ON SITE EMERGENCY PLAN

(OEP)

OF

M/S JINDAL STEEL & POWER LIMITED,

ANGUL.

DECEMBER-2017

CONTENTS

1.0 GENERAL INFORMATION OF THE FACTORY

1.1 INTRODUCTION:

Jindal Steel and Power Ltd., is one amongst the leading manufacturer of steel and producers of power in India with a vision of Nation building. The plant of Jindal Steel and Power Ltd. at Angul comprises a 6 MTPA integrated steel plant and 810 MW captive power plant. All the facilities available for production are state-of-the-art with unique production processes which are not only the best in the world but also promise the best utilization of natural resources.

Name & Address Of The Factory	M/s Jindal Steel & Power Limited At/Po- Nisha, State Highway 63, Angul – Chendipada Road Dist- Angul. Odisha, Pin- 759111 E Mail:dks@angul.jspl.com Fax No: 06761264141
Regd. Office Address	M/s. Jindal Steel & Power Limited At/Po- Nisha, State Highway 63, Angul – Chendipada Road Dist- Angul. Odisha, Pin- 759111 Fax- 06761264141 Web site – www.jindalsteelpower.com
Site Office	M/s. Jindal Steel & Power Limited At/Po- Nisha, State Highway 63, Angul – Chendipada Road Dist- Angul, Odisha, Pin- 759111
Name & Designation Of Occupier	Mr. DK Saraogi, ED-Incharge
Name & Designation Of Manager Under Factories Act	Mr. Damodar Mittal, EVP
Product	Steel Plates ,MS Bar and Electricity
Tel/Fax No Web Site	(Tel. No.) : 06761264191 Fax: 06761264141 E Mail: dks@angul.jspl.com www.jspl.com

1.2 LOCATION AND ACCESSIBILITY:

The integrated steel plant is located at Village-Nisha under Angul tehasil, District -Angul, Odisha and has the following coordinates:-

Latitude : 21.04^0N
Longitude : 84.88^0 E
Site Elevation : 195m AMSL

Total area of 4332 acres has been acquired for the plant. The topography of the site is moderately undulated with an average elevation of 195 m AMSL. The site is optimally suited for considering the topography and availability of fuel and water at the proximity.

SH 63 is passing by the Factory site.

RAIL: The nearest railway station is Angul of East Coast Railway, at a distance of about 17Kms from the Factory.

AIRPORT: The nearest airport is Bhubaneswar at a distance of 140Kms.

PORT: Nearest port is Paradeep which is located at a distance of 206Kms.

Other important features of the Factory: River Brahmani is the water source of the Factory.

1.3METEOROLOGICAL DATA:

METEROLOGICAL DATA				
		SUMMER	**RAINY**	**WINTER**
a.	**Max Wind Speed in m/s**	**1.37**	**2.21**	**1.16**
b.	**Min Wind Speed in m/s**	**0.49**	**0.45**	**0.45**
c.	**Average Wind Direction (from)**	**SSW**	**SSW**	**S**
d.	**Average Humidity**	**62.4**	**78.5**	**62.2**
e.	**Max Ambient Air Temp. (^{o}C)**	**49.9**	**39.8**	**45.7**
f.	**Min Ambient Air Temp. (^{o}C)**	**7**	**10.1**	**4.2**

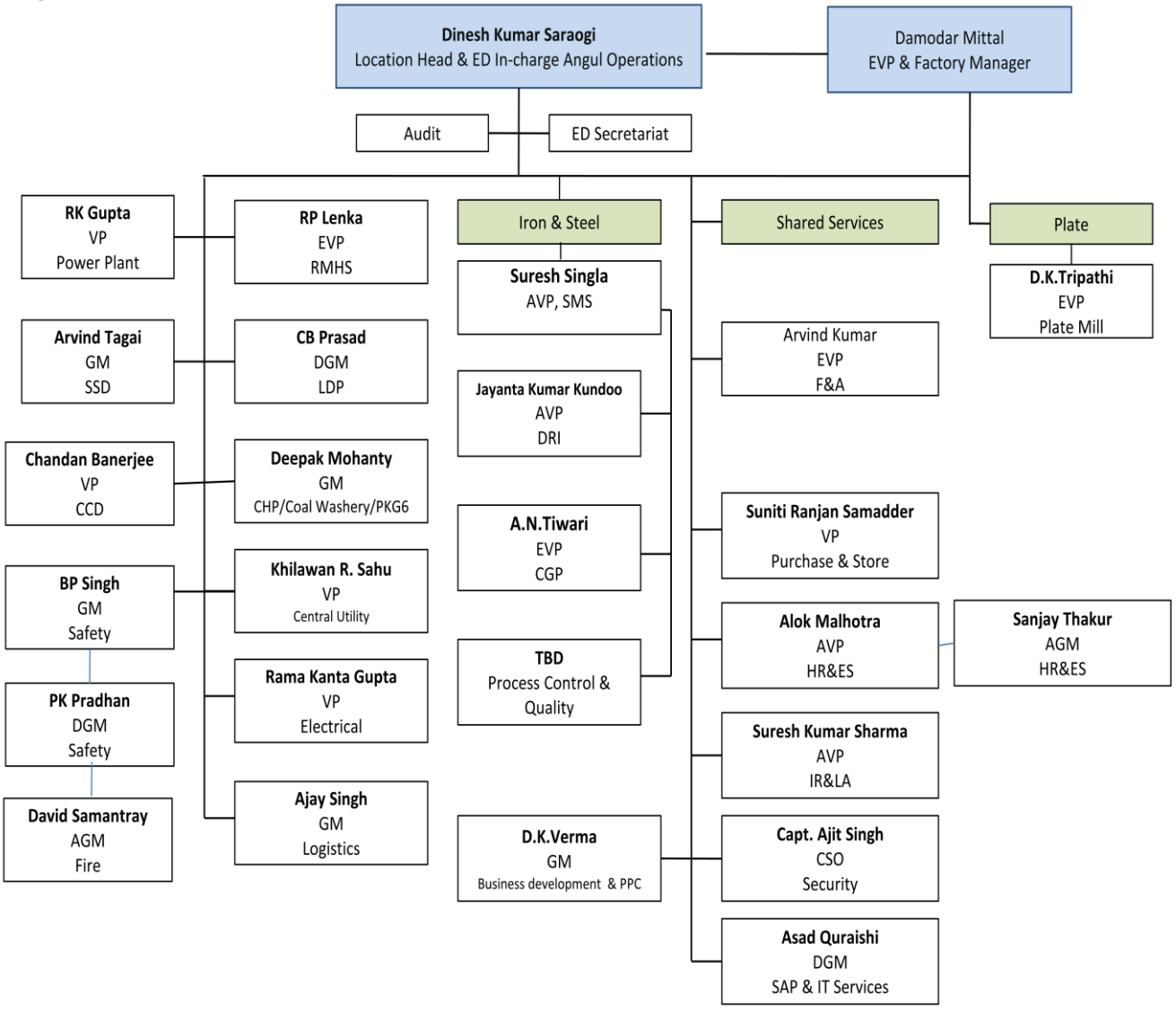
Source :- www.accuweather.com

The major facilities at the plant include:

1. Coal Gasification Plant
2. Oxygen plant
3. DRI Plant
4. Lime & dolomite plant
5. SMS & BOF
6. Plate Mill
7. Bar Mill
8. Steel & Structure Division
9. Coke oven & by product plant
10. Sinter Plant
11. Blast furnace
12. Power plant
13. RMHS
14. Coal Washery

2.0 ORGANISATIONAL SET UP:-

Org. Structure



3.0 MAN POWER:-

Licensed Man Power of the Factory 25000. However14000persons have been ordinarily employed as per the details mentioned below:

MANPOWER – OPERATION ACTIVITY (AVERAGE):

SHIFT	TIME	No. of Persons
A	0600-1400 hrs.	865
B	1400-2200 hrs.	865
C	2200-0600 hrs.	865
GENERAL	0900-1800 hrs.	3765
	Total	6360

MANPOWER – CONSTRUCTION ACTIVITY (AVERAGE) :

SHIFT	TIME	No. of Persons
A	0600-1400 hrs.	--
B	1400-2200 hrs.	--
C	2200-0600 hrs.	350
GENERAL	0800-1800 hrs.	7200
	Total	7550
GRAND TOTAL MAN POWER (6360 + 7550) = 13910		

4.0 INVENTORY OF RAW MATERIALS (Non Hazardous)

SL. NO.	NAME OF RAW MATERIAL	QUANTITY OF ONE TIME STORAGE IN MT	TYPE OF STORAGE	SIZE OF YARD/ TANK
1	Pellet	2 x 3.9 Lakh MT	Open Yard	L-608mtr. W-57mtr.
2	Lime Stone	5.2 Lakh MT	Open Yard	L-608mtr. W-57mtr.
3	Coal	2 x 2.7 Lakh MT	Coal yard	L-608mtr. W-57mtr.
4	Iron Ore	7 Lakh MT	Open Yard	L-608mtr. W-57mtr.

(A) PRODUCT :

Sl. No.	NAME OF THE PRODUCT	PRODUCTION CAPACITY	TYPE OF STORAGE
1	Electricity	6X 135MW	NA
2	Iron Plate	1.5 MTPA	Open Area
3	Bar	1.4 MTPA	Open Area

(B) BYE-PRODUCT:

Sl. No.	NAME OF THE PRODUCT	QUANTITY OF ONE TIME STORAGE IN MT – Capacity	TYPE OF STORAGE
1	Ammonia	2874	Bullet

5.0 (A).INVENTORY OF HAZARDOUS SUBSTANCES:

SL. NO.	HAZARDOUS SUBSTANCE	MAXIMUM INVENTORY	ONE TIME STORAGE CAPACITY	LOCATION OF STORAGE/ TYPE OF STORAGE	SIZE OF STORAGE TANK /Yard	DYKE SIZE (L X B XH)(in meter)
1	Propane	150 T	150 T	Propane Yard	26.696mx4.25m	40.49x29.20x4.5
2	Methanol	1082 MT	1082 MT	CGP	9.6 m x 9.4 m 9.6 m x 9.4 m 5.5 m x 5.6 m	24.29x19.85x0.63 24.29x20.60x0.63 24.39x19.85x0.63
3	Caustic Soda	36 MT	36 MT	Power Plant	3.3mx2.5mx2.5m	17.3x7.7x0.49
4	Propylene	153 M^3	153 M^3	CGP	4.6mx4.1m	26.45x11.40x0.30
5	Sulphuric acid	80 MT	80 MT	Power Plant	5.1mx5.1mx3m	7.2x4.7x1.98
6	Chlorine	30 MT	30 MT	Power Plant	2.09mx0.76m	NA
7	Gasification Oil	800 KL	800 KL	CPP	10mx10m	35.7x20.73x1.80
8	Ammonia	4210 M^3	4210 **M^3**	CGP	70mx58mx7m	77.39x26.92x0.30
9	HCL	40 MT	40 MT	Power Plant	3.3mx3mx3m	17.3x7.7x0.49
10	MEDA	225m^3	225m^3	**CGP**	7mx6.4m	21.65x16.30x0.30

11	Gasification Oil	1448 MT	1448 MT	**CGP**	13 m X12.5 m	24.39x23.34x0.63
12	Naphtha/Benzol	2208 MT	2208MT	**CGP**	12 mx11.3 m 12 m x 11.3 m 12 mx11.3 m	25.33x24.29x0.63 24.29x23.10x0.63 24.29x23.54x0.63
13.	Phenolic Pitch	125 MT	125 MT	**CGP**	5.8 m x 6.5 m	23.85x18.55x0.63
14	Depitch tar acid	630 MT	630 MT	**CGP**	9.6 m x 9 m	18.55x17x0.63
15	Sulphur	1000MT	1000MT	**CGP**	Open Yard	(20.4 X20.3 X1.43) X2
16	Caustic soda	21 T	21 T	**CGP**	2 m X 5 m	9 X5 X 0.48
17	HCl	16T	16T	**CGP**	2 m X 5 m	9 X5 X 0.48

(B).INVENTORY OF HAZARDOUS GASES PRODUCED/GENERATED DURING THE PROCESS :

SL. NO.	NAME OF HAZARDOUS GAS	QUANTITY OF ONE TIME FLOW	TYPE OF STORAGE
1.	Coke oven gas	20,000 Nm^3/hr	NA
2.	Mixed gas	11,000 Nm^3/hr	NA
3.	Basic oxygen furnace gas	20,000 Nm^3/hr	NA
4.	Blast furnace gas	350,000 Nm^3/hr	NA

6.0 IDENTIFICATION OF HAZARD :

SL. NO.	HAZARD	PREDICTABLE HAZARD SCENARIO	IMPACT
1	Propane	Pool fire / Fire ball may occur due to rupture in the Tank and Subsequent release and instantaneous ignition.	Fire may propagate to the nearby area
2	Propylene	Fire ball may occur due to rupture in the Tank and Subsequent release and instantaneous ignition	Fire may propagate to the nearby area
3	Gasification Oil	Fire ball may occur due to rupture in the Tank and Subsequent release and instantaneous ignition	Fire may propagate to the nearby area

4	Methanol	Fire ball may occur due to rupture in the Tank and Subsequent release and instantaneous ignition	Fire may propagate to the nearby area
5	Sulphuric acid/Hydrochloric acid	Acid vapour may leak or Spillage of acid due to rupture in the Tank or Valve	Skin irritation or respiratory problem
6	Chlorine	Chlorine Gas leak may occur due to failure of Valve of the chlorine cylinder	Chlorine gas may spread to nearby area
7	Ammonia	Ammonia Gas leak may occur due to failure of Valve of the Ammonia tank	Ammonia gas may spread to nearby area
8	MEDA	MEDA liquid/gas leak may occur due to failure of Valve of the storage tank	MEDA liquid/gas may spread to nearby area
9	Mixed gas	Mixed Gas leak may occur due to failure of Valve of the gas pipeline	Fire may propagate to the nearby area
10	Coke oven gas	Coke oven Gas leak may occur due to failure of Valve of the gas pipeline	Fire may propagate to the nearby area
11	Basic oxygen furnace gas	Basic oxygen furnace Gas leak may occur due to failure of Valve of the gas pipeline	Basic oxygen furnace gas may spread to nearby area
12	Blast furnace gas	Blast furnace Gas leak may occur due to failure of Valve of the gas pipeline	Blast furnace gas may spread to nearby area

7.0 IDENTIFICATION OF MOST CREDIBLE HAZARD SCENARIO

Case-1

Fire on METHANOL Storage Tank (Dispersion Modelling in Annexure - 5)

Fire Hazard in Methanol Storage Tank is considered as Credible Scenario because of the following reasons;

Methanol is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. It is a flammable liquid and vapor. It burns with a clean, clear flame, which is almost invisible in daylight, or a light blue flame and can decompose at high temperatures forming carbon monoxide and formaldehyde. May be harmful if inhaled, absorbed through the skin or swallowed. It has Mild central nervous system depressant also may cause headache, nausea, dizziness, drowsiness. Severe vision effects, including increased sensitivity to light, blurred vision, and blindness may develop following an 8-24 hour symptom-free period. Coma and death may result.

The effect of significant heat radiation level of 2 Kw/m^2,5 Kw/m^2 and 10 Kw/m^2 for different season in case of fire on Methanol storage tank as assessed is given in table below. The incredible scenario is during winter season with minimum wind speed.

Storage details	Significant heat level Kw/m^2	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
METHANOL 1000 MT	2	1300	1500	1300	1400	1300	1500	pain within 60 sec
	5	808	930	824	911	807	939	2nd degree burns within 60 sec
	10	556	644	567	629	555	650	potentially lethal within 60 sec.

*WS- Wind Speed

Software used: Solid works 15.0, Aloha& ANSYS CFD (V.16.1)

Case-2

Fire on PROPANE Storage Tank (Dispersion Modelling in Annexure –5)

Fire Hazard in Propane Storage Tank is considered as Credible Scenario because of the following reasons;

Propane is an extremely flammable gas. Fire classification as per OSHA, it comes under category Flammability-1. It is contained under pressure and may explode if heated. So, it is susceptible to fire hazard. Whenever Propane catches fire it shall manifest in the form of pool fire. Taking into consideration of the metrological data of the area, one time storage quantity of propane and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant heat radiation level of 2 Kw /m^2,5 Kw/m^2 and 10 Kw/m^2 for different season in case of fire on propane storage tank as assessed is given in table below.The incredible scenario is during summer season with maximum wind speed.

Storage details	Significant heat level Kw/m^2	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
PROPANE 450 MT	2	76	61	73	62	75	60	pain within 60 sec
	5	49	39	47	39	48	38	2nd degree burns within 60 sec
	10	34	26	33	26	33	25	potentially lethal within 60 sec.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-3

Gas Leakage from hydrochloric acid tank considered as most Credible Scenario because of the following reasons;

One time storage: 40 MT.

Hydrochloric acid is very toxic obnoxious gas with no colour and highly oxidizing agent. It reacts violently with water and Iron at elevated temperature. It is extremely irritating to the eyes and respiratory tract and is very toxic. Taking into consideration of the metrological data of the area, one time storage quantity of hydrochloric acid and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant concentration level of 1.8 PPM, 22PPM and 100 PPM for different season in case of hydrochloric acid leakage from cylinder valve connecting pipe as assessed is given in table below. The incredible scenario is during summer season with maximum wind speed.

Storage details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
HYDRO-CHLORIC ACID 40 MT	1.8	3000	824	890	506	3000	720	Population could experience irritation of skin and eyes.
	22	802	213	218	136	778	188	Irritation of throat.
	100	310	96	97	61	288	85	Population could experience decaying of teeth and severe irritation of skin with rash.

Software used: Solid works 15.0 , Aloha &ANSYS CFD (V.16.1)

Case-4

Gas Leakage from Sulphuric Acid Tank is considered as most Credible Scenario because of the following reasons;

Maximum one time storage: 80 MT.

Sulphuric acid gas is very toxic obnoxious gas with brown colour and highly oxidizing agent. It reacts violently with water and Iron at elevated temperature. It is extremely irritating to the eyes and respiratory tract and is very toxic. Taking into consideration of the metrological data of the area, one time storage quantity of Sulphuric acid and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant concentration level of 0.2 mg/cum, 8.7 mg/cum and 160 mg/cum for different season in case of Sulphuric acid leakage from cylinder valve connecting pipe as assessed is given in table below. The incredible scenario is during summer season with maximum wind speed.

Storage details	Significant toxic level mg/(cum)	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
SULPHURIC ACID 80 MT	0.2 mg/(cu m)	64	10	57	14	62	11	Respiratory irritation in humans.
	8.7 mg/(cu m)	10	10	10	10	10	10	Slight disabling effects..
	160 mg/(cu m)	10	10	10	10	10	10	Will develop life-threatening health effects

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-5

Gas emission from Ammonia Storage Tank

Gas emission from Ammonia Storage Tank is considered as Credible Scenario because of the following reasons;

Under ambient conditions, this is a colorless gas with a pungent, irritating odor. Exposure to concentrations moderately above the Threshold Limit Value may irritate the eyes, nose and throat. Higher concentrations may cause breathing difficulty; chest pain; bronchospasm; pink, frothy sputum; and pulmonary edema (fluid on the lungs).So, it is susceptible to toxic inhalation and exposure hazard. Whenever ammonia gas emits it shall manifest in the form of dispersed gas. Taking into consideration of the metrological data of the area, one time storage quantity of ammonia gas and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant toxic level of 30 ppm, 160 ppm and 1100 ppm for different season in case of leakage from Ammonia storage tank as assessed is given in table below. Rainy season being producing the incredible scenario with maximum distance of 2800 m with max wind speed.

Storage details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
AMMONIA 80 MT	30 ppm	1100	1000	2800	1600	1700	1600	Individuals could be exposed for up to 1 hr without experiencing or developing effects other than mild, transient health effects
	160 ppm	482	445	1100	683	738	674	Individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious adverse health effects or symptoms that could impair an individual's ability to take protective action.
	1100 ppm	181	166	399	255	276	252	potentially lethal within 60 Minutes.

Software used: Solid works 15.0, Aloha& ANSYS CFD (V.16.1)

Case-6

CHLORINE GAS LEAKAGE FROMCHLORINE TONNER (Dispersion Modelling in Annexure –5)

Gas Leakage from chlorine tonners considered as most Credible Scenario because of the following reasons;

Maximum one time storage: 30MT

Chlorine gas is very toxic obnoxious gas with greenish yellow colour and highly oxidizing agent. It reacts violently with water and Iron at elevated temperature. It is extremely irritating to the mucous membranes of the eyes and respiratory tract and is very toxic. Taking into consideration of the metrological data of the area, one time storage quantity of chlorine gas and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant concentration level of 0.5 PPM, 2PPM and 20 PPM for different season in case of chlorine gas leakage from chlorine or cylinder valve connecting pipe as assessed is given in table below. The incredible scenario is during rainy season with maximum wind speed.

Storage details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
CHLORINE 30 MT	0.5 ppm	3300	2500	4000	3000	3300	2400	Population could experience notable discomfort.
	2 ppm	1900	1400	2200	1700	1900	1300	irreversible or other serious long lasting effects or impaired ability to escape.
	20 ppm	687	481	770	601	736	761	Population could experience life threatening health effects or death.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-7

Fire on PROPELYNE (Dispersion Modelling in Annexure - 5)

Fire Hazard in PROPELYNE Storage Tank is considered as Credible Scenario because of the following reasons;

It is an extremely flammable gas. If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L — Fire Protection.

The effect of significant heat radiation level of 2 Kw/m², 5 Kw/m² and 10 Kw/m² for different season in case of fire on propelyne storage tank as assessed is given in table below. The incredible scenario is during summer season with maximum wind speed.

Storage details	Significant heat level Kw/m²	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
PROPYLENE 57 MT	2	161	131	154	132	160	128	pain within 60 sec
	5	102	82	99	83	102	80	2nd degree burns within 60 sec
	10	71	55	69	56	70	54	potentially lethal within 60 sec.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-8

GAS emission in MDEA storage tank (Dispersion Modelling in Annexure -5)

GAS emission hazard in MDEA Storage Tank is considered as Credible Scenario because of the following reasons;

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29CFR 1910.1200.it causes severe eye burns, burns of the mouth and throat, skin irritation, harmful if swallowed, aspiration hazard and can enter lungs and cause damage.

The effect of significant heat radiation level of 2.3ppm, 25 ppm and 150ppm for different season in case of gas emission from storage tank as assessed is given in table below. The incredible scenario is during summer season with maximum wind speed.

Storage details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
MEDA 225 m^3	2.3	3800	708	1300	456	3600	531	May cause moderate skin irritation with local redness.
	25	748	108	201	72	730	92	May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.
	150	204	44	54	38	204	38	Sufficient to cause respiratory irritation and other effects.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-9

Fire on Gasification Oil (Dispersion Modelling in Annexure - 5)

Fire Hazard in Gasification Oil Storage Tank is considered as Credible Scenario because of the following reasons;

It is a flammable gas. It is a dark oily liquid with strong lube oil odor having constituents like paraffin's, olefins, aromatic and tar acids. If inhaled it may cause headache.

The effect of significant heat radiation level of 2 Kw/m², 5 Kw/m² and 10 Kw/m² for different season in case of fire on Gasification Oil storage tank as assessed is given in table below. The incredible scenario is during rainy season with maximum wind speed.

Storage details	Significant heat level Kw/m²	Experience at distance in Mtrs.			Indication
		Summer	Rainy	Winter	
		Max WS	Max WS	Max WS	
GASIFICAION OIL 1450 MT	4.5	54	59	47	pain within 60 sec
	12.5	45	47	38	2nd degree burns within 60 sec
	37.5	10	13	11	potentially lethal within 60 sec.

Software used: Solid works 15.0, Aloha& ANSYS CFD (V.16.1)

Case-10

Basic Oxygen Furnace GAS (BOFG) LEAKAGE FROM Gas pipe line (Dispersion Modelling in Annexure – 5)

Gas Leakage from BOF considered as most Credible Scenario because of the following reasons;

Flow rate: 20,000 Nm^3/hr

Basic oxygen furnace (BOF), significant amount of gases, rich in carbon monoxide content, are generated during the blow time at a temperature of 950℃. It is extremely irritating & may cause headache, drowsiness, dizziness, nausea, vomiting, hallucinations, confusion, angina, convulsions and unconsciousness and may be fatal. Taking into consideration of the metrological data of the area, and flow quantity of the BOF gas and its physical and chemical property, it is considered credible Hazard scenario.

The effect of significant concentration level of 83 PPM and 330 PPM for different season in case of BOF gas leakage from BOF gas pipe line as assessed is given in table below. The credible scenario is during winter season with minimum wind speed and also summer season with minimum wind speed.

Flow details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
BOF GAS 20,000 Nm^3/hr								
	83 ppm	1600	1600	1100	1100	1600	1600	May cause headache, drowsiness, dizziness, nausea
	330 ppm	969	973	647	666	970	973	vomiting, hallucinations, confusion, angina, convulsions, unconsciousness and may fatal

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-11

Blast Furnace GAS (BF GAS) LEAKAGE FROM Gas pipe line (Dispersion Modelling in Annexure – 5)

Gas Leakage from BF Gas pipe line considered as most Credible Scenario because of the following reasons; Flow rate: 350,000 Nm^3/hr

BF gas should be handled with by wearing protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not eat, drink or smoke when using this product. If exposed, concerned or feel unwell, get medical advice/attention. If in eyes: Rinse cautiously with water for several minutes. If on skin (or hair), Take off immediately all contaminated clothing and rinse skin with water/shower. If inhaled, remove person to fresh air and keep comfortable for breathing. The effect of significant concentration level of 0.5 PPM, 2PPM and 20 PPM for different season in case of chlorine gas leakage from chlorine or cylinder valve connecting pipe as assessed is given in table below. The incredible scenario is during rainy season with maximum wind speed.

Flow details	Significant toxic level ppm	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
BLAST FURNACE GAS 350,000 NM^3/hr								
	83 ppm	982	989	1700	1300	985	989	Causes severe skin burns and serious eye damage. May cause cancer.
	330 ppm	623	636	1100	830	629	636	Causes damage to lungs through prolonged or repeated exposure

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-12

Coke Oven Gas LEAKAGE FROM Gas pipe line (Dispersion Modelling in Annexure – 5)

Gas Leakage from Coke Oven Gas pipe line considered as most Credible Scenario because of the following reasons;

Flow rate: 20,000 Nm^3/hr

It is a flammable, poisonous and odourless high-pressure gas. This gas also catches fire as contains lot of Calorific value in it with hydrogen as major composition. It can be fatal even with adequate oxygen and forms explosive mixtures with air. Harmful if inhaled. Self-contained breathing apparatus must be worn by rescue workers. Under ambient conditions, this product is a colorless, odorless gas. It should be stored below 1250F.This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

The effect of significant heat level of 2,5 and 10 Kw/m^2 for different season in case of CO leakage from gas pipe as assessed is given in table below.

Flow details	Significant Heat level KW/m^2	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
COKE OVEN GAS 20,000 NM^3/hr	2	27	25	28	26	32	31	pain within 60 sec
	5	17	14	19	16	20	19	2nd degree burns within 60 sec
	10	10	10	13	10	13	11	potentially lethal within 60 sec.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

Case-13

MIXED GAS LEAKAGE FROM Gas pipe line (Dispersion Modelling in Annexure – 5)

Gas Leakage from MIXED Gas pipe line considered as most Credible Scenario because of the following reasons;

Flow rate: 11,000 Nm^3/hr

It is a flammable, poisonous and odourless high-pressure gas. It is a combination of coke oven and blast furnace gas. This gas also catches fire as contains lot of Calorific value in it with hydrogen as major composition. It can be fatal even with adequate oxygen and forms explosive mixtures with air. Harmful if inhaled. Self-contained breathing apparatus must be worn by rescue workers. Under ambient conditions, this product is a colorless, odorless gas. It should be stored below 1250F. This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

The effect of significant heat level of 2, 5 and 10 Kw/m2 for different season in case of CO leakage from gas pipe as assessed is given in table below.

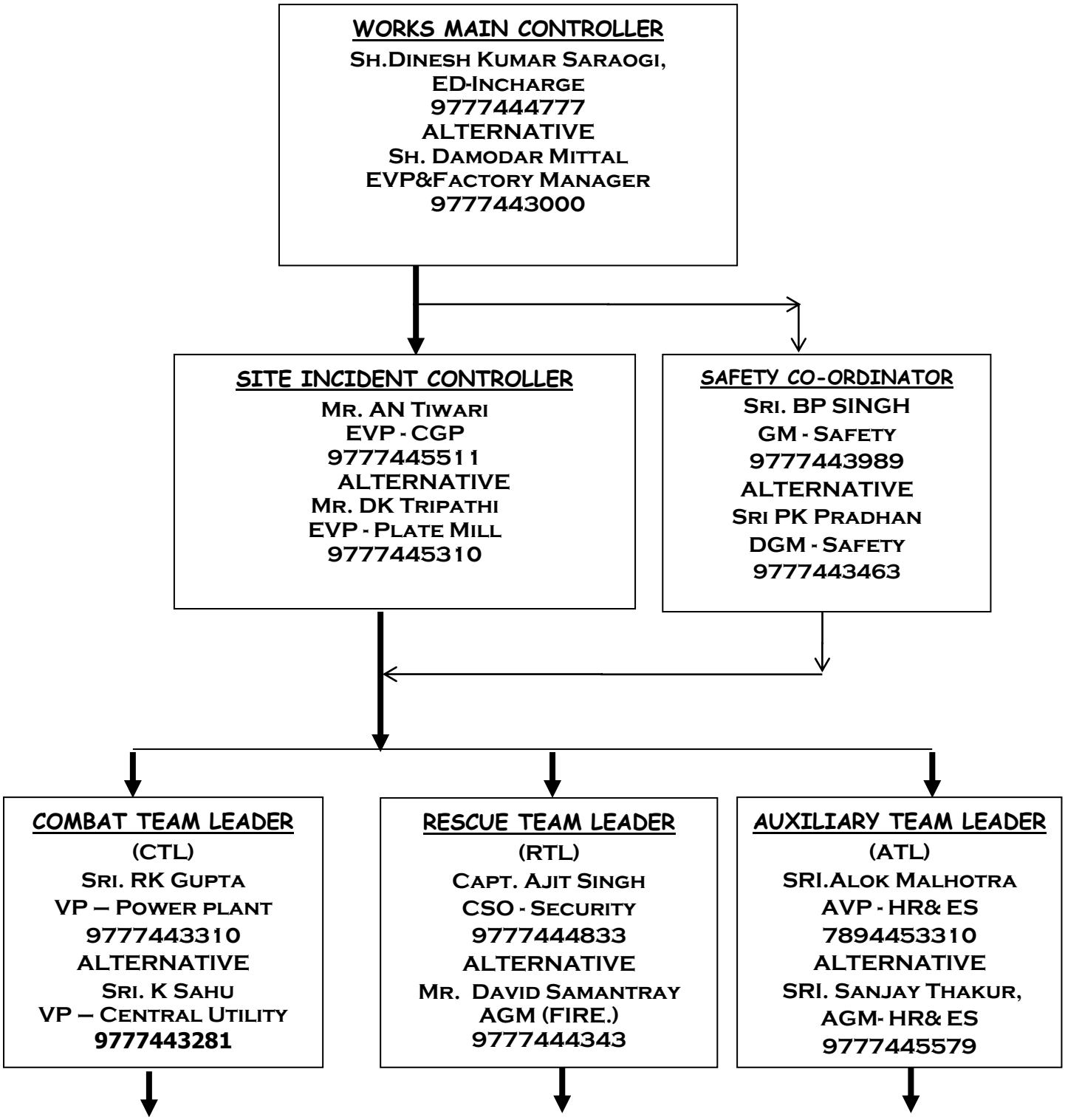
Flow details	Significant Heat Level Kw/m^2	Experience at distance in Mtrs.						Indication
		Summer		Rainy		Winter		
		Max WS	Min WS	Max WS	Min WS	Max WS	Min WS	
MIXED GAS 11,000 Nm^3/hr	2	15	14	16	15	17	17	pain within 60 sec
	5	10	10	11	10	11	10	2nd degree burns within 60 sec
	10	10	10	10	10	10	10	potentially lethal within 60 sec.

Software used: Solid works 15.0, Aloha & ANSYS CFD (V.16.1)

8.0 PLOT PLAN

The plot-plan showing Hazard Zone, Iso-Risk Contour, Emergency Control Room, Assembly points, Main, Material & Emergency Exit and Fire Hydrant line along with its no. of Hydrant Points in different color codes is given in **Annexure-6.**

9.0 EMERGENCY COMMAND STRUCTURE



Members:	MEMBERS	MEMBERS
1. SH.H.S MISHRA, AVP (CGP.) 9777445286 2. SH. RK SABAT 3. AVP (COKE OVEN) 9777444909 4. SH. JK KUNDOO, AVP (DRI) 9777446622 5. SH. Z KATPITIA GM(OXYGEN PLANT) 9777445454	1. SH.SAUKAT ALI KHAN(SO) 9777443245 2. SH. RAMESH SINGH (SO) 9777445218 3. SH.KC MAJHI (DM - FIRE) 9777444533 4. SH.SK LENKA (DM - FIRE) 9777443597	1. SH. ATANUPRAHARAJ, AGM(HR & ES) 9777444492 2. SH. BASANTA KUMAR MISHRA , DGM (HR & ES) 9777445202 3. SH.MANOJ KUMAR PANDA, DM (HR & ES) 9777443133

Note:

WMC :Sl No. 2 shall play the role of WMC in the absence of Sl No.1 otherwise he will assist Sl No.1.
SIC :Sl No. 2 shall play the role of SIC in the absence of Sl No.1 otherwise he will assist Sl No.1.
CTL : Sl No. 2 shall act as CTL in the absence of Sl No.1, otherwise he will assist the CTL.
ATL :Sl No. 2 shall act as ATL in the absence of SL No.1, otherwise he will assist the ATL.
RTL :Sl No. 2 & 3 shall act as RTL in the order of preference in absence of Sl No.1, otherwise they will assist the RTL.

10.0 ROLE OF KEY PERSONS OF EMERGENCY COMMAND STRUCTURE

10.1 Works main controller (WMC):-

- On being informed, rushes to the Emergency Control Room and takes overall charges of the situation
- Makes quick assessment of the situation and decides declaration of emergency by blowing the siren in appropriate code **[10 seconds up with a pause of 5 seconds for 3 minute" for fire and continuous for 5 minutes for toxic gas release]**
- Makes continuous review and assesses the possible developments to determine the extent of damage to plant and human beings
- Ensures that casualties are receiving adequate attention
- Liaises with the fire services, police services and other statutory authorities
- Declares closure of the emergency by blowing the siren [**Continuous for three minutes**]
- Issues the authorized statements to the media services.
- Reports all statutory authorities in the prescribed manner
- Communicates to employees about the mishap, measures taken and gives confidence to employees for avoiding recurrence of the incident by investigation and ordering preventive measures to be implemented

10.2 Site incident controller:-

- On hearing Emergency siren, rushes to the scene and reports to the Works Main Controller
- Makes quick assess about the gravity of the situation and appraises Works Main Controller
- Extend all sorts of help through different agencies to minimize the damage to human beings, plant, property and environment

- Reports the development of the situation time to time to Works Main Controller
- Provides the required information to the fire brigade team for fire fighting
- Preserves the evidences for the subsequent inquiries

10.3 Combat team leader:-

- On hearing the emergency siren, rushes to the scene with his team with sufficient equipment's in the minimum possible time and reports to Site Incident Controller
- Ensures the team members that, they resume their position with appropriate equipment's.
- Monitors the combat operation to control the situation
- Ensures that the situation is controlled by arresting, spillage, fighting fire, shutting of the valve and equipment's by the team in consultation with

10.4 Combat team member:-

- On hearing the emergency siren, rush to the scene with firefighting equipment's/gas masks in the minimum possible of time and report to their team leader
- Operate the firefighting equipment/close the valve of the gas cylinder for controlling the situation

10.5 Rescue team leader:-

- On hearing the emergency siren, rushes to the scene and reports to the Site Incident Controller
- Ensures the arrival of his team members
- Keeps necessary equipment's of first-aid for preliminary treatment

- Keeps the ambulance ready to carry the injure persons to the nearest hospital
- Ensures the use of proper personal protective equipment's by his team members & leads the team for rescue operation
- Informs the Works Main Controller for the developments time to time
- Guides the Mutual Aid Partner for their course of action at the site
- Guides the non-essential persons to reach assembly point
- Searches the missing person on the roll call basis

10.6 Rescue team members:-

- On hearing the emergency siren, rush to the scene with appropriate personal protective equipment's and report to their team leader

10.7 Auxiliary team leader:-

- On hearing the emergency siren rushes to the scene and reports to the Site Incident Controller
- Intimates statutory authorities over phone
- Intimates nearest Fire Station over phone
- Intimates Mutual-Aid Partner over phone
- Keeps the first-aid and primary health center staff, equipment ready to take care of immediate medical needs
- Takes care of victims' family
- Makes all arrangement like transport, other needs, arrange finance
- Ensures all casualties are shifted to hospital for medical treatment
- Keeps records of casualties and provide information of the matter to Works Main Controller

10.8 Auxiliary team members:-

- On hearing emergency siren, rush to the scene and report to the team leader
- Provide immediate first-aid treatment to the victims
- Ensure ambulance vehicle ready
- Coordinate with combat team, rescue team, statutory authorities and mutual-aid partners

10.9 SAFETY CO-ORDINATOR

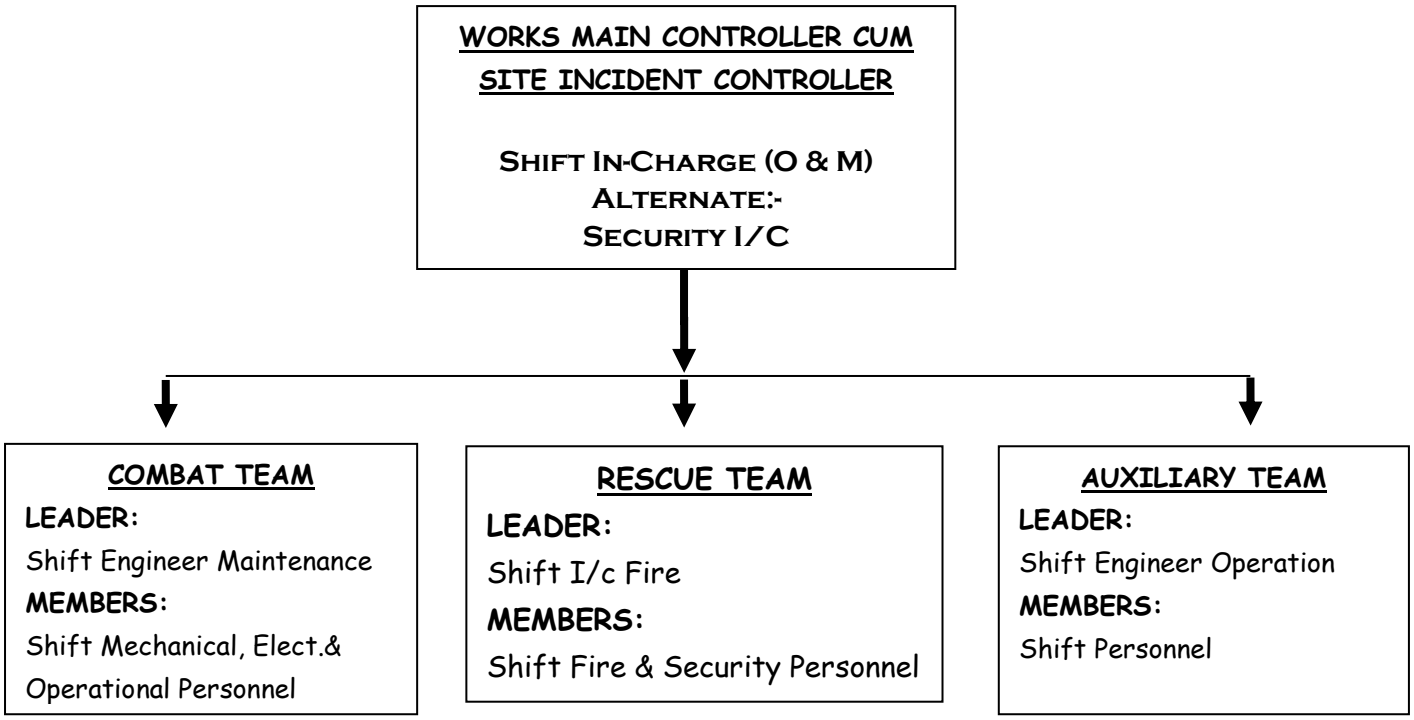
- During the emergency safety coordinator co-ordinates the work between Works Main Controller, Site Incident Controller & Leaders of Combat, Rescue & Auxiliary Teams.

11.0 ACTION PLAN FOR ON-SITE EMERGENCY:

STEP NO.	INITIATOR	ACTION TO TAKE
1.	The person noticing the emergency	➢ Informs the Control Room who in turn will inform Fire, Safety, Ambulance, Incident controller and Works main controller regarding the fire and other emergency.
2	Works Main Controller (WMC)	➢ Rushes to Emergency Site and observes the ongoing activities. ➢ Takes stock of the situation in consultation with the SIC. ➢ Moves to Emergency Control Room. ➢ Takes decision on declaration of emergency and asks for emergency wailing siren. ➢ Decides on declaration of normalcy of emergency after combating the situation. ➢ Ensures that the emergency operations are recorded chronologically.
3	Site Incident Controller (SIC)	➢ Rushes to the emergency scene and takes overall charges of the situation ➢ Starts firefighting operation/ close the valve of the gas cylinder with combat team ➢ Shutdowns the plant ➢ Arranges to evacuate the unwanted persons and calls for additional help. ➢ Time to time to passes information to the Works Main Controller (WMC) about the situation at site.
4	Combat Team leader	➢ Organizes trained personnel, equipped with firefighting appliances / gas mask and calls for fire tender at the place of fire. ➢ Starts combating, shutdown equipments and takes steps to extinguish fire with fire fighting facilities / stop gas leakage. ➢ Finds out the root cause of fire / gas leak and to takes necessary action for prevention of fire / gas leakage.
5.	Rescue Team leader	➢ Shift the injured persons to hospital by ambulance after providing necessary first aid. ➢ To inform the Auxiliary Team Leader for necessary help from Mutual Aid Partner.

6.	Auxiliary Team leader	➢ Informs about the emergency to Statutory Authorities depending upon the situation. ➢ Seeks help of Mutual Aid Partner and coordinates with Mutual Aid Partner to render their services, if required. ➢ Takes role call to find out the missing persons, if any. ➢ Arranges to inform the relatives of Casualties. ➢ Takes care of visit of the statutory authorities to the Emergency Site.
7.	Team Members	➢ Each of the team members should follow the instructions of concerned team leader to mitigate the emergency.
8.	Safety Coordinator	➢ Rushes to the site &coordinate the work between Works Main Controller, Site Incident Controller & Leaders of Combat, Rescue & Auxiliary Teams.

12.0 SILENT HOUR COMMAND STRUCTURE :-



12.1 ROLE OF KEY PERSONS IN SILENT HOUR COMMAND STRUCTURE

- Silent Hour is the time when General Shift people are not available.
- The command structure for the silent hour shall be same as during normal hour, however, during the silent hour the Shift In-charge (O&M) / Security in-charge shall act as Works Main Controller-cum-Site Incidence Controller , till the arrival of the Works Main Controller
- Since during these hours Works Main Controller, Site Incident Controller, Combat Team Leader, Rescue Team Leader and the Auxiliary Team Leader may not be available inside the plant, they shall be informed by the Shift I/c O&M / Security I/c (Works Main Controller during Silent Hour) either by telephone or by sending special messenger to their residences
- On receiving the information the Works Main Controller, Site Incident Controller, Combat Team Leader, Rescue Team Leader, Auxiliary Team

Leader& safety coordinator shall reach the site at the earliest and simultaneously Combat Team Leader, Rescue Team Leader and Auxiliary Team Leader shall ensure the presence of their respective team members.

- Thereafter the action plan as well as the role of key persons shall be same as the normal hour execution of Command Structure.

13.0 ACTIVATION AND CLOSING PROCEDURE FOR ON-SITE EMERGENCY

- The person noticing the incident of fire shall inform the location & nature of fire to the CTL, Security Gate (Fire Fighter) and concerned Shift-in-charge.
- CTL shall inform SIC and shall rush to the site immediately. He shall arrange for fire fighting and first aid available at site. CTL shall arrange to take necessary steps to eliminate the root cause of fire.
- SIC on getting information shall inform the WMC and reach the site at the earliest. He shall take over the charge and shall direct RTL to carry out rescue operations including fire fighting and medical treatment. SIC shall co-ordinate with CTL to eliminate the root cause of fire.
- WMC, on arrival at site shall take stock of the situation from SIC and then rush to ECR to declare emergency on the basis of assessment made by SIC. He shall give direction to the Security Gate / RTL to activate siren. **[10 seconds up with a pause of 5 seconds for 3 minute" for fire and continuous for 5 minutes for toxic gas release]**
- RTL shall mobilise fire fighting and medical resources to site and shall assist SIC.
- Chief of Safety / Fire Fighting (member of Rescue Team) shall co-ordinate the safety aspects of emergency rescue teams. He shall ensures safety of all others and equipment's etc.

- ATL takes charge of ECR. Ensures smooth operation of ECR. Informs relatives of casualties. Informs Mutual Aid Partners and ensures their arrival at site if required.
- ATL informs statutory authorities and district administration regarding emergency suitably and coordinates their visit at site.
- WMC coordinates and keeps the track of all the activities at site and off the site and arranges the recording of the activities in a chronological manner for review of the On Site Emergency Plan.
  - ⇒ WMC shall declare normalcy after full control of the emergency situation.
  - ⇒ WMC shall direct ATL / Security Gate to blow "all clear siren continuously for duration of one minute".
  - ⇒ Information is sent to statutory authorities by Chief of Personnel.
  - ⇒ Information is given to police (if required) & local authorities by ATL.
  - ⇒ Analysis of emergency and future precautionary measures shall be taken up by the On-Site Emergency Plan Committee consisting of following members: WMC, SIC, ATL, CTL, RTL, Chief of Safety, and Chief of Security.
  - ⇒ Review of On Site Emergency Plan (if required) shall be done by the above Committee. Revision shall be approved by WMC for implementation.
  - ⇒ NOTE- As a rule, On Site Emergency Plan shall be reviewed normally once in a year. Any modification / updating are approved by the WMC.