3m	10.12	EXISTING
M1	R & D LAB (KG SCALE)	7.5m x 15.4m	115.5	EXISTING
M2	R & D LAB (BENCH SCALE)	7.5m x 15.4m	115.5	EXISTING
N	F.O STORAGE TANK	6m x 6m	36	EXISTING
O	METAL SCRAP	3m x 10m	30	EXISTING
P	6LACS KCAL THERMIC FLUID HEATER AREA	11m x 6m	66	PROPOSED
		PLINTH AREA–C8	1285.15	

AREA STATEMENT C–9

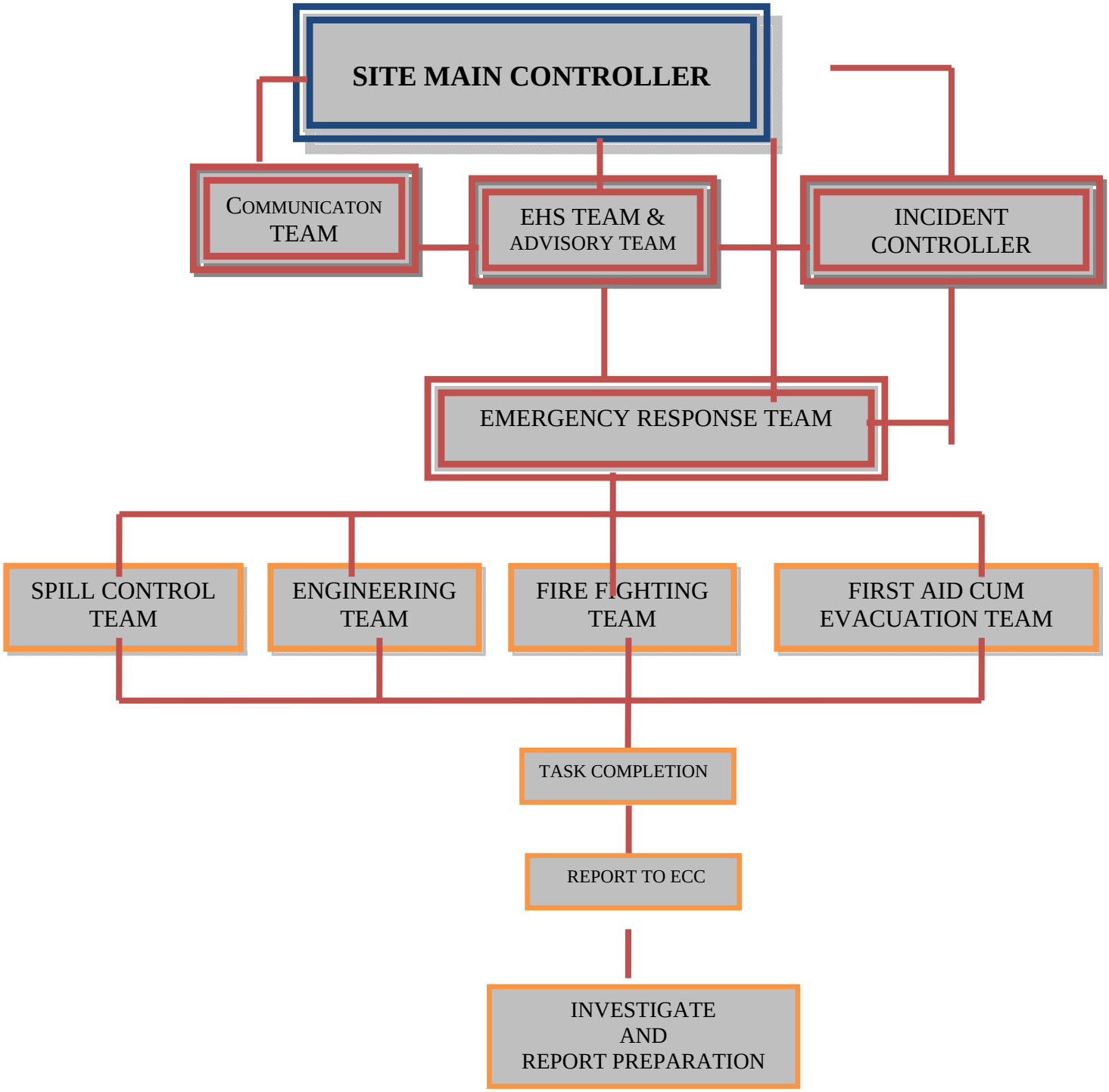
SR.No.	DESCRIPTION	DIMENSION	AREA IN SQ. M.	REMARK
A	ALPHA DEMASCONE, MULTI PROCESS PLANT	35.95m x 13.5m+ 2.77m x 22.45+ 6.45m x 3.23m	1130	EXISTING
B	DELTA DEMASCONE TANK FARM	15.1m x 7.1m	107.21	EXISTING
C	CHILLING PLANT	8.9m x 10.4m	92.56	EXISTING
D1	OFFICE & INSTRUMENT PANEL ROOM	4m x 10.4m	41.6	EXISTING
D2	ELECTRICAL MCC PANEL ROOM	8m x 10.4m	83.2	EXISTING
D3	ISC/SF MCC PANEL ROOM	4m x 6.9m	27.6	EXISTING
E	ALPHA DAMASCONE TANK FARM	7.6m x 9.1m	69.16	EXISTING
F	ORANGE OIL PLANT	7.8m x 8.15m	63.57	EXISTING
G	ROTOCON VACCUM DRYER	15.69m x 5.38m	84.4122	EXISTING
H	UNDER GROUND TANK AREA	22m x 17.8m	391.6	EXISTING
I	SECURITY & TIME OFFICE	3m x 2.5m	7.5	EXISTING
J	ORANG OIL DAY TANK AREA	9m x 10m	90	EXISTING
K	IBC/DRUM STORAGE AREA	20m x 8m	160	EXISTING
L	L–CARVONE TANK FARM	10.7m x 3.93m	42.051	EXISTING
		PLINTH AREA–C9	2390.41	

M/s – PRIVI ORGANICS LTD.
C3,4,5,6,6/1,8&9 M. I. D. C. AREA MAHAD,
MAHAD, RAIGAD.

TITLE: PLOT PLAN

SCALE:– 1:500 DATE:– 2/2/2012
DRG. No. PRI–II/PLAN/12/201 REV.–00 A1

Annexure- 2 EMERGENCY MANAGEMENT



EMERGENCY PREPAREDNESS AND RESPONSE ORGANISATION

2.1. SITE EMERGENCY KEY PERSONNEL

Key Personnel	Responsible & It's Alternative
• Site Main Controller	V.P. Opérations/ G.M. Manufacturing/G.M. QS and Shift In-charge (From 17.30 Hrs-9.00 Hrs)
• Incident Controller	HOD/ Section Head/ Shift In-charge/Shift Exécutive
• Communication Team	IR Dept.
• Engineering Team	Manager Engineering Services, Available Electrical, Instrument & Maintenance Technician
• Fire Fighting Team	Trained persons from the available Manpower
• First Aid Team	Trained persons from the available Manpower
• Evacuation Team	Trained persons from the available Manpower
• Spill Control Team	Nominated & Trained person from each plant & section
• EHS & Advisory Team	EHS Team, G.M. R & D, G.M.Technical, G.M-QS, all Managers other than emergency area and team.

Annexure 3 – Important Telephone Numbers

No	Service	Description	Telephone no.
1.	POLICE	Superintend of police, Alibag Add. Superintend of police, Alibag	02141 – 222093(O) –228530 (O) --222008 (R)
		Dep. Superintend of police, Mahad	222170
		Police Station, MIDC	233010
2.	INSPECTOR	District Collector, Alibag Inspector of factory, CBD-Mumbai Dir. Of Industrial Safety and Health	02141-222118/222001 022- 27578587 022- 28696875
3.	FIRE BRIGADE	MMA Fire Station Mahad	101 / 102/ 232405 222116
4.	HOSPITAL	Deshmukh Nursing home, Mahad Govt. Hospital Municipal dispensary, Mahad MMA Hospital	223086 / 223124 223047 222282 232562/233879
5.	AMBULANCE	Mahad Nagar Parishad MMA Fire Station	222116 232405 /101
6	CIVIL SURGEON	Civil Surgeon, Alibag	02141- 222017/222157
7.	MIDC	Mahad	232289
8	MSEDCL	MIDC area	232199
9	MPCB	Director of MPCB, Mumbai MPCB(MIDC area)	022-27562132 02145-232372

9.2 HEAD OFFICE

Sr. No.	Name	Designation and address	Phone Nos.	
			Office	Residence
1.	Mr. Mahesh Babani	Managing Director	9930262719/ 9930262720	9821024242
2.	Mr. D. B. Rao	Executive Director	9930262719/ 9930262720	9821122111

KEY PERSONNEL OF THE FACTORY

NAME	Designation	Intercom	Res. Number
Mr. S.B.Pathare	VP-Operations	101	9167219216
Mr. Sachin Rajurkar	GM-Manufacturing	103	9619492978
Mr. H. M. Rafiq	General Manager –Quality System	400	9930262721
Mr.R.L.Chavan	General Manager-Technical	601	9930262733
Dr. Chandramohan	General Manager-R&D	411	9619492976
	Sr.Manager – EHS	501	9930262730
Mr. Krishna Pawar'	Manager – IR / Admn	105	9930262738
Mr. N.Kasabe	Manager –Plant HR	107	9619492973
Mr. E. J. S. Gokarnam	Sr.Manager – Production	200	9930262736/ 9604097401
Mr. J.R.Kumbhar	Manager – QC	451	9619492972
Mr. G. Ramesh Babu	Sr.Manager – Logistics	700	9930262722
Mr. Saleem Sirkhot	Sr.Manager-Production-U-I	-	9930262744
Mr.M.J.Sutar	Manager-Maintenance-U-I	-	9930262724
Mrs. Anita Khot	Manager - Excise	721	9930262723
Mr. Anilkumar Mishra	Sr.Manager-Instrumentation	301	9930262729
Mrs. Vinita Mane	Manager-QA	403	9930262740
Mr.S.Sharma	Sr.Manager-Process Development	432	9822098208
Mr.Pradeep Yelave	Manager-Technical	606	9769611978
Mr.Mihirkumar Sharma	Asst.Manager-Production	241	9822649302
Mr. Mr.Girish Upadhye	Asst.Manager-Production	221	8097525065
Mr.A.Markandeyulu	Asst.Manager-Mechanical	312	9930262732
Mr.Javed Patel	Asst.Manager-Project	651	9619492974
Mr.S.V.Warange	Asst.Manager-EHS	503	9930262745
Mr. Pradeep Pawar	Asst.Manager-Logistics	702	9699434039
Mr.G.B.Anarse	Asst.Manager-Production-U-I	-	9930262741

Annexure-4 MSDS of Chemicals

Sr.No.	NAME
1	Citral
2	Sulphuric Acid
3	Acetic Anhydride
4	Alpha pinene
5	Toluene
6	Methanol
7	MEK
8	Hydrogen
9	Phosphoric Acid
10	Dihydro Mercene
11	Hexane
12	MDC
13	Caustic Soda
14	Crude Sulphated Turpentine

Annexure-5 LIST OF FIRE FIGHTING TEAM

SR.NO.	NAME OF FIRE FIGHTER	DEPARTMENT
1.	MR. GANESH KADAM	PRODUCTION (HYDROGENATION PLANT)
2.	MR.LAXMAN DESHMUKH	PRODUCTION (HYDROGENATION PLANT)
3.	MR.G.V.RAMANA	PRODUCTION (HYDROGENATION PLANT)
4.	MR.U.DANIAL	PRODUCTION (CST PLANT)
5.	MR.SANDESH CHAVAN	PRODUCTION (HYDROGENATION PLANT)
6.	MR.RAMCHANDRA GAIKWAD	PRODUCTION (IONONE/SP. PLANT)
7.	MR.SACHIN GADE	PRODUCTION (IONONE/SP. PLANT)
8.	MR.KISHOR DALVI	PRODUCTION (IONONE/SP. PLANT)
9.	MR.SACHIN DESHMUKH	PRODUCTION (IONONE/SP. PLANT)
10.	MR.AMRUT PATIL	PRODUCTION (IONONE/SP. PLANT)
11.	MR.PRASAD YERUNKAR	PRODUCTION (IONONE/SP. PLANT)
12.	MR.MAHESH NAKTI	PRODUCTION (IONONE/SP. PLANT)
13.	MR.JAYANT KADAM	PRODUCTION (DHMOL PLANT)
14.	MR.M.SUKUM	PRODUCTION (DHMOL PLANT)
15.	MR.IRFAN PARKAR	PRODUCTION (DHMOL PLANT)
16.	MR.DEVIDAS DESHMUKH	PRODUCTION (DHMOL PLANT)
17.	MR.CHETAN MORE	ETP
18.	MR.SHARAD KADAM	PRODUCTION (DHMOL PLANT)
19.	MR.SWAPNIL JADHAV	PRODUCTION (DHMOL PLANT)

20.	MR. SAKHARAM UTEKAR	PRODUCTION (HYD.GEN.PLANT)
21.	MR.SUBHASH GAWALI	PRODUCTION (DAMASCONE PLANT)
22.	MR.SANDESH MULYE	PRODUCTION (DAMASCONE PLANT)
23.	MR.MANOJ SAPALE	PRODUCTION (DHMOL PLANT)
24.	MR. SATISH PULEKAR	PILOT
25.	MR.OMPRAKASH GUDEKAR	QC
26.	MR.SATISH MANVE	PILOT PLANT
27.	MR.PRASHANT RAJIWALE	PILOT PLANT
28.	MR.SUYOG NIKAM	PILOT PLANT
29.	MR.NINAD BAGADE	ENGINEERING (INSTRUMENTATION)
30.	MR.AMUL BAGADE	ENGINEERING (INSTRUMENTATION)
31.	MR.VIJAY MANDE	PRODUCTION (GPMI PLANT)
32.	MR.DEEEPAK PAWAR	PRODUCTION (GPMI PLANT)

LIST OF SPILL CONTROL TEAM

SR.NO.	NAME OF EMPLOYEE	DEPARTMENT
1	MR.RAVINDRA URADE	PILOT PLANT
2	MR.ABHISHEK RAVKAR	R&D
3	MR. DHANANJAY SONAVANE	R&D
4	MR.KAMLESH MAHADIK	TECHNICAL
5	MR.SUNIL GAIKAWAD	QC
6	MR. KAILAS MORE	PRODUCTION(DHMOL PLANT)
7	MR. PRAFULLA PADGHE	PRODUCTION(DHMOL PLANT)
8	MR.RAJESH SUKUM	PRODUCTION(DHMOL PLANT)
9	MR.MAHESH AMBAVALE	PRODUCTION(DHMOL PLANT)
10	MR.MARUTIRAO SAYKAR	QC
11	MR. R. L. SALUNKHE	PRODUCTION(HYDROGENATION PLANT)
12	MR.SUSHANT JADHAV	PRODUCTION(HYDROGENATION PLANT)
13	MR.S.P.VARULE	PRODUCTION(HYDROGENATION PLANT)
14	MR.ULHAS D. VADAL	PRODUCTION(HYDROGENATION PLANT)
15	MR. DNYANDEEP NAGAONKAR	PRODUCTION(HYDROGENATION PLANT)
16	MR.MANIK KADAM	PRODUCTION(IONONE/SP. PLANT)
17	MR.SANTOSH HATE	PRODUCTION(IONONE/SP. PLANT)
18	MR.YUVRAJ SHINDE	PRODUCTION(IONONE/SP. PLANT)

19	MR. SUNIL SUTAR	PRODUCTION(GPMI PLANT)
20	MR.SAGAR KAREKAR	PRODUCTION(GPMI PLANT)
21	MR.PRALHAD MAHADIK	PRODUCTION (INONE PLANT)
22	MR.RAJENDRA PANCHAL	PRODUCTION (DHMOL PLANT)
23	MR. SARVESH CHAVAN	EHS
24	MR.GAURAV BHATKHANDE	PRODUCTION(HYDROGEN GEN. PLANT)
25	MR. RAM KATE	ENGINEERING (MECHANICAL)
26	MR. SAMEER SUKALE	ENGINEERING (MECHANICAL)
27	MR. LOKARE	PROJECT

Annexure-6 LIST OF FIRST AID CUM EVACUATION TEAM

SR.NO	NAME OF EMPLOYEE	DEPARTMENT
1.	MR.GANESH THAKUR	ENGINEERING (ELECT.)
2.	MR.AJAY GANPAT MAHADIK	ENGINEERING (INST.)
3.	MRS.ANITA KHOT	EXCISE
4.	MR.DATTATRAYA PANDURANG SALUNKE	EHS
5.	MR.V.PALKAR	PRODUCTION (DHMOL)
6.	MR.JITENDRA N.GARGE	PRODUCTION (DHMOL)
7.	MR.FARZAD U.CHAFEKAR	PRODUCTION (IONONE)
8.	MR.SUSHIL SAHADEV BHUVAD	PRODUCTION (HYDROGENATION PLANT)
9.	MR.SACHIN S.MAHADIK	PRODUCTION (HYDROGENATION PLANT)
10.	MR.R.TAMBITKAR	PRODUCTION (HYDROGENATION PLANT)
11.	MR.MUKESH VASUDEV BHUTKAR	PRODUCTION (HY.GENERATION PLANT)
12.	MR.N.PHANSE	PILOT PLANT
13.	MR.AJAY MISTRY	PROJECT
14.	MR. SAMEER MARUTI SHIRKE	PILOT
15.	MR.SANKET NIKAM	PRODUCTION(GPMI)
16.	MR. SACHIN SHEVERKAR	PRODUCTION(DAMASCONE)
17.	MR. TUSHAR DESHMUKH	PRODUCTION(GPMI)
18.	MR. ANIL GOLAMBADE	PRODUCTION(GPMI)

19.	MR. C.H.RAVI	ENGINEERING (MAINTENANCE)
20.	MR. M.SHAIKH	ENGINEERING (UTILITY)
21.	MS.VAISHALI S. THAKUR	R&D
22.	MS.PRITAM P. PHADTARE	R&D
23.	MR. SURAJ S. ZANJE	PRODUCTION (HYDROGENATION PLANT)
24.	MR.VAIBHAV SHEDGE	EHS
25.	MR.D.B.GHARGE	ENGINEERING (MAINTENANCE)
26.	MR.P.S.JOSHI	ENGINEERING (MAINTENANCE)
27.	MR.SUNIL KATE	LOGISTICS
28.	MR.SACHIN T.MANDE	ENGINEERING (INST.)
29.	MR.ILLYAS MUSTAFA	EHS
30.	MR.G.DONGARE	PROJECT
31.	MR. SURENDRANATH JADHAV	UTILITY
32.	MR.BHARAT R.VADKE	PRODUCTION(DHMOL)
33.	MR.A.R.PATIL	PRODUCTION (IONONE)
34.	MR.SAMEER N.GOLE	PRODUCTION (IONONE)
35.	MR.MANDAR B.PATIL	PRODUCTION (IONONE)
36.	MR.AMIT A.GOGAWALE	PRODUCTION (IONONE)
37.	MR.M.L.SAYKAR	QC
38.	MR.RAKESH V.BHOI	PRODUCTION (DAMASCONE)
39.	MR.SHEKHAR B.BHANGALE	PRODUCTION (DAMASCONE)
40.	MR.YOGESH C. DESHMUKH	PRODUCTION (DHMOL)

41.	MR.JAYKUMAR D.PATIL	PRODUCTION (DHMOL)
42.	MR.BALU G.KELASKAR	PRODUCTION (HY. GENATION PLANT)
43.	MR.BABURAV S.CHAVAN	PRODUCTION (HY.GENATION PLANT)
44.	MR.GANESH SAYAJI KADAM	PRODUCTION (HYDROGENATION)
45.	MR. GANESH R. KUMBHAR	PRODUCTION (CST PLANT)
46.	MR PRANAV V. KOTBHAGE	PRODUCTION (CST PLANT)
47.	MR.MUKESH N . GOVILKAR	PRODUCTION (DAMASCONE
48.	MR. SHAILESH A. MOHITE	R&D

Annexure – 7 EMERGENCY MUTUAL AID

MUTUAL AID RESPONSE GROUP

COMPANY	PHONE
	OFFICE
Sudarshan Chemicals Ind. Ltd.	232309/10
Pidilite Industries	232043
Exon Laboratories	232058
Akzo Nobel Limited	232153/45
Embio Ltd.	233699/700/701
Vinati Organics Limited	232012
Astec Life Sciences Ltd	8888848792
Laxmi Organics Ltd	232548/233417
Aquapharma Ltd	251090/91
Sandoz Pvt. Ltd.	251061/64/66/67
Hikal	232063
MMA Fire Station	232405
MMA Hospital	232562/233879

ANNEXURE: 8 LIST OF PERSONEL PROTECTIVE EQUIPMENTS

Sr. NO.	ITEM	Sr No.	ITEM
1	Safety Helmet	11	PVC Dust Mask
2	Safety Goggles	12	Cotton Dust Mask
3	Safety Shoes	13	Eye Wash Fountain
4	Rainy Shoes	14	Safety Belt
5	Gum Boots	15	Full Face Gas Mask
6	PVC Apron	16	Organic Vapour Mask
7	Asbestos Hand Gloves	17	Self Contained Breathing Apparatus
8	Rubber Hand Gloves	18	Half Line Gas/ Organic Vapour Mask
9	Electrical Hand Gloves	19	On Line Respirator Hood
10	Leather Hand Gloves		