

SMS PHARMACEUTICALS LIMITED, UNIT - VII

**SY.NO. 160,161,163 TO 168 AND 170 (KANDIVALASA VILLAGE),
SY. NO.72 (KOVVADA AGRAHARAM VILLAGE),
PUSAPATIREGA MANDAL, VIZIANAGARAM DISTRICT,
ANDHRA PRADESH**

FINAL EIA REPORT

- 1. ENVIRONMENTAL IMPACT ASSESSMENT**
- 2. ENVIRONMENT MANAGEMENT PLAN**
- 3. PUBLIC CONSULTATION**
- 4. COMPLIANCE OF TERMS OF REFERENCE**
- 5. ANNEXURES**
- 6. MANUFACTURING PROCESS, REACTION SCHEMES, PROCESS FLOW DIAGRAM AND MATERIAL BALANCE**

**Project No. 0119-21-01
January 2019**

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**SUBMITTED TO
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI**

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1.0 INTRODUCTION

1.0 Introduction of the Project (*Terms of Reference No. 2(ii) & 2(iii)*)

Bulk drugs, its intermediates and few fine chemicals constitute active pharma ingredients, which are essential for ensuring human wellbeing throughout the world. This sector consists of many public and private organizations that discover, develop, manufacture and market medicines for human and animal health protection. The active pharma ingredients which are mainly synthetic organic chemicals are developed with research into etiology of diseases and ailments, and its prevention and or control. Modern scientific and technological advances are accelerating the discovery and development of innovative active pharma ingredients with improved therapeutic activity and reduced side effects.

Chemical synthesis produces majority of drugs currently available in the market. Chemical synthesis consists of four steps - reaction, separation, purification, and drying. Organic solvents are mainly used as medium for chemical synthesis, while manufacturing processes occasionally utilize solvents for extraction and interchanges. The manufacturing of active pharma ingredients requires various process equipment and chemical methods. Chemical synthesis consists of one or more batch reactions followed by separation and purification steps utilizing organic and inorganic reactants, solvents, and catalysts, and is solvent-intensive. Sources of emissions include dryers, reactors, distillation units, storage and transfer of materials, filtration, extraction, centrifugation, and crystallization. Waste streams generated are numerous and complex due to the raw materials used and varied nature of operations. Organic synthesis generates a mother liquor containing unconverted reactants, by-products, and residual product in a solvent or aqueous base, as well as acids, bases, metals, etc. In this context the API manufacturing is viewed as an environmentally hazardous activity. Accordingly, Ministry of Environment and Forests, GOI mandated prior environmental clearance for synthetic organic chemicals manufacturing units vide S.O.1533 dt. 14.9.2006.

M/s. SMS Pharmaceuticals Limited, Unit VII obtained Environment Clearance Vide letter no. F. No. J-11011/361/2006-IA II (I) dated: 16.04.2007 and No. 11-45/2007-IA III dated: 08.10.2007 for marine disposal of treated wastewater through dedicated pipeline to sea. It is now proposed to expand the API manufacturing capacity from 179.05 TPM to 740.76 TPM with inclusion of a captive power plant of 2 x 2 MW capacity in existing site area of 95.56 acres. The capital cost for expansion is Rs. 600 crores for additional production blocks and utilities, enhancement of treatment facilities, storages and additional equipment to enhance the capacity, at Sy. Nos. 160, 161, 163 to 168 and 170 Kandivalasa Village, Sy. No. 72 Kovvada Agraharam Village, Pusapatriega Mandal, Vizianagaram District, Andhra Pradesh. The terms of reference for the environmental impact assessment studies was obtained from MoEF&CC vide letter no. IA-J-11011/510/2017-IA II (I) dt. 16.11.2017 for a capacity of 542.76 TPA and inclusion of 2 x 2MW co-generation power plant and subsequently a fresh TOR was obtained vide letter no. IA-J-11011/12/2018-IA II (I) dated 05.02.2018 for the proposed manufacturing capacity of 740.76 TPM and inclusion of 2 x 2MW co-generation power plant, as part of environmental clearance process. Hence the baseline data collected as part of EIA preparation for the initial TOR dt. 16.11.2017, was used for preparing the EIA for expansion to 740.76 TPM and inclusion of 2 x 2MW co-generation power plant. The certified compliance letter from the regional office of MoEFCC, Bangalore is obtained vide letter no. F.No. EP /12.1/526/AP/1864 dated 20.11.2017 and F.No. EP /12.1/604/AP/1863 dated 20.11.2017 for conditions mentioned in the environmental clearances and CRZ clearance obtained for marine outfall as mentioned above. Public Hearing was conducted on 12.07.2018 as part of environmental clearance process.

M/s. SMS Pharmaceuticals Limited, Unit VII is aware that the Environmental impact assessment process is a decision-making tool enabling them to adopt best management practices to achieve least impact on the surroundings due to their activity and accordingly decided to carry out the Environmental Impact Assessment to identify the negative and positive impacts and to delineate effective measures to control pollution and to mitigate environmental pollution. M/s. SMS Pharmaceuticals Limited, Unit VII

has appointed Team Labs and Consultants for the preparation of Environmental Impact Assessment report.

Immediately after the receipt of the work order for the preparation of EIA report, the collection of primary (field data) and secondary (data available with various state and central government agencies) data has begun. Reconnaissance survey of the region was carried out during of September 2017, and various sampling locations to monitor environmental parameters have been identified. Subsequently, monitoring has commenced for collection of data on meteorology, ambient air quality, surface and ground water quality, soil characteristics, noise levels flora and fauna at the specified locations during October to December 2017. The other studies such as socio-economic profile, land use pattern etc. are based on secondary data collected from various Government agencies and validated through the primary surveys. The Ambient air monitoring locations have been selected based on historic meteorological data generated at the nearest IMD station in Visakhapatnam.

Field team of M/s. Team Labs and Consultants worked in the study area during October to December 2017 and base line data for various environmental components i.e., air, water, soil, noise and flora and fauna and socio economic status of people was collected in a circular area of 10 km radius by taking the industry site as the center point, to assess the existing environmental status as per the guidelines specified by Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. This report presents the results of environmental impact assessment study along with the environmental management plan, necessary to avoid or mitigate the observed environmental impacts of the proposed expansion of synthetic organic chemicals manufacturing unit.

1.1 Product Profile *(Terms of Reference No. 3(ii)& (iii))*

The manufacturing capacity of permitted and after expansion products are presented in **Table 1.1** and by-products after expansion is presented in **Table 1.2**.

Table 1.1 Manufacturing Capacity

S.No	Name of Product	Capacity (TPM)	
		Permitted	After

			Expansion
1	Efavirenz	16	120
2	Lopinavir	3	5
3	Emtricitabine	1.5	20
4	Tenofavir	5	60
5	Atazanavir	0.5	15
6	Valcyclovir	10	30
7	Ritonavir	1	5
8	Zidovudine	7	20
9	Lamivudine	2	75
10	Valsartan	13	13
11	Abacavir	5	10
12	TPN Base	3	3
13	Pantoprazole	2	5
14	Ranitidine	90	90
15	Levetiracetam	10	20
16	Temisartan	0.5	2
17	Olmisartan	0.5	5
18	Candesartan	0.3	2
19	Ibresartan	0.25	2
20	Itraconazole	1.5	3
21	L-Carboxy-Stiene	2	10
22	Sulfamide	3	3
23	Gabapentin	1	40
24	Valganociclovir	1	5
25	Sitagliptin		10
26	Vildagliptin		2
27	Briviracetam		10
28	Amlodipine		5
29	Penciclovir		1
30	Arpiprazole		2
31	Rosiglitazone		0.5
32	Canagliflozin		2
33	Dapagliflozin		2
34	Empagliflozin		20
35	Ranolzine		10
36	Lanoconazole		0.05
37	Paliperidone Palmitate		0.1
38	Mirabegron		0.5
39	Solefinacin		1
40	Lamotrazine		5
41	Sumatriptan		0.5
42	Famotidine		5
43	Almotriptan		0.1
44	Ondansertan		0.5
45	Zolmitriptan		0.5
46	Rizatriptan		0.5
47	Elitriptan		0.25

48	Tadalafil		0.5
49	Sildenafilcitrate		2
50	Lanthanum Carbonate		2
51	Luliconazole		0.01
52	Verdinafil		0.25
53	Raltegravir		5
54	Dolutegravir		25
55	Darunavir		15
56	Linagliptin		0.5
57	Rivaroxaban		3
58	Apixaban		1
59	Sofosbuvir		30
60	Trazadone		15
	Total	179.05	740.76
61	Co-generation Power Plant	---	2 x 2 MW

Table 1.2 List of By-Products - After expansion

S.No	Name of Product	Stage	Name of By-product	Quantity	
				Kg/day	TPM
1	Atazanavir Sulphate	III	Triethylamine HCl	521.2	15.6
2	Dapagliflozin Propanediol	I	N-Methylmorpholine HCl	121.7	3.6
3	Darunavir	II	1-Hydroxy pyrrolidine-2,5-dione	210.2	6.3
4	Dolutegravir Sodium	III	Toluene	175.8	5.3
5	Efavirenz	V	Trichloro methanol	3430.9	102.9
6	Emitricitabine	I	Menthol	438.7	13.2
			Isopropyl Alcohol	168.7	5.1
		II	Triethyl amine HCl	377.2	11.3
7	Leviteracetam	II	Potassium Chloride	876.0	26.3
8	Sofosobuvir	I	Triethyl amine HCl	821.4	24.6
		III	4-Trifluoromethyl phenol	306.2	9.2
9	Tenofovir disoproxil fumarate	I	p-Toulene sulfonic acid	555.1	16.7
			Ethanol	296.9	8.9
10	TPN Base	II	Ammonium chloride	43.7	1.3
11	Valacyclovir HCl	III	Benzoyl formate	377.3	11.3
12	Zidovudine	I	Trityl chloride	695.4	20.86

1.2 Technology

The technology for the product profile is indigenous based on synthetic organic chemistry. The facility shall have required infrastructure to manufacture multiple products. The product profile has been finalized based on the market demand and the

technology compatibility. The synthesis involves reaction of fine chemicals in a solvent medium, followed by separation, purification and drying.

1.3 Plant Location and Layout

The project site of 95.56 acres is located at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh. There is no additional land acquisition for the proposed expansion and the available land of 96.56 acres is sufficient for expansion. The site is situated at the intersection of 18⁰⁰6'02" (N) latitude and 83⁰³5'22" (E) longitude. The site elevation above mean sea level (MSL) is in the range of 38-45 m. The plant site is surrounded by NH-5 to Chintapalli Road in North and East direction, open lands in south and west directions. The nearest village from the plant is Kovvada Agraharam village located at a distance of 1.7 km in southwest direction. The main approach road AH45 (NH-5) is at a distance of 1.9 km in north direction. The nearest Town Vizianagaram is at a distance of 16 km in northwest direction and Nellimarla railway station is at a distance of 17 km in northwest direction and nearest airport is Visakhapatnam located at a distance of 56 km in southwest direction. Kandivalasa gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 3.4 km in east direction, and Champavathi gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 7.4 km in southwest direction. Bay of Bengal is at a distance of 6.7 km in SE direction. There are three reserve forests in the study area, Kumili RF is at a distance of 2.6 km in northeast direction, Konada RF is at a distance of 7.6 km in southwest direction, Damarasingi RF is at a distance of 8.2 km in northwest direction. There is no National Park, sanctuary, critically polluted area and interstate boundary within the impact area of 10 km surrounding the site. Pydibhimavaram industrial area, which has a number of pharmaceutical manufacturing industries is located at a distance of 4.5 km in northeast direction. There are few discreetly located active pharma ingredient manufacturing units, outside Pydibhimavaram industrial area, within the impact area. The location map and site layout is as shown in [Fig 1.1](#) and [Fig 1.2](#).



Site Photographs of SMS Pharmaceuticals Limited Unit VII
(Terms of Reference No. 4(vii))

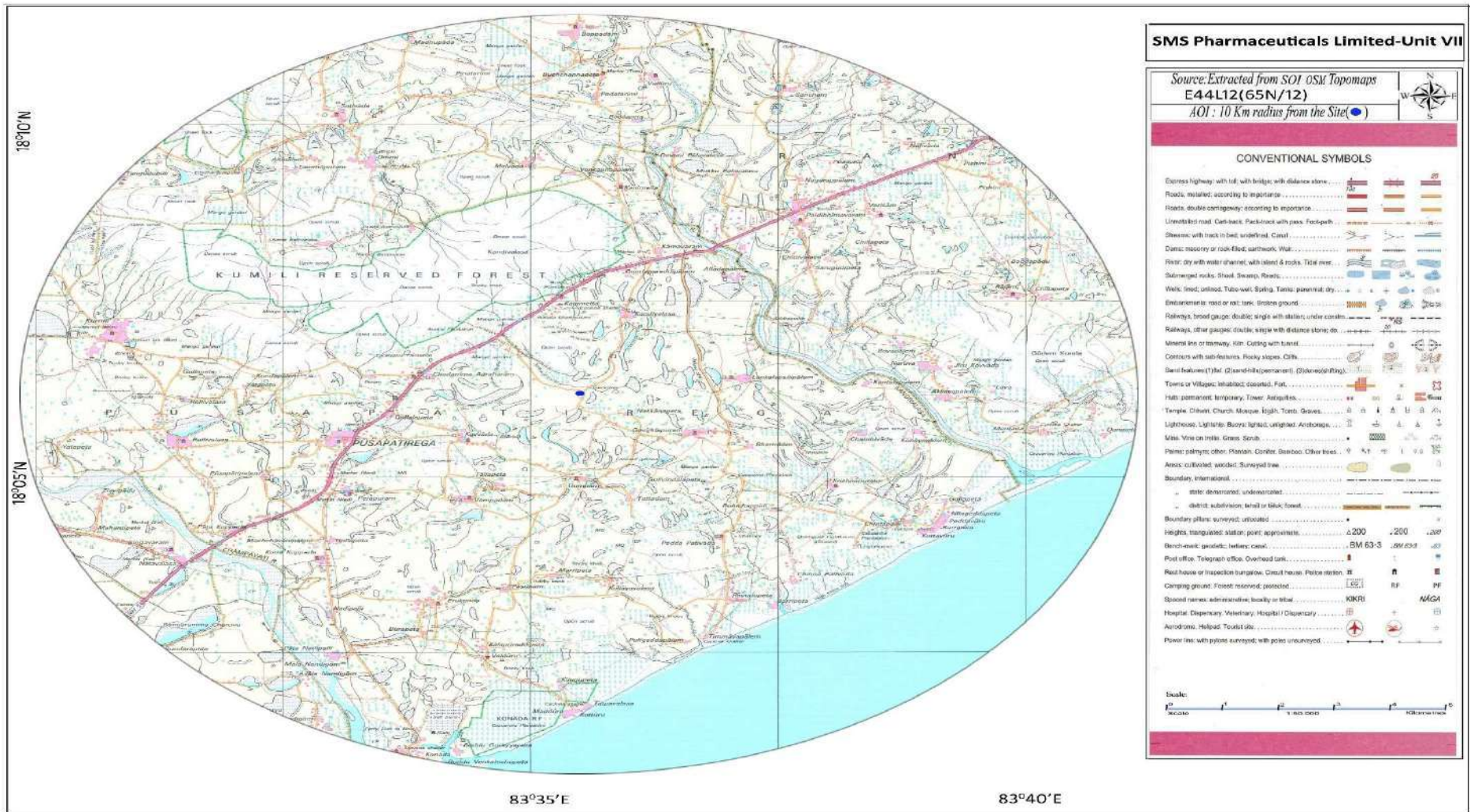


Fig 1.1 Location of M/s. SMS Pharmaceuticals Limited, Unit VII (Terms of Reference No. 4(ii))

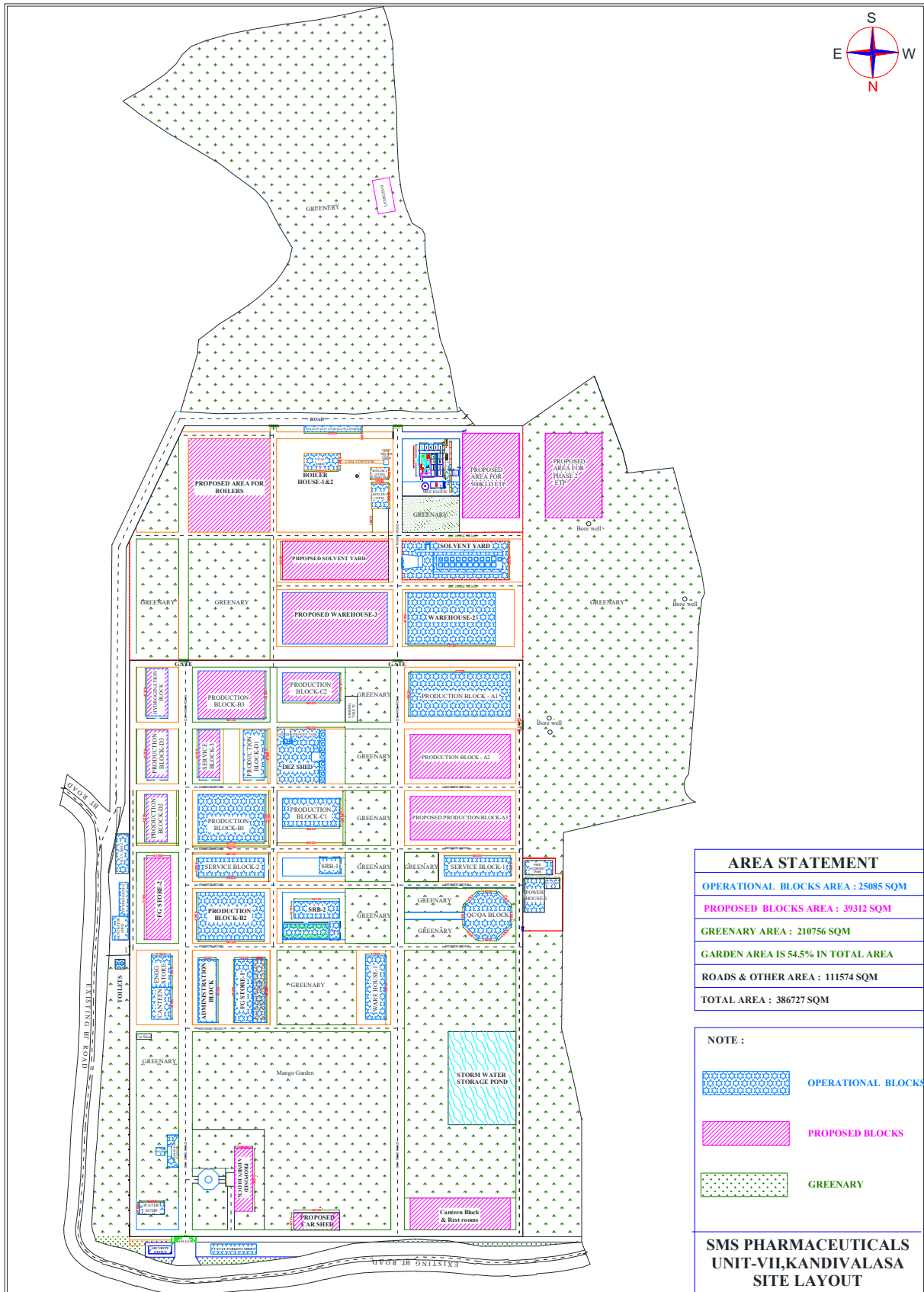


Fig 1.2 Plant Layout of M/s. SMS Pharmaceuticals Limited, Unit VII

(Terms of Reference No. 4(vi) & (viii))

1.4 Scope of EIA Studies

EIA study involves three basic components, viz. identification, prediction and evaluation of impacts. The brief scope of EIA study incorporating the terms of reference (TOR) obtained from MoEFCCis as follows:

- An intensive reconnaissance and preliminary collection of environmental information to plan field study.
- Base line data generation and characterization of air, water, soil, noise and vegetation in the ten kilometer radius area (impact zone) over a period of Three months.
- A thorough study of the process including provisions for pollution control, and environmental management that includes prediction of impacts and relevant mathematical modeling.
- Preparation of Environmental Monitoring Program.
- Preparation of Environmental Management Plan suggesting suitable methods for mitigating and controlling the pollution levels. Environmental Monitoring Plan is suggested for monitoring the pollution loads at various facilities in the premises and to ensure compliance with the statutory requirements.

2.0 PROCESS DESCRIPTION AND POLLUTION CONTROL FACILITIES

M/s. SMS Pharmaceuticals Limited, Unit VII proposed to expand the manufacturing capacity from 179.05 TPM to 740.76 TPM and inclusion of captive power plant of capacity 2 x 2 MW in existing site area of 95.56 acres to meet the increasing market demands. The expansion entails a capital cost of Rs. 600crores towards additional production blocks, utilities and enhancement of treatment facilities, storages and additional equipment to enhance the capacity. The permitted and proposed manufacturing capacity is presented in [Table 2.1](#). List of By-products is presented in [Table 2.2](#).

Table 2.1 Manufacturing Capacity

S.No	Name of Product	Capacity (TPM)	
		Permitted	After Expansion
1	Efavirenz	16	120
2	Lopinavir	3	5
3	Emtricitabine	1.5	20
4	Tenofovir	5	60
5	Atazanavir	0.5	15
6	Valacyclovir	10	30
7	Ritonavir	1	5
8	Zidovudine	7	20
9	Lamivudine	2	75
10	Valsartan	13	13
11	Abacavir	5	10
12	TPN Base	3	3
13	Pantoprazole	2	5
14	Ranitidine	90	90
15	Levetiracetam	10	20
16	Temisartan	0.5	2
17	Olmisartan	0.5	5
18	Candesartan	0.3	2
19	Ibresartan	0.25	2
20	Itraconazole	1.5	3
21	L-Carbocystiene	2	10
22	Sulfamide	3	3
23	Gabapentin	1	40
24	Valganciclovir	1	5
25	Sitagliptin		10
26	Vildagliptin		2
27	Briviracetam		10
28	Amlodipine		5

29	Penciclovir		1
30	Arpiprazole		2
31	Rosiglitazone		0.5
32	Canagliflozin		2
33	Dapagliflozin		2
34	Empagliflozin		20
35	Ranolzine		10
36	Lanoconazole		0.05
37	Paliperidone Palmitate		0.1
38	Mirabegron		0.5
39	Solefinacin		1
40	Lamotrazine		5
41	Sumatriptan		0.5
42	Famotidine		5
43	Almotriptan		0.1
44	Ondansertan		0.5
45	Zolmitriptan		0.5
46	Rizatriptan		0.5
47	Eletriptan		0.25
48	Tadalafil		0.5
49	Sildenafilcitrate		2
50	Lanthanum Carbonate		2
51	Luliconazole		0.01
52	Verdinafil		0.25
53	Raltegravir		5
54	Dolutegravir		25
55	Darunavir		15
56	Linagliptin		0.5
57	Rivaroxaban		3
58	Apixaban		1
59	Sofosbuvir		30
60	Trazadone		15
	Total	179.05	740.76
61	Co-generation Power Plant	---	2 x 2 MW

Table 2.2 List of By - Products after Expansion

S.No	Name of Product	Stage	Name of By-product	Quantity	
				Kg/day	TPM
1	Atazanavir Sulphate	III	Triethylamine HCl	521.2	15.6
2	Dapagliflozin Propanediol	I	N-Methylmorpholine HCl	121.7	3.6
3	Darunavir	II	1-Hydroxy pyrrolidine-2,5-dione	210.2	6.3
4	Dolutegravir Sodium	III	Toluene	175.8	5.3
5	Efavirenz	V	Trichloro methanol	3430.9	102.9
6	Emitricitabine	I	Menthol	438.7	13.2
			Isopropyl Alcohol	168.7	5.1
		II	Triethyl amine HCl	377.2	11.3
7	Leviteracetam	II	Potassium Chloride	876.0	26.3
8	Sofosobuvir	I	Triethyl amine HCl	821.4	24.6
		III	4-Trifluoromethyl phenol	306.2	9.2
9	Tenofovir disoproxil fumarate	I	p-Toulene sulfonic acid	555.1	16.7
			Ethanol	296.9	8.9
10	TPN Base	II	Ammonium chloride	43.7	1.3
11	Valacyclovir hydrochloride	III	Benzoyl formate	377.3	11.3
12	Zidovudine	I	Trityl chloride	695.4	20.86

2.1 Process Description(Terms of Reference No.3(viii))

The manufacturing process for the above-mentioned products involves chemical synthesis utilizing mainly organic chemicals as raw materials in batch process. Active pharma ingredients which have unique physical and pharmacological properties are manufactured in batch process. Typically, a series of chemical reactions are performed in multi-purpose reactors and the products are isolated by extraction, crystallization and filtration. The manufacturing process, reaction schemes, material balance and flow diagrams of each product are presented in **Annexure - I**.

2.2 Utilities

The proposed expansion requires additional steam for both process and effluent treatment system. It is proposed to establish coal fired boilers of 1 x 20 TPH, 1 x 12 TPH, and 2 x 10 TPH capacity and 1 x 10 lac k.cal/hr and 1 x 2 lac. K.cal/hr coal fired thermic fluid heaters for process requirement in addition to the existing 1 x 6 TPH, and 1 x 3 TPH coal fired

boilers. It is proposed to keep proposed 1 x 12 TPH coal fired boiler and the existing 1 x 6 TPH and 1 x 3 TPH coal fired boilers as standby after expansion. The DG sets required for emergency power during load shut down is estimated at 12000 KVA and accordingly 7 x 1500 kVA DG sets are proposed in place of exiting 1 x 125kVA. The list of utilities is presented in **Table 2.3**.

Table 2.3 List of Utilities

S. No	Description	Unit	Capacity		
			Existing	Proposed	Total after expansion
1	Coal Fired Boilers	TPH	1 x 6	1 x 20	1 x 20
			1 x 3	1 x 12	1 x 12*
				2 x 10	2 x 10
					1 x 6*
					1 x 3*
2	Themic Fluid Heater	K.Cal/hr		1 x 2 Lac	1 x 2 Lac
				1 x 10 Lac	1 x 10 Lac
3	DG Set**	KVA	1 x 125	7 x 1500	7 x 1500
					1 x 125

* Standby**DG sets will be used during load shut down by AP TRANSCO.

2.3 Water Requirement (Terms of Reference No3(vii), 9& 33)

Water is required for process, scrubbers, washing, cooling tower makeup, steam generation and domestic purposes. The total water requirement after expansion increased from 324 KLD to 2035 KLD. The required water shall be drawn from ground water supply by APIIC from Thota palli reservoir. The water balance for daily consumption after expansion is presented in **Table 2.4**.

Table 2.4 Total Water Balanceafter Expansion

Purpose	INPUT (KLD)	OUTPUT (KLD)	
	Fresh Water	Loss	Effluent
Process	400.2		430.7*
Washings	60		60
Scrubber	40		40
Boiler Feed	300	255	45
Cooling Tower	1100	890	210
DM Regeneration	80		80
Domestic	35	7	32
Gardening	20	20	
Gross Total	2035	1172	897

* Includes water formed during reaction and water in raw material

2.4 Pollution Control Facilities

Liquid Effluents, air emissions and solid wastes are the major pollutants from process operations of active pharma ingredient manufacturing activity. The pollution control measures proposed to treat/mitigate the emissions and effluents are described as follows.

2.4.1 Water Pollution

The effluents generated in the process, separation techniques and during purification contain organic and inorganic soluble raw materials, adducts, solvents, and products. Hence the effluents contain both organic and inorganic salts and chemicals in various quantities. Effluents from process, washings, scrubbing media, garment washings and utility blow downs will be sent to the effluent treatment system. The treated effluent will be disposed to sea by using marine outfall system. Domestic wastewater is sent to sewage treatment plant and treated wastewater is reused for greenbelt development. The total effluent generated and mode of treatment is presented in [Table 2.5](#). The compiled characteristics of process effluents for each product is presented in [Table 2.6](#).

Table 2.5 Total Effluent Generated and Mode of Treatment

S.No	Description	Quantity (KLD)		Mode of Treatment/Disposal
		Permitted	After Expansion	
I	High TDS Effluents			
1	Process	71.91	430.7	Effluent is stripped in a steam stripper to remove organics and then concentrated in multiple effect evaporators (MEE) followed by drying in agitated thin film dryer (ATFD). Stripper condensate will be sent to cement plants for Co-Incineration. Salt from ATFD is sent to TSDF. Distillate from MEE and ATFD is sent for further treatment in biological treatment plant.
2	Washings	20	60	
3	Scrubber	---	40	
	Total - I	91.91	530.7	
II	Low TDS Effluents			
1	Process	3.6	--	Sent to biological treatment plant and disposed to sea from guard ponds on site, through Marine Outfall system after bioassay, only when it meets the disposal standards.
2	Boiler Blow downs	16	45	
3	Cooling tower blow downs	12.5	210	
4	Domestic wastewater	16	31.5	

5	RO/DM Rejects	53.5	80	
	Total - II	101.6	366.5	
	Grand Total (I+II)	193.51	897.2	

Table 2.6 Process Effluents Quantity and Quality - Product Wise after Expansion

S.No	Name of Product	Quantity (Kg/Day)			Concentration (mg/l)	
		Total Effluent	TDS	COD	TDS	COD
1	Abacavir	3704.8	269.2	22.3	72675	6023
2	Almotriptan	2347	173.4	20	73902	12619
3	Amlodipine	1279.1	8	106.6	6273	83318
4	Apixaban	3604.1	32.2	24.1	8936	6686
5	Arpiprazole	8424	113.9	34.2	13517	4058
6	Atazanavir	26388.6	364.5	165.7	13812	6280
7	Briviracetam	1780.9	146.3	74	82126	41574
8	Canagliflozin	1037.4	20	38.3	19278	36913
9	Candesartan	3333.9	189	97.3	56691	29180
10	Dapagliflozin	2167.7	58	159.1	26756	73410
11	Darunavir	16584.2	420.1	222.7	25328	13430
12	Dolutegravir	9448.6	160.8	350.1	17014	37054
13	Efavirenz	161110.8	4715.8	2650.6	29270	16452
14	Elitriptan	2114.7	41.1	69.8	19435	33001
15	Empagliflozin	9262	673.1	56	72675	6023
16	Emtricitabine	5216.5	202.4	11.5	38796	2205
17	Famotidine	8324.7	137.3	166.9	16495	20045
18	Gabapentin	31531.1	2171.3	75.2	68862	2384
19	Ibresartan	1153.2	53	28.3	45616	24566
20	Itraconazole	13032	287.4	191.2	22050	14674
21	Lamivudine	34545.8	1271.1	301.3	36796	8722
22	Lamotrazine	3177.6	138.5	3.6	43573	1133
23	Lanoconazole	730.3	2.4	8.9	3286	12242
24	Lanthanum Carbonate	1739.8	29.9	2.3	17169	1293
25	L-Carbocy-Stiene	5612.9	412	150.7	73397	26845
26	Levetiracetam	3363.8	116.1	54	34507	16053
27	Linagliptin	383.7	3.7	7.4	9658	19352
28	Lopinavir	1517.3	2.7	14.1	1796	9273
29	Luliconazole	84	1	0.4	11890	4764
30	Mirabegron	1182.9	9.9	29	8377	24514
31	Olmisartan	1207.4	46.2	19.4	38264	16026
32	Ondansertan	1767.1	20.2	68.5	11441	38782
33	Paliperidone Palmitate	355.3	2.6	6.9	7439	19493
34	Pantoprazole	1652.6	104.2	16.6	63071	10020
35	Penciclovir	2400.4	30.7	66.4	12775	27642
36	Raltegravir	865.9	27.9	29.1	32183	33586

37	Ranitidine	1660.9	66.2	111.6	39844	67165
38	Ranolzine	17357.2	1235.9	148.3	71204	8544
39	Ritonavir	1367.7	47.5	36.7	34699	26835
40	Rivaroxaban	2183.1	28.7	109.3	13168	50046
41	Rizatriptan	382.6	20.5	21.1	53672	55156
42	Rosiglitazone	556.4	36.3	11.3	65200	20391
43	Sildenafilcitrate	1035.7	40.6	55	39217	53122
44	Sitagliptin	1559.1	15.4	62.7	9865	40197
45	Sofosbuvir	5213.6	150	95.4	28771	18298
46	Solefinacin	5707.5	435.5	64.1	76307	11226
47	Sulfamide					
48	Sumatriptan	1379.1	35.9	43.3	26032	31378
49	Tadalafil	713.8	12.3	14.9	17268	20923
50	Temisartan	783.1	50.5	16.4	64554	21007
51	Tenofavir	28943.3	632.6	348.4	21857	12037
52	TPN Base	561.4	2.3	27.7	4013	49304
53	Trazadone	4016.2	217.2	32.0	54083	321
54	Valcyclovir	7685.2	407.9	242.7	53082	31582
55	Valganociclovir	15171	37.5	127.4	2469	8400
56	Valsartan	11654	290.6	1046.7	24932	89813
57	Verdinafil	496.8	17.7	7.5	35619	15058
58	Vildagliptin	1313.8	86.4	3.6	65751	2712
59	Zidovudine	9446.4	368.4	42	39001	4446
60	Zolmitriptan	502.8	15.2	10	30318	19985
Total (Worst Case 20 Products)		430659.3	14898.2	6867.1	34594	15946

2.4.1.2 Process Description and Technical Specification of Effluent Treatment System

The effluents are segregated into two streams; high TDS/ COD and Low TDS/COD stream. The segregation is at source and is stream wise. Effluent from process, washings and scrubbers are considered as high TDS and high COD; Effluent from Boiler, cooling tower blow downs, DM/softener rejects and domestic wastewater are considered as Low TDS and low COD; The effluent treatment system shall be developed in modules at the same location for ease of operation.

I. The High TDS/ COD Effluents

The treatment system for treating High TDS/ COD effluents consists of equalization, neutralization, settling tank, stripper, multiple effect evaporator (MEE) followed by agitated thin film dryer (ATFD). The organic distillate from the stripper is sent to cement plants for co-incineration and aqueous bottom from stripper is sent to MEE followed by ATFD for evaporation. The condensate

from the MEE and ATFD are sent to Effluent treatment plant based on biological treatment. Salts from ATFD are disposed to TSDF.

II. The Low TDS/ COD Effluents

These effluents along with the condensate from MEE and ATFD are treated in primary treatment consisting of equalization, neutralization, and primary sedimentation followed by secondary biological treatment consisting of aeration tank and clarifier. The treated effluents after biological treatment will be stored in Guard ponds and sent to marine disposal after meeting the standards in bioassay test. Photographs presented were obtained from project proponent. Schematic diagram of effluent treatment system is presented in [Fig 2.1](#). Details of treatment facilities are presented in [Table 2.7](#).

Table 2.7 Details of Treatment Facilities

S.No	Facility Description	Capacity (KLD)			Operating Volume after Expansion (KLD)
		Existing	Proposed	Total after Expansion	
1	Stripper	120	2 x 200	2 x 200 1 x 120	432.7
2	Multiple Effect Evaporator	100	2 x 200 1 x 100	2 x 200 2 x 100	464.6
3	Agitated Thin Film Dryer (ATFD)	12	2 x 20	2 x 20 1 x 12	42.3
5	Biological Treatment Plant	60	2 x 400	2 x 400 1 x 60	813

Note: Proposed facility will be established in modules

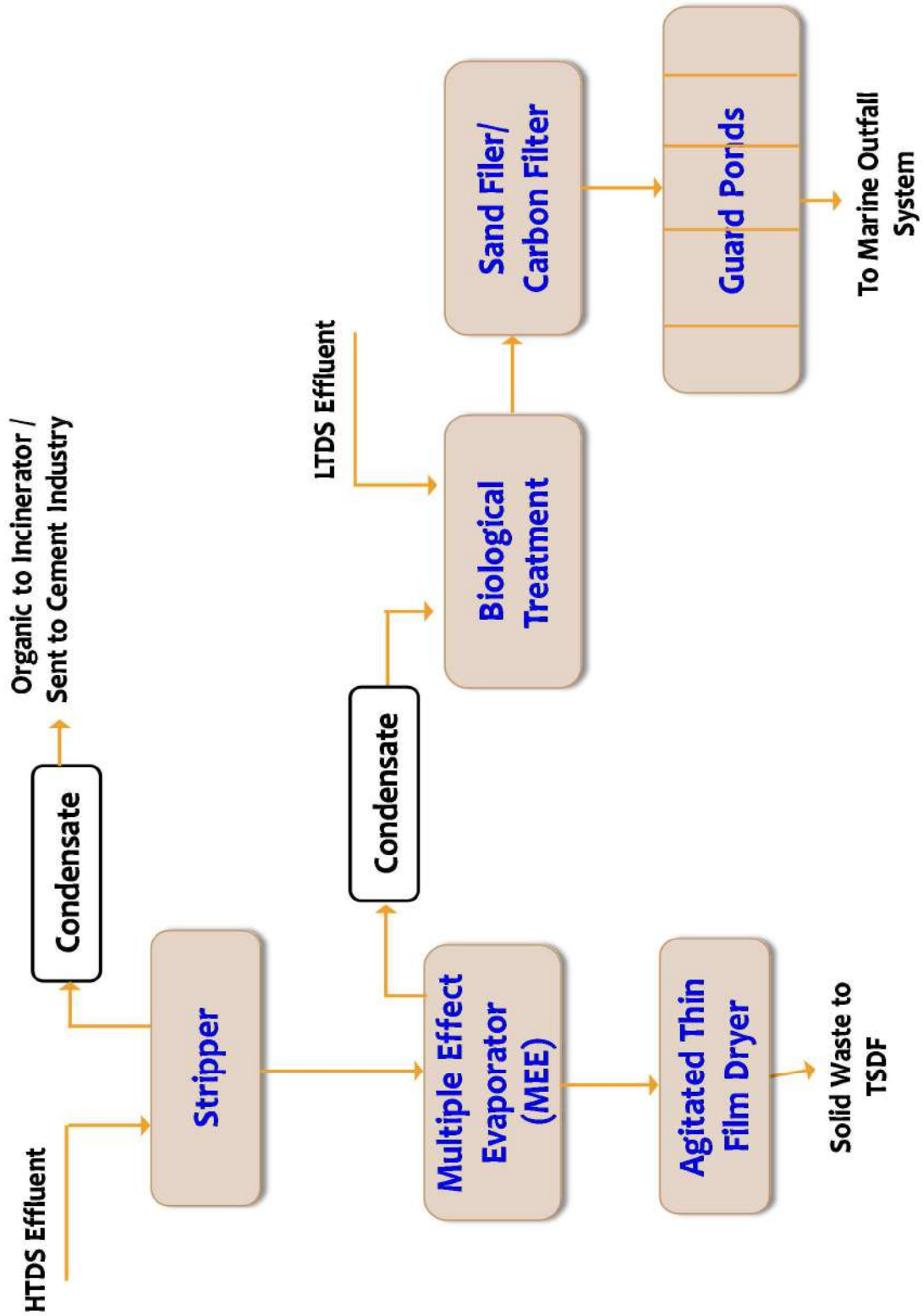


Fig 2.1 Schematic Diagram of Effluent Treatment System



Existing Treatment System - Photographs

2.4.2 Air Pollution

The manufacturing process consists of reaction, separation and purification. The reaction is conducted in closed reactors, while separation activity is conducted in centrifuge, filtration equipment etc. The purification would be conducted in reactors or filtration equipment. The transfer of materials will be through closed pipelines. Various sources of emissions are identified from process operations. The usage of boiler for steam generation and DG sets for emergency power also results in point source emissions.

2.4.2.1 Emissions from Utilities *(Terms of Reference No.9)*

The sources of air pollution are proposed 1 x 20 TPH, 1 x 12 TPH, 2 x 10 TPH coal fired boilers, existing 1 x 6 TPH and 1 x 3 TPH coal fired boilers and proposed coal fired 1 x 10 Lac. K.cal/hr and 1 x 2 lac K.Cal/hr thermic fluid heaters. Proposed 1 x 12 TPH coal fired boiler and existing 1 x 6 TPH and 1 x 3 TPH coal fired boilers will be kept as standby after expansion. Proposed 7 x 1500 kVA and existing backup DG set of 1 x 125 kVA capacity are also sources of air pollution when used during load shutdown by TRANSCO. Bag filters are proposed as air pollution control equipment for 1 x 20 TPH, 1 x 12 TPH (standby) and 2 x 10 TPH coal fired boilers. DG sets shall be provided with required stack height based on CPCB formula. Photographs presented were obtained from project proponent. The emission rates of SO₂, NO_x and PM from each stack are presented in [Table 2.8](#). Technical specifications of bag filters are presented in [Tables 2.9](#)

Table 2.8 Emission Details of Pollutants from Stack

S. No	Stack Connected to	Stack Ht (m)	Dia of stack at top(m)	Temp. of exhaust gases (°C)	Exit Velocity (m/sec)	Pollutant Emission Rate (g/sec)		
						PM	SO ₂	NO _x
Existing								
1	1 x 6 TPH Coal fired Boiler *	30	1.3	140	6.2	0.5	0.42	0.15
2	1 x 3 TPH Coal Fired Boiler *	30	0.83	128	8.5	0.15	0.4	0.21
3*	1 x 125 kVA DG set	2.2	0.15	320	5	0.001	0.01	0.02
Proposed								
1	1 x 20 TPH Coal Fired Boiler	40	1.8	180	15	1.8	3.2	4.6

2	1 x 12 TPH Coal fired Boiler *	40	1.3	140	6.2	0.8	1.5	2.4
3	2 x 10 TPH Coal Fired Boilers	30	1.5	180	10	0.5	1.2	1.9
4	1 x 10 Lakh Kcal Thermic Fluid Heaters	30	1.2	170	7.5	0.08	0.12	0.19
5	1 x 2 Lakh Kcal Thermic Fluid Heaters	15.2	0.4	180	6	0.04	0.08	0.12
6**	7 x 1500 kVA DG sets	12	0.2	180	10	0.02	0.03	0.5

* standby

**DG sets will be used during load shut down by AP TRANSCO.



Photographs of Existing Boilers Stack connected to Bag Filters

Table 2.9 Technical Specifications of Bag Filters

S.No	Application	Unit	Value		
1	Boiler Capacity	TPH	20	12	10
	Fuel		Coal	Coal	Coal
2	Gas Volume	m ³ /hr@170 degC	28500	22824	20000
	Gas Temperature	Deg C	180	180	180
	Outlet emission	mg/Nm ³	<50	<50	<50
	Flange to flange pr. drop	mmWC	160	140	140
	Moisture Content	%	8.5	8.5	8.5
	No. of Bags		340	280	268
	Filter area per bag	m ²	1.82	1.79	1.72
	Total filter area	m ²	664	500	460

	Air to cloth ratio	m ³ /min/m ²	1.14	1.14	1.15
3	Bags				
	Diameter	ID, mm	160	150	160
	Length	mm	3860	3650	3650
	Material		Nomex	Nomex	Nomex
	Max. operating temp.	degC	190	190	190
4	Bag Cleaning				
	Compressed air required	Nm ³ /Hr	6-8 kg/cm ²	5-7 kg/cm ²	5-7 kg/cm ²
	No. pulse cum solenoid valve		13	10	10
	Size of pulse valve	NB	40	40	40
5	Material of Construction				
	Casing		MS	MS	MS
	Tube Sheet		MS	MS	MS
	Cage		MS	MS	MS
	Hopper		MS	MS	MS
6	Terminal Points				
	Dirty air	Inlet of Poppet Valve, Flanged end			
	Clean air	Outlet of Bag Filter, Flanged end			
	Dust discharge	RALV			
	Compressed air	Inlet of Air Header			
	Electricals	Power Supply for Timer 230 V Ac			

2.4.2.2 Emissions from Process

The manufacturing process consists of reaction, separation and purification. The reaction is conducted in closed reactors, while the separation is conducted in centrifuge, filtration equipment etc. The purification would be conducted in reactors or filtration equipment. The transfer of materials is through closed pipelines. The following sources of emissions are identified.

Process Emissions: The process emissions contain ammonia, carbon dioxide, carbon monoxide, hydrogen, nitrogen, nitrous oxide, oxygen, isobutylene, hydrogen chloride, hydrogen bromide and sulfur dioxide. Ammonia, hydrogen chloride, hydrogen bromide and sulphur dioxide are sent to scrubber in series. The resultant solutions after scrubbing i.e., Sodium chloride solution from Hydrogen chloride gas scrubbing, ammonium bicarbonate solution from carbon monoxide, sodium bromide solution from hydrogen bromide scrubbing, ammonium bicarbonate solution from carbon monoxide scrubbing, ammonium chloride solution from ammonia scrubbing, sodium bisulphite solution from

sulfur dioxide scrubbing are sent to ETP. Carbon dioxide, Nitrogen, nitrous oxide and oxygen are let out into atmosphere following a standard operating procedure, isobutylene gas let out into atmosphere safely through a flare stack, while Hydrogen gas is let out into atmosphere through a water column. The quantity of process emissions is presented in **Table 2.10**. Photographs presented were obtained from project proponent. is presented in **Fig 2.2**. Technical Specifications of two stage scrubber is presented in **Table 2.11**.

Table 2.10 Quantity and Mode of Treatment of Process Emissions after expansion

S.No	Product Name	Stage	Name of Gas	Quantity (Kg/day)	Mode of Treatment
1	Apixaban	I	Hydrogen	0.2	Let into atmosphere through water column
		V	Carbonmonoxide	2	To Scrubber
2	Aripiprazole	I	Carbon dioxide	8	Let into atmosphere safely
		III	Carbon dioxide	3.4	
		IV	Carbon dioxide	6.5	
3	Atazanavir Sulphate	III	Isobutylene	88.1	Let into atmosphere safely through a flare stack
			Carbon dioxide	69.2	Let into atmosphere safely
4	Canagliflozin	I	Hydrogen bromide	12.1	To Scrubber
5	Dolutegravir Sodium	II	Carbon dioxide	49.8	Let into atmosphere safely
7	Eletriptan	I	Hydrogen chloride	3.1	To Scrubber
			Carbon dioxide	3.2	Let into atmosphere safely
			Carbonmonoxide	2.1	To Scrubber
		II	Hydrogen chloride	2	To Scrubber
		III	Carbon dioxide	1.9	Let into atmosphere safely
		IV	Hydrogen bromide	2.7	To Scrubber
8	Emitricitabine	I	Hydrogen	11.3	Let into atmosphere through water column
9	Irbesartan	I	Carbon dioxide	0.4	Let into atmosphere safely
			Hydrogen	0.03	Let into atmosphere through water column
			Nitrogen	0.1	Let into atmosphere safely
		IV	Hydrogen bromide	13.5	To Scrubber
			Nitrous Oxide	0.5	To Scrubber
10	Itraconazole	III	Sulfur dioxide	9.1	To Scrubber
11	Lamivudine	III	Sulfur dioxide	419.8	To Scrubber
			Hydrogen chloride	124.1	Let into atmosphere safely
			Sulfur dioxide	103.7	To Scrubber
12	Leviteracetam	I	Sulfur dioxide	308.1	To Scrubber
			Hydrogen chloride	270.1	To Scrubber

13	Linagliptan	II	Nitrogen	1.1	Let into atmosphere safely
		III	Carbon dioxide	1.6	Let into atmosphere safely
14	Lopinavir	I	Carbon dioxide	1	Let into atmosphere safely
15	Olmesartan	I	Carbon dioxide	7	Let into atmosphere safely
16	Ranolazine pure	I	Hydrogen chloride	54.7	To Scrubber
		II	Hydrogen chloride	45.5	To Scrubber
17	Ritonavir	I	Carbon dioxide	10.7	Let into atmosphere safely
18	Rivaroxaban	IV	Sulfur dioxide	14.7	To Scrubber
			Hydrogen chloride	8.4	To Scrubber
19	Rizatriptan Benzoate	I	Carbon dioxide	1.3	Let into atmosphere safely
		V	Carbon dioxide	4	Let into atmosphere safely
20	Rosiglitazone maleate	III	Hydrogen	0.02	Let into atmosphere through water column
21	Sildenafil Citrate	I	Oxygen	4.1	Let into atmosphere safely
			Hydrogen	0.04	Let into atmosphere through water column
		II	Sulfur dioxide	9	To Scrubber
			Hydrogen chloride	10.3	To Scrubber
		III	Sulfur dioxide	8.5	To Scrubber
			Hydrogen chloride	9.7	To Scrubber
22	Sofosobuvir	I	Hydrogen chloride	217.7	To Scrubber
23	Sumatriptan	I	Sulfur dioxide	5.2	To Scrubber
		II	Hydrogen	0.3	Let into atmosphere through water column
24	Tadalafil	I	Sulfur dioxide	3.9	To Scrubber
			Hydrogen chloride	4.4	To Scrubber
25	Tenofovir disoproxil fumarate	I	Carbon dioxide	142	Let into atmosphere safely
26	TPN Base	II	Carbon dioxide	18	Let into atmosphere safely
			Hydrogen chloride	14.9	To Scrubber
27	Valganciclovir HCl	I	Oxygen	59.2	Let into atmosphere safely
		III	Carbon dioxide	18.8	Let into atmosphere safely
28	Valsartan	I	Sulfur dioxide	90.8	Let into atmosphere safely
			Hydrogen chloride	51.8	Let into atmosphere safely
		II	Hydrogen bromide	109	Let into atmosphere through water column
29	Vardenafil HCl Trihydrate	II	Carbon dioxide	1.1	Let into atmosphere safely
		IV	Hydrogen chloride	0.9	Let into atmosphere through water column
30	Viladagliptin	II	Carbon dioxide	4.8	Let into atmosphere safely
31	Zidovudine	I	Ammonia	42.4	Let into atmosphere safely
32	Zolmitriptan	I	Oxygen	2.4	Let into atmosphere safely



Fig 2.2 Existing Two Stage Scrubbing System

Table 2.11 Technical Specifications of Two Stage Scrubber

Type	Packed Tower Scrubber Two Stage
MOC	PP/FRP
Dimensions	Dia-700mmx 6mtr long
Packing Material	PP dia-25 mm pal rings
Inlet Temp.	35°C
Inlet Gas Pressure	Atmospheric
Scrubbing medium for I st Stage	Caustic Solution 10% Solution
Scrubbing medium for II nd Stage	Caustic Solution 10% Solution
Blower	
MOC	PPFRP
Capacity	7.5HP
RPM	1440
Circulation System	
Flow Rate	6 M ³ /hr
Head	30 Meters
Motor Make	Kirloskar NFLP
MOC	PP PUMP
Storage/ Recirculation Tank	
Capacity	3 KL
Size	1200 Dia X 2600mm Ht.
MOC	PP/FRP

2.4.2.3 Diffuse Emissions

Emissions are also released from various operations of manufacturing like drying, distillation, extraction etc. These emissions mainly contain volatile contents of the material sent for processing. The emissions are normally passed through vent scrubber before releasing into atmosphere to mitigate odor. The emissions from distillation are passed through condensers, which mitigate odor. Vent condensers in series to reactors, distillation columns, driers and centrifuge etc. are provided to mitigate VOC emissions release. Other vents are connected to common headers and scrubbers. The transfer pumps shall be provided with double mechanical seals. The transfer of solvents will be mainly by closed pipeline systems, while drum transfer is by using air operated diaphragm pumps in closed hoods. The charging of solid raw materials shall be by powder transfer system to avoid dust emissions, safety and hazard of static electricity. Safety relief valves, rupture disc, and breather valve are provided to reactors. Thermal insulation and condensers will be provided for storage tanks of low boiling point solvents. The reactor or solvent storage tank vents when not use shall be kept closed.

2.4.2.4 Fugitive Emissions*(Terms of Reference No.9)*

Fugitive emissions are anticipated from equipment leakage and transfer spills. The periodic maintenance program shall ensure integrity of equipment mitigating the equipment leakage. The spills however shall be managed by adopting spill management scheme as mentioned in the respective MSDS. The fugitive emissions shall be reduced by closed transfer and handling of all hazardous solvents and chemicals. The ventilation system provided will reduce the health impact on employees by way of dilution of work room air and also dispersion of contaminated air.



Existing Engineering Controls to Mitigate Diffuse and Fugitive Losses

2.4.3 Solvent Use and Recycle *(Terms of Reference No. Sp. TOR 1)*

Solvents are used for extraction of products and as reaction medium. Solvents constitute major consumable material of synthetic organic chemical manufacturing, mainly used as reaction medium. The used solvents constitute major waste stream of synthetic organic chemical manufacturing. Hence it is proposed to recycle the solvents by distillation for reuse in process, thereby reducing total solvent consumption in the plant and reducing the waste quantity to be disposed. The distillation columns are mainly provided to remove moisture and impurities from spent single solvents, and mixed solvents. The recycled single solvents are reused in the process, while mixed solvents are sold to end users. Distillation process

generates residues which are mainly organic in nature containing significant calorific value and can be sent to cement plants for co-incineration as fuel. The total solvent balance product wise and stage wise is presented in [Table 2.12](#) & [2.13](#) respectively. Photographs of existing solvent recovery system is presented in [Fig 2.3](#).

Table 2.12 Total Solvent Balance - Product Wise After Expansion

S.No	Name of the product	Quantity (Kg/Day)				
		Solvent Input	Recovered	Fugitive loss	To wastewater	Residue
1	Abacavir sulfate	1975	1922.8	28.4	14.9	8.9
2	Almotriptan	2845	2711.1	14	20.1	99.8
3	Amlodipine Maleate	3857.7	3623.1	26.2	10	198.4
4	Apixaban	5809	5470	37.6	18.4	287.4
5	Aripiprazole	6116.7	6005.3	21.4	17.6	72.5
6	Atazanavir Sulphate	25900	24914.3	166.7	110.5	708.5
7	Briviracetam	7000	6563.5	12.5	20	404
8	Canagliflozin	2775	2575.2	8.6	25.5	165.7
9	Candesartan Cilexetil	2200	2103.2	33	18.5	45.3
10	Dapagliflozin Propanediol	2554.2	2418.5	18.6	5.2	112
11	Darunavir	16000	15610	150.3	84	155.7
12	Dolutegravir Sodium	24994	24504.1	215.9	9.4	264.6
13	Efavirenz	166000	162471.5	574.3	576.5	2377.8
14	Eletriptan	3600	3395.5	28.8	25.3	150.5
15	Empagliflozin	2400	2280	2.4	9.6	120
16	Emitricitabine	8661	8483	92.3	3.5	82
17	Famotidine	3230	2933.6	25.8	161.5	109.1
18	Gabapentin	9420	9008.4	43.7	50.1	317.7
19	Irbesartan	4164.4	4075.4	13.4	13.9	61.7
20	Itraconazole	14010	13449.6	112.1	117.9	330.4
21	Lamivudine	21587	20674.9	132.2	137.9	642
22	Lamotrigine	2200	2142	29.9	2.4	25.7
23	Lanoconazole	575.1	545.7	6.5		22.9
25	L Carbocisteine	2460.5	2337.5	12.3	29.5	81.2
26	Leviteracetam	9413.2	9168.1	56.9	36	152.1
27	Linagliptan	119.5	116.8	0.6	0.1	2
28	Lopinavir	2660	2596.2	21.6	9.4	32.8
29	Luliconazole	55	53.2	1.6		0.2
30	Mirabegron	1927.6	1831.2	10.1	2.2	84.1
31	Olmесartan	8205	8013.8	70.6	12.9	107.6
32	Ondansetron Hydrochloride Dihydrate	1235	1169.3	5.9	8.1	51.8
33	Paliperidone Palmitate	355	340.2	2.28	1.82	10.7

34	Pantoprazole sodium	2220	2173.2	10.9	8	28
35	Penciclovir	3083.8	2929.6	20.3	3.4	130.5
36	Raltegravir Potassium	1495	1443.6	9.3	19.4	47
37	Ranitidine hydrochloride	8046.3	7644	40.2	74.4	287.7
38	Ranolazine pure	21361.8	20657.9	109.8	64	530
39	Ritonavir	3805	3705.9	34.9	19.9	44.4
40	Rivaroxaban	4030	3891.4	30.2	18.2	90.2
41	Rizatriptan Benzoate	877	844.4	5	5.7	21.9
42	Rosiglitazone maleate	340	323	2.5		14.5
43	Sildenafil Citrate	1810	1725.5	12.8	31.3	40.4
44	Sitagliptin Phosphate	4290	4098.6	23.4	21.8	146.2
45	Sofosbuvir	8800	8637	48	63.6	51.4
46	Solifenacin	1850	1750	15.7	6.3	78
47	Sulfamide	300	265	15.7	4.3	15
48	Sumatriptan	1557	1452.4	9.6	16.6	78.5
49	Tadalafil	136.2	130.8	1.1	1.4	3.2
50	Telmisartan	936	898.6	5.9	6.8	24.6
51	Tenofovir disoproxil fumarate	22700	22192.5	144.1	161.3	202.1
52	TPN Base	1420	1346.8	19.9	15	38.4
53	Trazadone	18000	17200	72	57.9	670.1
54	Valacyclovir hydrochloride	6410	6220.7	35.4	6.3	147.6
55	Valganciclovir HCl	4741.3	4504.6	40.9	5	190.8
56	Valsartan	13924.5	13426.4	66	38.9	393.1
57	Vardenafil HCl Trihydrate	688.5	668	3.6	0.2	16.7
58	Viladagliptin	2245	2095.1	12.4	2.4	135.1
59	Zidovudine	7180	7030.3	52.3	28	69.4
60	Zolmitriptan	315	300.4	1.5	1.2	11.9
Total - Worst Case 20 Products on Campaign Basis		405549.8	393274.3	2074.2	1629.3	8576.2

Table 2.13 Total Solvent Balance - Stage Wise After Expansion

Name of the product	Stage	Name of Solvent	Quantity (Kg/Day)				
			Solvent Input	Recovered	Fugitive loss	To waste water	Residue
Abacavir sulfate	I	Triethylorthoformate	415	404.6	5.8	2.1	2.5
		Dimethyl sulfoxide	160	155.2	1.6	1.6	1.6
		Isopropanol	400	388	6	3.2	2.8
	II	Isopropyl alcohol	1000	975	15	8	2
Almotriptan maleate	I	Chloroform	500	480.0	2.5		17.5
	II	Methanol	100	95.0	0.3	1.2	3.5
		Dimethyl formamide	400	380.0	2.0		18.0
	III	Isopropyl alcohol	165	160.1	0.8	2.0	2.1
	IV	Ethyl acetate	830	788.5	4.2	4.2	33.2
	V	Ethyl acetate	350	332.5	1.8	5.3	10.5
	VI	Acetone	500	475.0	2.5	7.5	15
Amlodipine Maleate	I	Acetic acid	167	160.3	0.8		5.8
		Isopropanol	334	320.6	1.7		11.7
	II	Acetic acid	417.5	400.8	2.1		14.6
		Isopropyl Alcohol	167	158.7	1.5		6.8
		Methanol	183.7	174.5	1.5		7.7
		Ethyl acetate	835	768.2	6.7		60.1
	III	Toulene	1085.5	998.7	5.4	0.0	81.4
		Ethanol	668	641.3	6.5	10	10.2
Apixaban	I	Methylene chloride	924	887	4.6		32.3
		Methanol	176	167.2	0.9	2.1	5.8
	II	Ethylacetate	1001	920.9	8	12	60.1
		Hexane	880	809.6	4.4		66
	III	Ethyl acetate	100	95	0.5	0.8	3.7
		Triethylamine	44	40.5	0.4	0.5	2.6
	IV	O-Xylene	352	334.4	4.2		13.4
		Ethyl acetate	712.8	677.2	3.6		32.1

	V	Methylene chloride	831.6	790	4.2		37.4
		Acetonitrile	286	271.7	2.6		11.7
		Ethyl acetate	253	240.4	1.3		11.4
		Methanol	248.6	236.2	3	3	10.9
Aripiprazole	I	Methylene Dichloride	660	650.1	1.7	2.3	5.9
		n-Hexane	260	253.5	1.3		5.2
	III	Acetonitrile	2000	1960	8	5	27
		Cyclohexane	146.7	143.5	0.6		2.6
		Toluene	930	913.3	2.3		14.4
		Methanol	130	128.1	0.3	0.3	1.4
	IV	Acetonitrile	660	646.8	2.6	3.3	7.3
		Isopropyl alcohol	1330	1310.1	4.7	6.7	8.6
Atazanavir Sulphate	I	Ethyl acetate	5845	5640.4	29.2	58.5	116.9
		n-Heptane	2505	2367.2	12.5		125.3
	II	Isopropyl alcohol	2004	1913.8	20	12	58.1
	III	Dichloromethane	5000	4860	25	10	105
		Ethyl acetate	3000	2895	15	30	60
		n-Heptane	1200	1134	6		60
	IV	Ethanol	3340	3173	33.4		133.6
		n-Heptane	3006	2930.9	25.6		49.6
Canagliflozin	I	Methanol	1110	1026.8	2.8	5.6	74.9
		Acetone	1665	1548.5	5.8	20	90.7
Candesartan Cilexetil	I	Methanol	880	844.8	13.2	8.8	13.2
		Isopropyl alcohol	880	836	17.6	4.4	22
	II	Acetone	440	422.4	2.2	5.3	10.1
Dapagliflozin Propanediol	I	Methylene dichloride	300	285	1.8		13.2
		Toluene	240	228	1.9		10.1
	II	Methanol	194.2	185.3	1.5	1.9	5.4
		Toulene	270	251.1	1.6		17.3
		Tetrahydrofuran	180	171	0.9		8.1

		n-Hexane	140	130.2	0.8		9.0
	III	Acetonitrile	300	282	1.8		16.2
		Methylene dichloride	210	195.3	1.9		12.8
	IV	Isopropyl Alcohol	270	256.5	2.2	1.4	10
		Cyclohexane	210	203.7	2.2		4.1
		Methanol	240	230.4	1.9	1.9	5.8
Darunavir	I	Ethyl acetate	7000	6825	66.5	84	24.5
		Tetrahydrofuran	2000	1930	17.2		52.8
	II	Methylene chloride	4000	3900	38.4		61.6
		Cyclohexane	3000	2955	28.2		16.8
Dolutegravir Sodium	I	Acetic acid	300	288	1.2		10.8
		Toluene	4500	4432.5	37.8		29.7
		Ethyl acetate	4000	3940	37.6		22.4
		n-hexane	6664	6564.0	62		38.0
	II	Toluene	300	292.8	2.5		4.7
		Ethyl acetate	500	475	4	4	17
		Methanol	200	188	1.7	2.4	7.9
		Acetic acid	200	192	0.6	3	4.4
	III	Tetra hydrofuron	1249.5	1205.8	10.5		33.2
		Methanol	1666	1609.4	14		42.6
		Chloroform	833	812.2	6.9		13.9
		Ethanol	416.5	401.9	3.9		10.7
	IV	Ethanol	4165	4102.5	33.3		29.2
Efavirenz	I	Acetonitrile	40000	39200	160	200	440
		Ethyl acetate	15000	14625	45	75	255
	II	Toluene	15000	14730	37.5		232.5
		n-Hexane	8000	7800	40		160
		Tetrahydrofuran	12000	11784	42	60	114
	III	Methanol	15000	14775	30	45	150
		Toluene	8000	7856	20		124

		Acetic acid	2000	1940	4	7	49
		Methyl tert-butyl ether	4500	4275	36		189
	IV	Methanol	4000	3880	8	12	100
		Ethyl acetate	15000	14625	45	75	255
		n-Hexane	7000	6825	35		140
		Tetrahydrofuran	12000	11784	42	60	114
	V	Isopropyl alcohol	8500	8372.5	29.8	42.5	55.3
Eletriptan	I	Dichloro Methane	400	380	2	0.8	17.2
	II	THF	300	285	1.5	2.4	11.1
		Ethyl acetate	200	190	1	1.6	7.4
		Hexane	300	282	2.4		15.6
	III	Tetrahydrofuran	350	325.5	1.8	2.8	20
		Ethylacetate	350	322	2.1	5.3	20.7
	IV	Acetonitrile	200	188	1.6	1	9.4
		Ethyl Acetate	400	380	3.2	4.8	12
		Hexane	250	237.5	3		9.5
	V	Methanol	250	237.5	3	2	7.5
		Ethyl acetate	200	188	2.4	1.4	8.2
		Methyl tert-butyl ether	400	380	4.8	3.2	12
Emitricitabine	I	IsoPropyl alcohol	1000	980	11.5	1.3	7.2
		Toluene	1200	1182	15.6	0.2	2.2
		Ethanol	800	784	9.6	2	4.4
	II	Dichloromethane	2664	2624	22.6		17.3
		Methanol	1998	1954	30		14
	III	Isopropyl alcohol	999	959	3		37
Famotidine	I	Acetone	1330	1223.6	10.6	66.5	29.3
	II	Methanol	1900	1710	15.2	95	79.8
Gabapentin	I	Methylene dichloride	3950	3752.5	19.8	15.8	162
	II	Acetone	750	712.5	3.4	2.3	31.9
	III	Methylene Dichloride	135	129.6	0.5		4.9

		Acetone	1035	988.4	4.1	10.4	32.1
	IV	Methanol	1810	1737.6	7.2	21.7	43.4
		Methylene Dichloride	1740	1687.8	8.7		43.5
Irbesartan	I	Methanol	7	6.9	0.0	0.0	0.1
		Chloroform	75	73.3	0.3	0.3	1.1
	II	Isopropyl alcohol	10	9.8	0.0	0.0	0.1
		Chloroform	25	24.4	0.1	0.1	0.4
		Toluene	39	38.1	0.2		0.7
	III	Methanol	25	24.6	0.1	0.1	0.3
		Chloroform	75	73.3	0.3	0.3	1.1
	IV	Acetone	375	366.8	1.3	2.1	4.9
		Chloroform	775	757.2	2.6	3.3	11.9
		n-Hexane	200	195	1		4
		Ethyl acetate	208	202.8	0.6	1	3.5
	V	O-xylene	540.8	531.1	1.2		8.5
		Methanol	540.8	532.7	1.1	1.6	5.4
		n-Hexane	208	202.8	1		4.2
		Chloroform	748.8	731.6	2.5	3.2	11.5
Itraconazole	I	Acetone	312	305.1	1.1	1.7	4.1
		Dimethyl sulfoxide	1320	1267.2	10.6	13.2	29
		Acetic Acid	1050	1008	8.4	10.5	23.1
	II	Chloroform	2820	2707.2	22.6	28.2	62
		Dimethylformamide	900	864	7.2	9	19.8
		Methylene Dichloride	2220	2131.2	17.8		71
		Methanol	5700	5472	45.6	57	125.4
Lamivudine	I	Cyclohexane	3000	2850	15.0		135
		Acetic acid	200	190	1.6	2.4	6
	II	Triethylamine	12	10.9	0.1	0.2	0.8
		Toluene	2000	1880	24		96

		n-Hexane	2300	2116	9.2		174.8
	III	Dimethylformamide	800	764	3.2		32.8
		Triethylamine	1275	1224	6.4	15.3	29.3
		Methylene dichloride	6000	5820	36.0	90	54
		Toluene	2500	2450	17.5		32.5
		n-Hexane	1500	1470	9.3		20.7
		Ethyl acetate	2000	1900	10	30	60
Lamotrigine	I	n-Propyl Alcohol	200	192	0.9	2.4	4.7
	II	n-Propyl Alcohol	2000	1950	29		21
Lanoconazole	I	Dimethylsulfoxide	50	47.5	0.3		2.3
		Ethylacetate	480	456	5.8		18.2
		Diethylether	20	18.4	0.2		1.4
	II	Ethanol	25.1	23.8	0.2		1.1
L Carbocisteine	I	Ethanol	2460.5	2337.5	12.3	29.5	81.2
Leviteracetam	I	Methanol	313.2	303.9	0.8		8.5
		Acetone	100	98.2	0.5		1.3
	II	Chloroform	6000	5820	42		138
		Acetone	3000	2946	13.7	36	4.3
Linagliptan	I	Methanol	19.5	18.8	0.1	0.1	0.5
	II	Iso Propyl Alcohol	100	98	0.5		1.5
Lopinavir	I	Tetrahydrofuran	650	633.8	5.5	6.5	4.2
		Dimethylformamide	160	154.4	1.4	1.3	3
		Ethylacetate	1500	1477.5	12.8		9.8
		n-Heptane	150	142.5	1.2		6.3
		Ethanol	200	188	0.8	1.6	9.6
Mirabegron	I	Triethylamine	15.4	14.6	0.1	0.1	0.6
		Toluene	42.2	40.1	0.2		1.9
	IIa	Dimethyl formamide	130	123.5	0.7		5.9
	IIb	Methanol	600	570.0	3.0		27.0
		Diisopropyl Ether	1000	950.0	5.0		45.0

	IV	Ethanol	140	133	1.1	2.1	3.8
Olmesartan	I	Dioxane	2600	2563.6	25.6		10.8
		Ethyl acetate	300	292.5	1.5	3	3
		Dimethyl acetamide	830	811.7	11.6		6.6
		Diisopropyl ether	830	809.3	8.1		12.7
	II	Acetic acid	1330	1298.1	13.1	6.7	12.2
		Ethyl acetate	650	640.3	2.1	3.3	4.4
III	Methanol	1665	1598.4	8.7		57.9	
Ondansetron Hydrochloride Dihydrate	I	Acetone	120	114	0.6		5.4
		Acetic acid	170	161.5	0.9	2.6	5.1
		Isopropyl alcohol	345	327.8	1.7	5.2	10.4
		Toulene	520	494	2.6		23.4
	II	Methanol	80	72	0.1	0.4	7.5
Pantoprazole sodium	I	Methylene chloride	665	655	2.2	1.4	6.4
		Isopropyl ether	600	585	2.6	3	9.4
	II	Ethyl acetate	665	655	4.2	3.4	2.4
		Tetra hydrofuran	40	38.1	0.2	0.2	1.5
	III	Methylene chloride	250	240	1.8		8.3
Penciclovir	I	N,N-Dimethylformamide	610.0	579.5	7.3		23.2
		Methanol	625.1	593.8	3.1		28.1
	II	Methylene chloride	1443.1	1370.9	7.2		64.9
		Methanol	206.2	195.8	1	1	8.2
		Triethylamine	199.5	189.5	1.6	2.4	6
Raltegravir Potassium	I	Isopropyl alcohol	835	810	4.2	12.5	8.4
		Methanol	500	480	4	6	34
		Tetrahydrofuran	160	153.6	1.1	0.9	4.4
Ranitidine hydrochloride	I	Isorpropyl alcohol	5546.3	5269	27.7	44.4	205.2
		Methanol	2500	2375	12.5	30	82.5
Ranolazine pure	I	Acetone	381.8	362.7	1.6	0.8	16.8
	II	Acetic acid	500	470	2	4	24.1

		Isopropyl alcohol	2490	2378	24.9	14.9	72.2
		Methylene dichloride	4980	4855.5	22.2	10	92.4
		Cyclohexane	1300	1222	5.2	10.3	62.5
	III	Toluene	830	803.9	3.7	3.4	19.1
	IV	Toluene	1160	1123.5	5.1	4.8	26.7
		Methanol	200	195	1	1.2	2.8
		Acetone	1200	1152	8.4	4.8	34.8
		Dichloro methane	5000	4875	22.3	10	92.8
	V	Acetone	3320	3220.4	13.6		86
Ritonavir	I	Ethyl acetate	1980	1930.5	25.7	2	21.8
	II	Ethyl acetate	1665	1623.4	8.3	16.7	16.7
		n-Heptane	160	152	0.8	1.3	5.9
Rivaroxaban	I	Isopropyl Alcohol	1000	956	7	13.5	23.5
	II	Tetrahydrofuran	1370	1335.8	12.3		21.9
	III	Iso Propyl Alcohol	100	97	0.7		2.3
	IV	Acetone	550	530.8	4.4	2.5	12.4
		Toluene	460	443.9	2.1		14
		N-Methyl-2-Pyrrolidone	550	528	3.7	2.2	16.1
Rizatriptan Benzoate	I	Dimethyl formamide	35	33.8	0.2	0.2	0.8
		Ethyl acetate	80	77.1	0.4	0.6	1.9
		Isopropanol	50	48.3	0.4	0.3	1.1
	II	Methanol	120	114.6	0.6	1.2	3.6
		Toluene	50	47.5	0.5	0.3	1.8
	III	Methanol	110	104.5	0.9	1.1	3.5
		Toluene	50	48.8	0.3	0.5	0.5
		Cyclohexane	50	48.7	0.3		1.1
	IV	Ethanol	70	67.6	0.4	0.7	1.3
		Methyl t-butyl ether	35	33.4	0.1		1.5
		Dichloromethane	70	69	0.2		0.9
		V	Ethyl acetate	60	57.3	0.3	0.6

		Methanol	25	23.9	0.3	0.3	0.6
	VI	Acetone	72	70.2	0.3		1.5
Rosiglitazone maleate	I	Dimethyl formamide	120	114	1.1		4.9
	II	Toluene	120	114	0.6		5.4
	III	n-Hexane	100	95	0.8		4.2
Sildenafil Citrate	I	Ethyl acetate	330	303.6	1.7	16.5	8.2
	II	Toluene	125	120	0.6	1.3	3.1
		Dimethyl Formamide	70	67.2	0.4	0.7	1.8
	III	Methylene Dichloride	50	48	0.3	0.5	1.3
		Acetone	55	53.9	0.4	0.6	0.1
	IV	Methylene Dichloride	50	48	0.4	0.5	1.1
	V	Acetone	1130	1084.8	9	11.3	24.9
	Sitagliptin Phosphate	I	Dichloroethane	1320	1267.2	6.6	
Isopropyl alcohol			990	940.5	5	11.9	32.7
II		Methanol	1980	1890.9	11.9	9.9	67.3
Sofosobuvir	I	Methylenedichloride	200	191	0.6		8.4
		Methyl tert-butyl ether	400	394	1.6		4.4
	II	Pet. Ether	1000	987	8.3		4.7
		Tetra hydrofuron	3000	2928	24.9	30	17.1
		Ethyl acetate	4200	4137	12.6	33.6	16.8
Sumatriptan	I	Methanol	160	140.8	0.3	0.8	18.1
		Acetone	240	216	0.5	0.5	23.0
	II	Methanol	997	937.2	8	15	36.9
		III	Methanol	160	158.4	0.8	0.3
Tadalafil	I	Methanol	25.0	24	0.2	0.3	0.8
	III	Isopropyl alcohol	31.2	30	0.2	0.3	0.7
	IV	Methylene Dichloride	80	76.8	0.6	0.8	1.8
Telmisartan	I	Acetone	600	570	3	4.8	22.2
		II	Methanol	80	77.9	0.5	1.2
			Methylne chloride	160	157.6	1.5	

		Acetic acid	48	46.8	0.5	0.3	0.4
		Dimethyl formamide	48	46.3	0.5	0.5	0.7
Tenofovir disoproxil fumarate	I	Dimethyl formamide	600	585	2.4	6	6.6
		Toluene	500	488	4.3		7.8
		Methylene dichloride	700	689.5	6.0		4.6
		Acetone	100	95.5	0.5	0.8	3.2
	II	Cyclohexane	6000	5850	57.0		93
		Isopropyl acetate	6000	5880	30	60	30
		Isopropyl alcohol	7500	7350	37.5	75	37.5
		Ethyl acetate	1300	1254.5	6.5	19.5	19.5
TPN Base	I	Acetone	170	161.5	2		6.5
	II	Isopropyl alcohol	450	427.5	6.8	5.4	10.4
	III	Isopropyl alcohol	450	425.3	5.9	5.4	13.5
		Methanol	350	332.5	5.3	4.2	8.1
Valacyclovir hydrochloride	I	Toluene	740	714.1	4.6	2.3	19
		Hexane	490	474.1	2.2		13.7
	II	Dichloromethane	990	975.5	2.1		12.4
		Isopropanol	650	627.3	4		18.7
		Dimethyl formamide	570	550.3	2.9	4	12.8
	III	Methanol	1485	1447.9	12.2		24.9
		Ethanol	1485	1431.5	7.4		46
Valganciclovir HCl	I	Ethyl acetate	10	9.5	0.1		0.4
		Cyclohexane	30	28.8	0.3		0.9
	II	Acetic Acid	800	760	4		36
		Ethyl acetate	3400	3230	34		136
	III	Methanol	7.2	6.8	0.0	0.1	0.3
		Isopropyl Alcohol	226.5	215.1	1.1	2.3	7.9
		n-Propanol	267.7	254.3	1.3	2.7	9.4
Valsartan	I	Isopropyl ether	692	657.4	3.5		31.1
		Methanol	867.5	830.4	8.7		28.4

	II	Dichloromethane	2230	2196.6	4.7		28.8	
		Acetone	2510	2409.6	9		91.4	
	III	Toluene	2640	2547.6	11.6		80.8	
		Isopropanol	2180	2107	13.5	17.4	42.1	
	IV	Methanol	1495	1420.3	7.5	15	52.3	
Ethyl acetate		1310	1257.6	7.6	6.6	38.3		
Vardenafil HCl Trihydrate	I	Ethyl acetate	30	28.8	0.6		0.6	
		Cyclohexane	15	14.7	0.2		0.2	
	II	Toluene	15	14.4	0.3		0.3	
	III	Isoproyl Alcohol	30	29.1	0.5		0.4	
	IV	Isoproyl Alcohol	150	145.5	0.8		3.8	
	V	Acetic Acid	60	58.2	0.3		1.5	
		Toluene	15	14.6	0.0		0.4	
	VI	Methanol	21	20.4	0.1		0.6	
		Toluene	90	87.8	0.2		2.1	
		Methylene Dichloride	7.5	7.3	0.0		0.2	
	VII	Methylene Dichloride	90	87.3	0.3	0.2	2.3	
	VIII	Acetone	165	160.1	0.5		4.5	
Viladagliptin	I	Methylene dichloride	950	883.5	4.8	2.4	59.4	
		Cyclohexane	75	69.8	0.4		4.9	
	II	Tetrahydrofuran	720	676.8	4.3		38.9	
		Ethyl Acetate	500	465	3		32	
Zidovudine	I	Ethylacetate	2600	2548	13	20	19	
		Toluene	1980	1950.3	9.9		19.8	
		Methanol	1600	1552	14.4	8	25.6	
		Dimethylsulfoxide	1000	980	15		5	
Zolmitriptan	I	Ethyl Acetate	80	76.8	0.3	0.4	2.5	
		Methanol	83	78.9	0.4	0.8	2.9	
		Ethanol	16	15.5	0.1	0.0	0.3	
	II	Methanol		48	45.6	0.2		2.2

	III	Ethyl acetate	88	83.6	0.4	4
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Fig 2.3 Photographs of existing Solvent Recovery System

2.4.4 Solid Waste *(Terms of Reference No. 9)*

Solid wastes are generated from process, solvent distillation, wastewater treatment and utilities. Process residue contains mainly unreacted raw materials, adducts, off specification products and byproducts. These are collected from the reactors and other process equipment and stored in drums. Solvent residue is generated from distillation units. These residues are tarry substances with good calorific value and are stored in drums. The other major waste is salts from agitated thin film dryer of effluent treatment system. These salts are stored in HDPE lined bags. All solid waste storage containers/drums/bags are labeled showing the source, nature of hazard and type of wastes. All the hazardous wastes are

stored in a closed shed with fire safety measures, and the shed is provided with a leachate collection facility connected to effluent conveyance lines. The stripper distillate, process residue and solvent residue are sent to cement plants for co-incineration based on acceptability. If these wastes are not suitable for co-incineration, the same is sent to TSDF facility. Mixed solvents shall be sent to authorized recyclers /cement plant for co-incineration while spent solvents are recovered within plant premises. The evaporation salts are sent to TSDF. Filter media, activated carbon and catalysts are sent to TSDF. Waste oil and used batteries from the DG sets are sent to authorized recyclers. The sludge from effluent treatment plant is considered hazardous and the same is sent to TSDF. The other solid wastes expected from the unit are containers, empty drums which are returned to the product seller or sold to authorize buyers after detoxification. The process wastes are compiled for each product in **Table 2.14**. The quantity of solid waste generated in the plant and the disposal practice is presented in **Table 2.15**.

**Table 2.14 Solid Waste Generated from Process - Product Wise
After Expansion**

S.No	Name of Product	Quantity (Kg/Day)					Total
		Organic residue	Inorganic residue	Solvent residue	Spent Carbon	Hyflow & Catalyst	
1	Abacavir	13.5		8.9	40		62.4
2	Almotriptan	9.1		99.8			109
3	Amlodipine	216.9		198.4	33	25	473.8
4	Apixaban	27.7	14.5	287.4			329.6
5	Arpiprazole	25.2		72.5			97.7
6	Atazanavir	811.5		708.5			1519.9
7	Briviracetam	204	662	404			1269.8
8	Canagliflozin	255.4		165.7			421.1
9	Candesartan	49.7		45.3			95
10	Dapagliflozin	107.3		112			219.3
11	Darunavir	63.5		155.7	20		239.2
12	Dolutegravir	251.9	180	264.6			696.5
13	Efavirenz	12063.9		2377.8	285	70	14796.6
14	Elitriptan	41.1	1.6	150.5			193.2
15	Empagliflozin	34		22	100		156
16	Emtricitabine	58.9		82	95		235.8
17	Famotidine	71.5		109.1			180.5
18	Gabapentin	486.7		317.7	15		819.4
19	Ibresartan	69.6		61.7			131.3



20	Itraconazole	30.1		330.4	12		372.5
21	Lamivudine	1265		642	10	10	1927
22	Lamotrazine	120.8		25.7			146.5
23	Laniconazole	14.3		22.9	2.1		39.3
24	Lanthanum Carbonate		45				45
25	L-Carbocy-Stiene			81.2			81.2
26	Levetiracetam	200.5		152.1	30	25	407.6
27	Linagliptin	15.8		2			17.7
28	Lopinavir	10		32.8	8		50.8
29	Luliconazole	0.8	2.5	0.2	0.1		3.6
30	Mirabegron	230		84.1	1.2	1.3	316.4
31	Olmisartan	108.2		107.6		0.6	216.5
32	Ondansertan	80.4		51.8	20		152
33	Paliperidone Palmitate	2.7		10.7			13.4
34	Pantoprazole	23.5		28.0	2		53.5
35	Penciclovir	71		130.5	7.5	7	215.5
36	Raltegravir	6.4		47	5		58.4
37	Ranitidine	13.5		287.7			301.2
38	Ranolzine	337.5		530	10	25	902.6
39	Ritonavir	170.1		44.4			214.5
40	Rivaroxaban	485.6		90.2			575.8
41	Rizatriptan	7.8		21.9	4.7	1.5	35.8
42	Rosiglitazone	13.4		14.5		1	28.9
43	Sildenafilcitrate	21.3		40.4	10	3	75.1
44	Sitagliptin	308.1		146.2	13.2		467.5
45	Sofosbuvir	69.2	50	51.4			170.6
46	Solefinacin	29.7		78			107.7
47	Sulfamide	3		15			18
48	Sumatriptan	12.9		78.5			91.3
49	Tadalafil	5.6		3.2			8.8
50	Temisartan	9.3		24.6	2.4		36.4
51	Tenofavir	51.2		202.1	60		313.3
52	TPN Base	63.5		38.4	6		107.9
53	Trazadone	70.8		670			740.9
54	Valcyclovir	704.2		147.6	13	11	875.8
55	Valganociclovir	567		190.8			757.6
56	Valsartan	372.2		393.1	33	16	814.3
57	Verdinafil	12.3	34.85	16.7			63.8
58	Vildagliptin	29.7		135.1			164.8
59	Zidovudine	83.1		69.4	16.7		169.2
60	Zolmitriptan	0.8		12	3.3		16
	Total (Worst Case 20 Products)	19267	989.9	8576.2	831.3	196.8	28783.1

Table 2.15 Total Solid Waste Generated and Mode of Disposal

S.No	Description	Units	Quantity		Mode of Treatment/Disposal
			Permitted	After Expansion	
1	Process residue	TPD	5.076	19.26	Sent to TDSF/Cement Plants for Co-incineration
2	Solvent Residue	TPD		8.57	
3	Stripper Distillate	KLD		4.68	
4	Spent Carbon	Kg/day	530	831.3	Recovered within plant premises and reused
5	Spent Solvents	KLD		354	
6	Spent Mixed Solvents	KLD		39.2	Sent to authorized recovery units/Cement plants for co-incineration
7	Evaporation salts	TPD	29	18.43	Sent to TSDF
8	ETP Sludge	TPD	2.4	4.4	Sent to TSDF
9	Inorganic Residue	Kg/day		990	Sent to TSDF
10	Ash from Boiler and thermic fluid heater	TPD		17.2	Sold to Brick manufactures
11	Detoxified containers & liners	No.s/month		3200	Sold to authorized vendors
12	Waste oil	KLPA		7.2	Sent to Authorized Recyclers
13	Used batteries	No.s/Yr		52	
14	MS/SS/HDPE/PVC as scrap	TPM		9	Sold to authorizes vendors
15	Insulation waste	TPM		1.2	Sent to TSDF/ Authorized vendor.
16	E-WASTE	Kg /month		30	Authorized agency.
17	Off-Spec/Expired Chemicals	TPA		25	TSDF/Cement industries
18	Glass/Glass Bottles	Kg /month		60	Sent to Athorized recyclers after detoxification.

10.2.4.1 Ash Handling System

Ash will be of two types, viz., bottom ash and fly ash. The bed ash will be about 10% of the total ash and the remaining 90% of the total ash will be fly ash. Bag Filter (dust collector) will separate all the fine ash particles from flue gases. The efficiency of Bag filter will be 90-95%. An enclosed pneumatic conveying system will be used to convey the ash to storage bin. Ash will be loaded in to trucks using screw conveyor with water as conditioner to mitigate fugitive emissions.

2.4.5 Noise Pollution

The noise levels may increase due to motors, compressors, turbine, DG set and other activities. The major source of noise generation is turbine which emit noise levels of above 100 dB (A) at a reference distance of 1m from the source. The steam generator and auxiliaries will perform continuously within noise limits as per relevant standard specification but not more than 85 dB (A) at 1 meter from any equipment or sub-equipment. The machines and equipment shall have noise arresting system / low noise levels to limit noise level. Further, all noise generating equipment shall be housed within acoustic enclosure (where ever possible), to ensure attenuation of noise. The employees shall be trained in the mitigation measures and personal protection measures to be taken to prevent noise related health impacts. Hearing conservation program is adopted to ensure that employee's hearing is not affected during his working life to an extent greater than that usually occurring with age and to preserve it at a level sufficient for normal speed perception.

CHAPTER 3.0 BASELINE ENVIRONMENTAL STATUS

3.1 Introduction

Collection of base line data is an integral aspect of the preparation of Environmental Impact Assessment Report. Baseline data reflects the present status of environment due to the existing industrial activity. The possible effects due to proposed expansion of synthetic organic chemicals of SMS Pharmaceuticals Limited, Unit VII are estimated and superimposed on the compiled baseline data subsequently to assess environmental impacts.

The study was conducted in the impact area; 10 km radius area surrounding the project site, during October – December 2017. Studies were undertaken to generate baseline data of Micrometeorology, Ambient Air Quality (AAQ), Water Quality (Ground water, Surface water), Noise levels, Flora and Fauna, Land use and land cover, Soil quality and Socio-economic status of the community.

3.2 Land Environment

Land and soil constitute basic components of physical environment. The location of an industrial project may cause changes in land, land use, soil and denudational processes in different intensities contingent on spatial proximity of the activity and receptors. Land and soil may be altered within the vicinity of 5 km radius and to a lesser extent upto 10 km radial distance due to proposed expansion of Unit.

3.2.1 Physiography

The project site of 95.56 acres is located at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh. The site elevation above mean sea level (MSL) is in the range of 38-45 m. The plant site is surrounded by NH-5 to Chintapalli Road in North and East direction, open lands in south and west directions. The nearest village from the plant is Kovvada Agraharam village located at a distance of 1.7 km in southwest direction. The main approach road AH45 (NH-5) is at a distance of 1.9 km in north direction. The nearest Town Vizianagaram is at a distance of 16 km in northwest direction and Nellimarla railway station is at a distance of 17 km in

northwest direction and nearest airport is Visakhapatnam located at a distance of 56 km in southwest direction. Kandivalasa gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 3.4 km in east direction, and Champavathi gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 7.4 km in southwest direction. Bay of Bengal is at a distance of 6.7 km in SE direction. There are three reserve forests in the study area, Kumili RF is at a distance of 2.6 km in northeast direction, Konada RF is at a distance of 7.6 km in southwest direction, Damarasingi RF is at a distance of 8.2 km in northwest direction. There is no National Park, sanctuary, critically polluted area and interstate boundary within the impact area of 10 km surrounding the site. The slope of the region is from north to southwest. The area has mainly single crop agricultural lands irrigated by rain/tube wells. The site photographs are presented in **Figures 3.1**. The base map of the study area is prepared from Survey of India Toposheets (65 N12) is presented in **Figure 3.2**.



Figure 3.1 Site and Plant Photographs – SMS Pharmaceuticals Limited, Unit VII

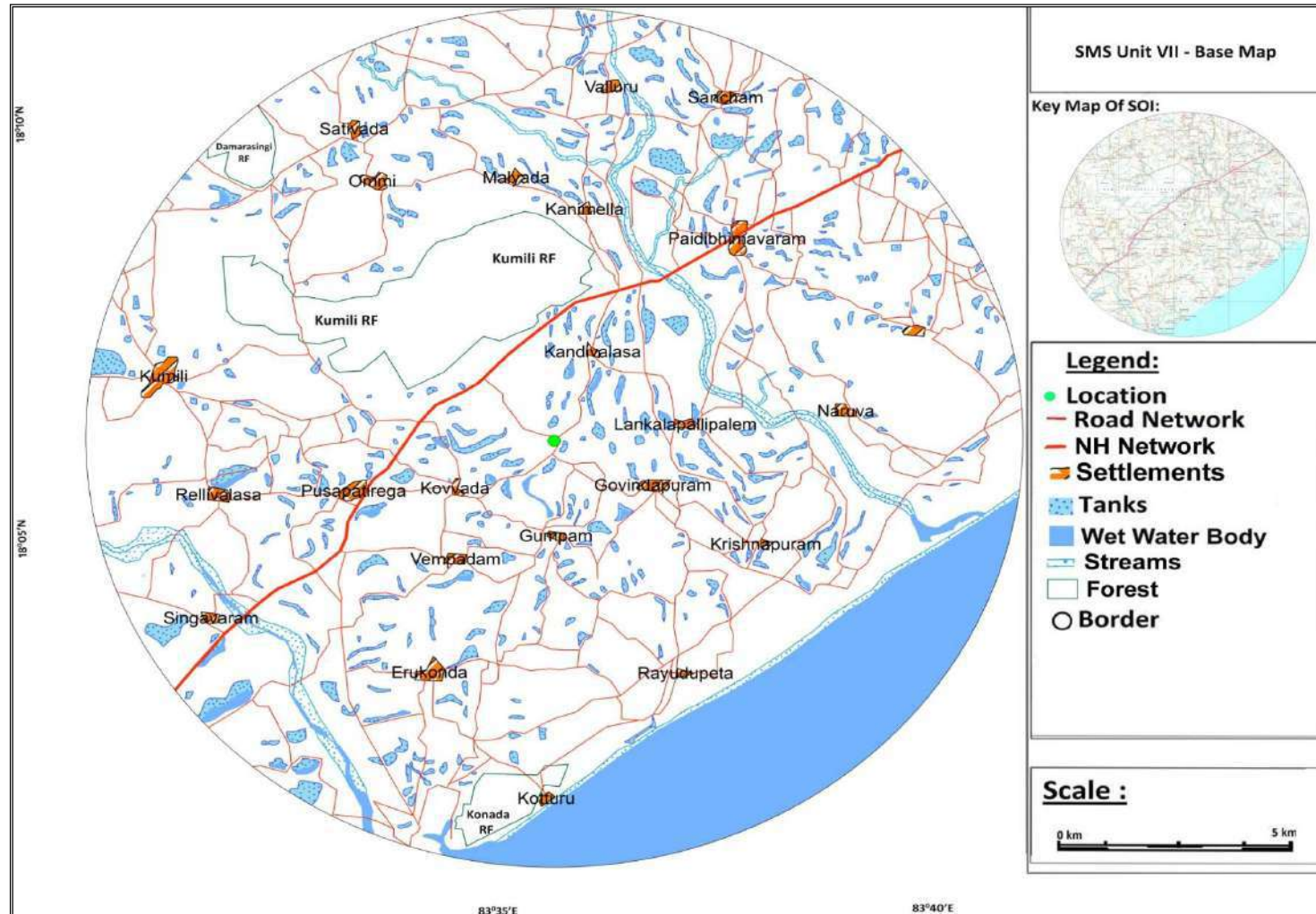


Figure 3.2 Base map of the study area

3.2.2 Geology (Terms of Reference No. 4(x))

The study area forms part of Eastern ghat tectonic complex of Archaean age. The rock types are represented by granulite group of rocks like Khondalites and Charnockites. These are overlain by laterites of Sub-recent age. The Khondalite suite of rocks is represented by quartz-feldspar-garnet stilliminate gneisses, quartzites and calc granulites. These formations are medium to coarse grained and gneissic in texture. The color of rocks is generally red. Quartzites occur as bands and occur more towards the contact zones between leptynites and Khondalites. The charnockite group of rocks includes acidic-intermediate and basic hypersthene granulites/gneisses. These are hard, massive and dark colored and are generally pink, medium grained and granulitic in texture. These are represented by feldspathic gneisses with bands of charnockite. They occupy mainly low-lying areas and occupy the crestal parts of antiforms, quartz, orthoclase, plagioclase and garnet are essential constituents.

The regional structure identified in the area consists of second generation antiform. Quaternary deposits are represented by laterites/lateritic gravel and surficial deposits. Colluvium is debris material along the foothills essentially derived from Khondalite hill ranges by fluvial action near Vempadu and Payakaraopet hill range. It is composed of sand, silt, clay and gravel in varying proportions. Colluvium is followed by weathered rock. Red sediments are unique in the area associated with hill flanks and in valleys. Coastal sands include dunes, mounds, dune sands and beach sands. Dune mounds consist of loose sand piled or heaped by the wind and are found on the back shore. The dune sands are blown up by winds and deposited inland at some places. The chronological succession of the geological formations of the area is presented in [Table 3.1](#). Geological map of the study area is presented in [Figure 3.3](#).

Table 3.1 The Succession of Geological Formations

Geological Age	Type of Formation
Sub recent to recent	Alluvium, Colluvium, soils and valley fills
Upper Cretaceous	
Pre-Cambrians (Bhimas)	Sandstones, Limestones and Shales
Archean	Gneissic complex rocks, diorite, coarse grained Granite with doleritic dyke intrusions.

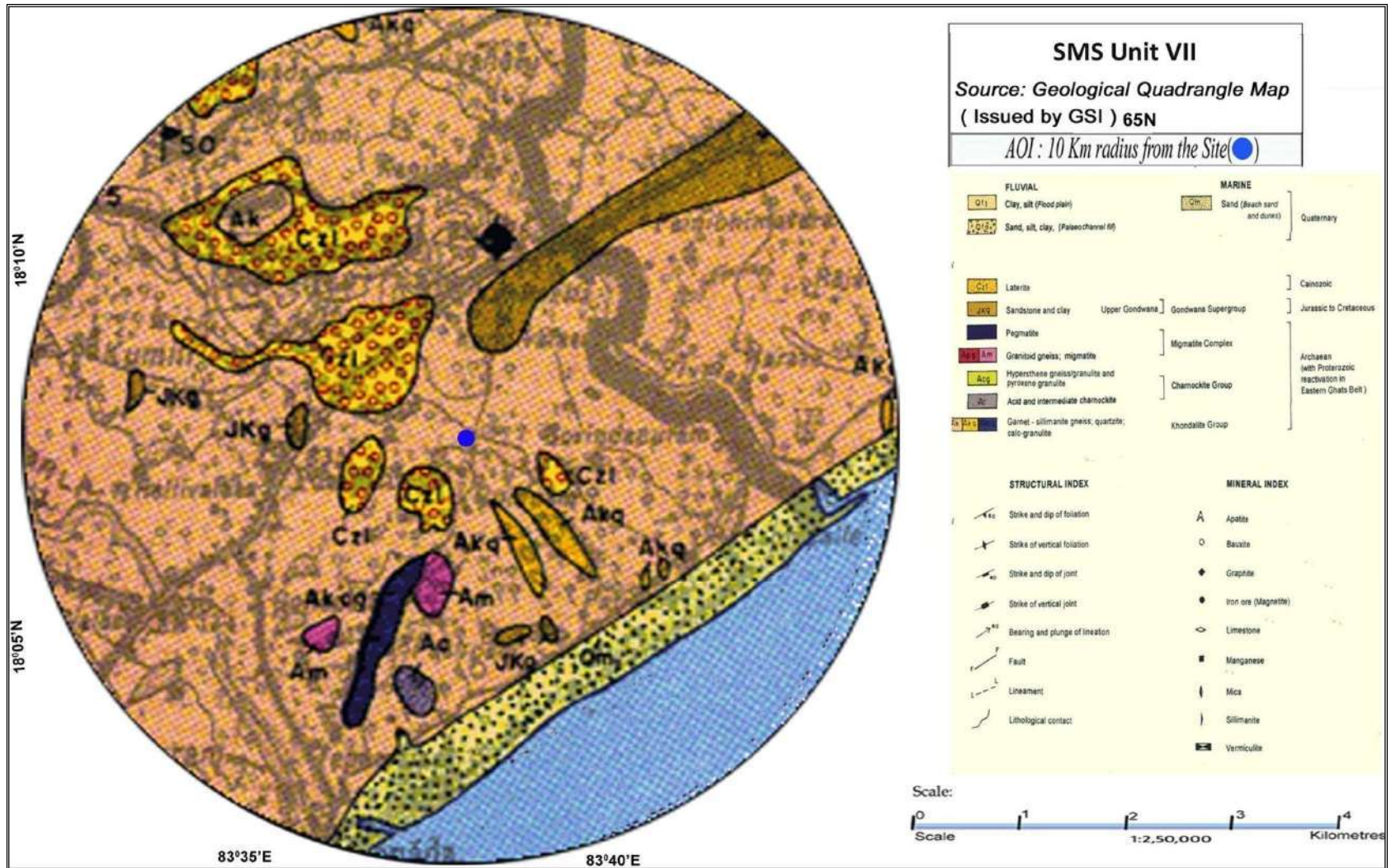


Figure 3.3 Geological map of the study area (Terms of Reference No. 4(x))

3.2.3 Hydrogeology *(Terms of Reference No. 4(x))*

The occurrence and behavior of ground water is controlled by topography climate, geology and structure of the area. Ground water occurs under the water table conditions in the weathered basalts in the joints and fractures. Thickness of weathering in traps ranges up to 21 m. Dug wells and dug-cum bore wells range in the depth between 4 and 15 m. Generally in well bores from the bottom of the dug wells pierced through the entire thickness of weathered zone in order to increase the yield of the wells. The water level in the dug wells ranges from 2 to 12 m. The yield of dug cum bore wells is around 40 m³/h and capable of pumping continuously 6 hours per day. The development of ground water is poor in the area underlain by traps. The depth of wells generally ranges from 3 to 11m. The depth to water level in them is ranged from 0.5 to 0.9 m. The extract of hydrogeological map of impact area is presented in [Figure 3.4](#). The source of water for the proposed expansion shall be groundwater or APIIC supply from Thotapally reservoir proposed to supply to the nearby industrial area.

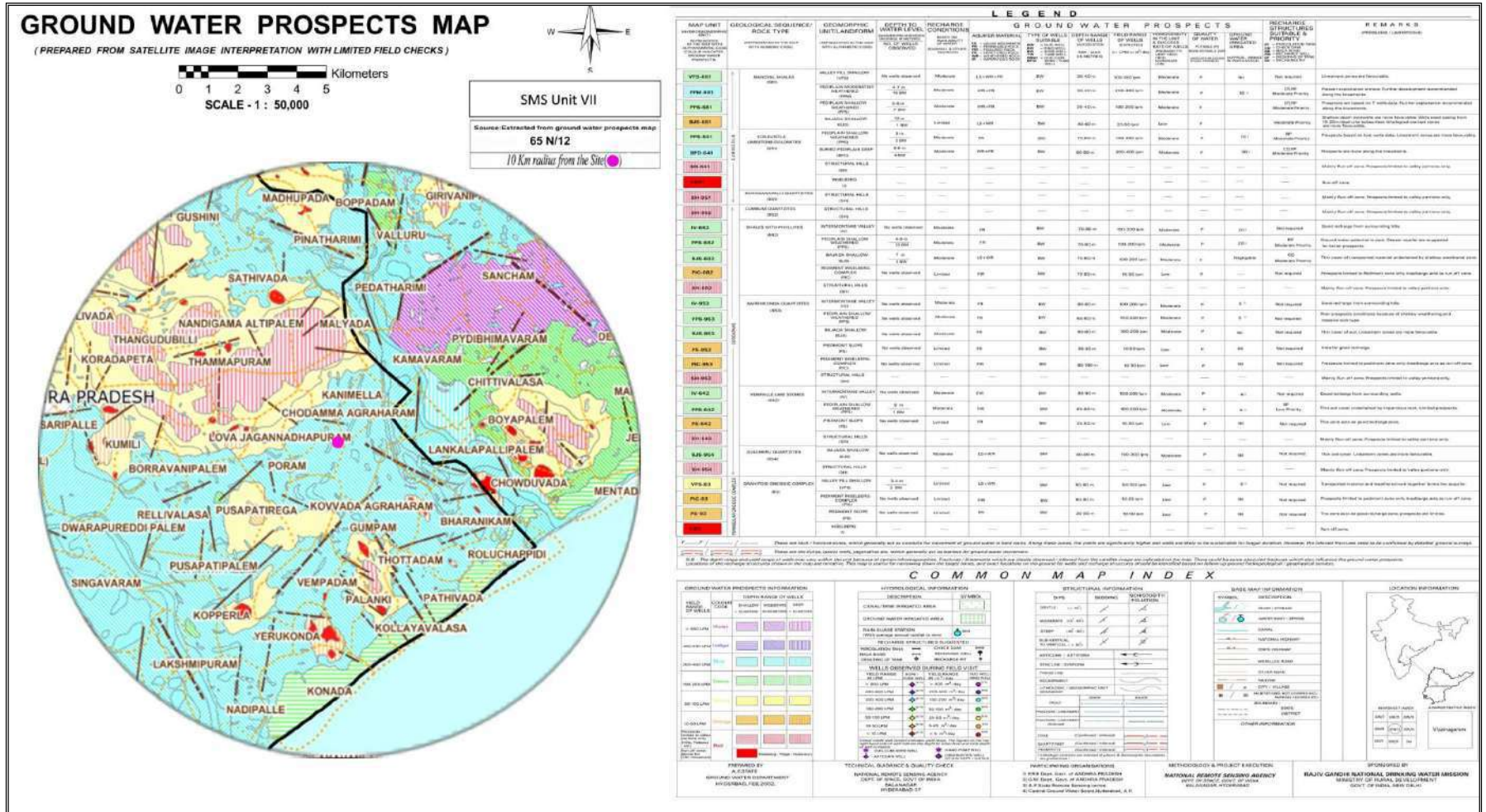


Figure 3.4 Hydrogeological Map of the study area

3.2.4 Soils

Soil may be defined as a thin layer of earth's crust that serves as a natural medium for the growth of plants. It is the unconsolidated mineral matter that has been subjected to and influenced by genetic and environmental factors such as parent materials, climate, organisms and physico-chemical action of wind, water and sunlight, all acting over a period of time. Soil differs from the parent materials in the morphological, physical, chemical and biological properties. Also soil differs among them in some or all the genetic or environmental factors, therefore, some soils are yellow, some are black, and some are coarse textured. They serve as a reservoir of nutrients for plants and crop and also provide mechanical anchorage and favorable tilth.

The Soil characteristics include both physical and chemical parameters. M/s. Team Labs and Consultants field team carried out soil survey to assess the soil characteristics of the study area. The land use and land cover map of the study are shown in [Figure 3.5](#). It may be noted that the land use land cover map reflects predominantly agricultural lands. The impact area also has a significant percentage of agriculture lands dependent on tank irrigation. Representative soil sampling is done at various locations and these locations are shown in [Figure 3.6](#). Analytical data of soil samples is presented in [Table 3.2](#).

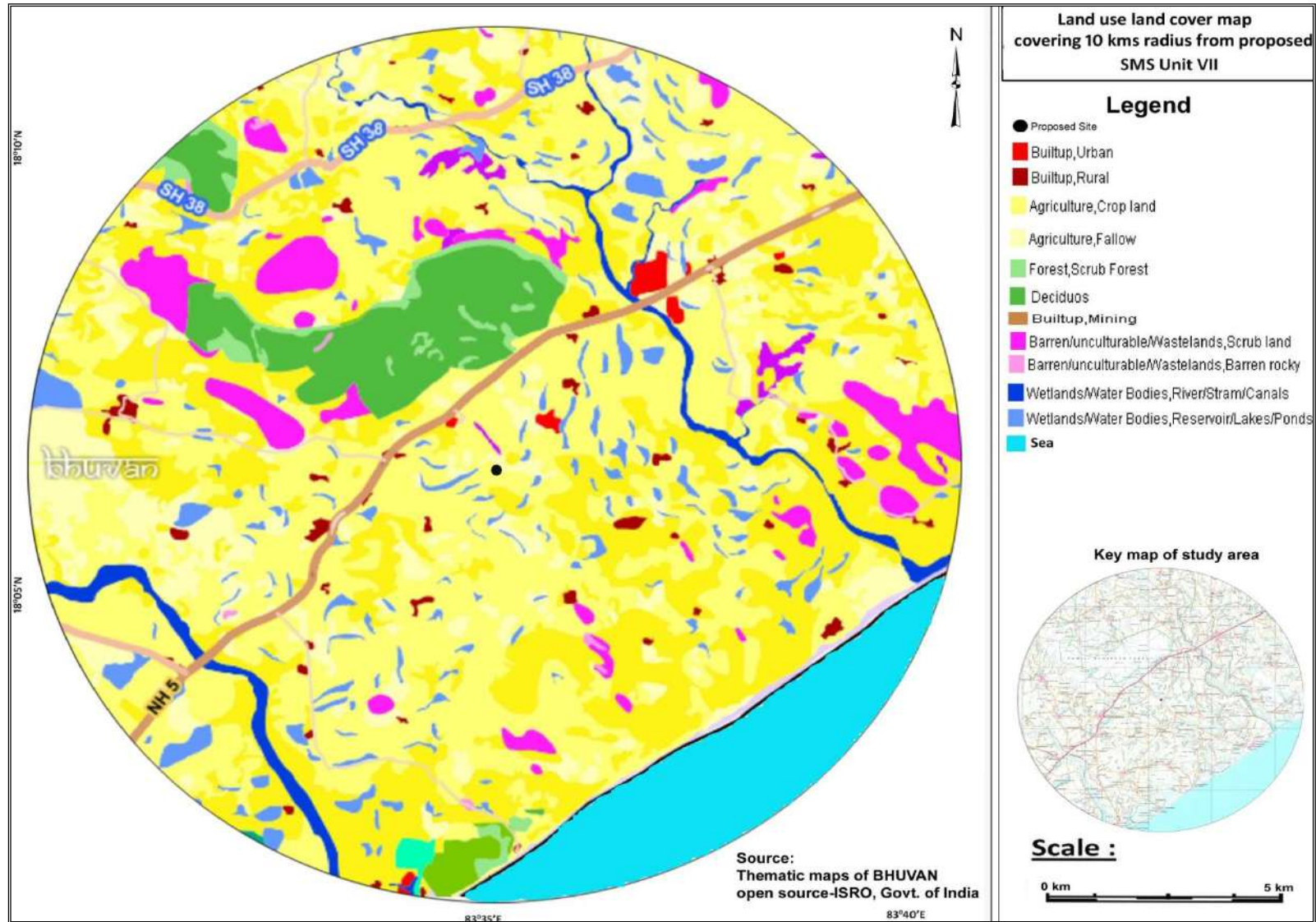


Figure 3.5 Land Use and Land Cover of the study area (Terms of Reference No. 4(ix) & 5(ii))

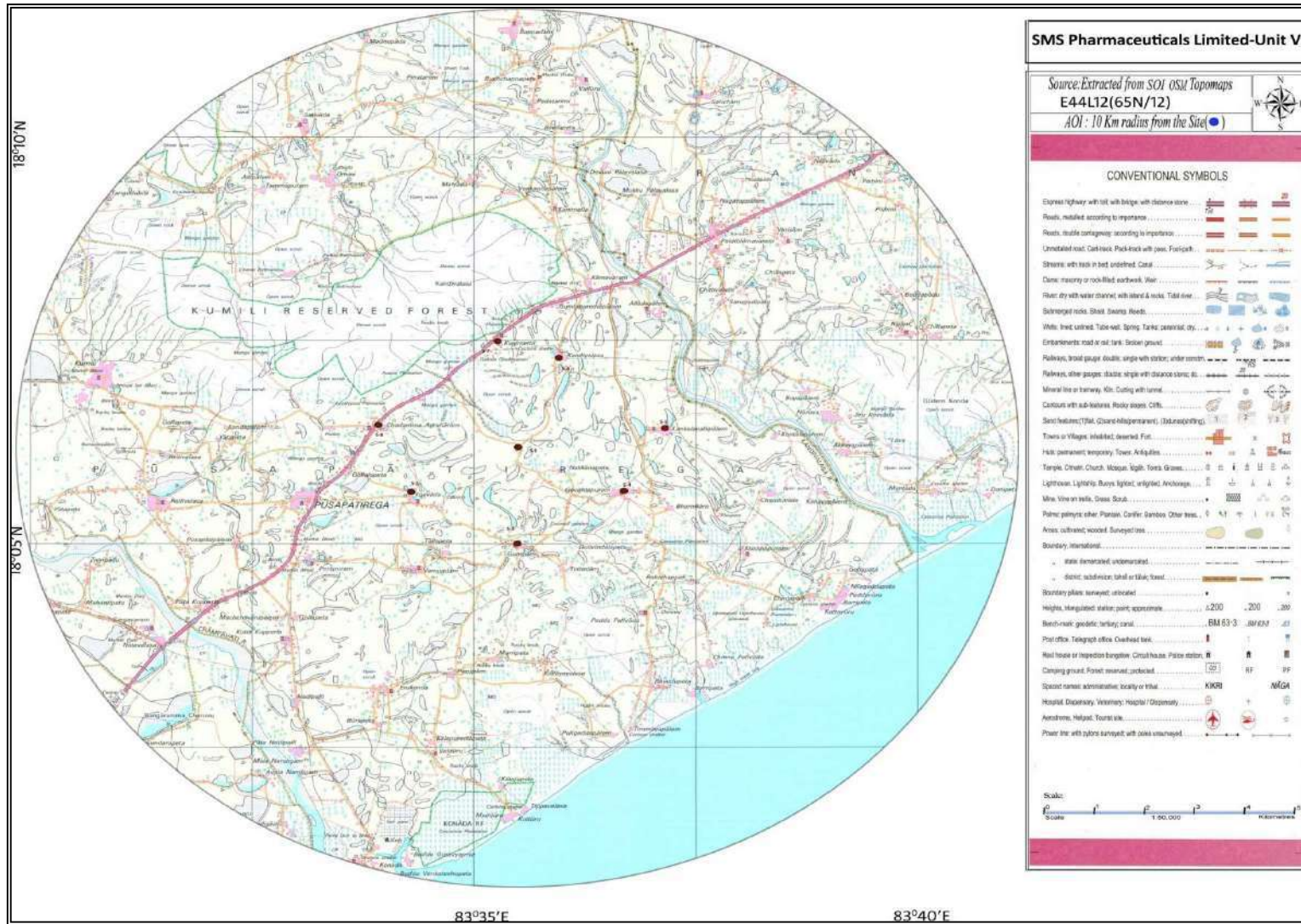


Figure 3.6 Soil Sampling Locations

Table 3.2 Soil Analysis Data (Terms of Reference No. 6(viii))

Parameter	Unit	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
pH	-	6.67	7.56	7.62	6.39	6.35	7.64	7.21	7.37
Electrical Conductivity (EC)	dS/m	0.291	0.167	0.194	0.112	0.17	0.194	0.182	0.110
Bulk Density	g/cc	1.25	1.33	1.18	1.11	1.33	1.33	1.43	1.11
Cation-Exchange Capacity (CEC)	Cmol+/kg	0.90	1.89	1.64	1.96	1.2	1.55	1.40	1.65
Infiltration rate	mm/hour	21	18	21	16	10	27	17	18
Porosity	%	53	50	56	58	50	50	46	58
Water Holding Capacity	%	8.21	8.82	2.9	13.9	5.9	6.84	3.65	7.82
Moisture	%	8.02	8.67	2.72	12.6	5.92	6.01	2.94	6.99
Organic Matter	%	0.82	2.5	0.94	0.96	2.52	1.54	1.31	1.42
Carbonates	%	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Sand	%	45	52	45	34	40	54	49	51
Silt	%	40	31	41	46	28	27	33	35
Clay	%	15	17	14	20	32	19	18	14
Organic Carbon	%	0.47	1.44	0.54	0.55	1.52	0.89	0.76	0.82
Nitrogen (as N)	%	0.102	0.112	0.067	0.034	0.19	0.094	0.034	0.062
Carbon / Nitrogen Ration (C/N)	-	4.6	12.9	8.1	16.2	7.9	9.5	22.4	13.2
Phosphorus (as P)	%	0.942	0.431	0.721	0.541	0.73	1.34	0.462	0.671
Potassium (as K)	mg/kg	64	172	94	265	125	231	106	149
Sodium (as Na)	mg/kg	54	82	56	89	62	72	63	77
Calcium (as Ca)	mg/kg	56	74	119	57	59	61	94	92
Magnesium (as Mg)	mg/kg	26	86	67	72	32	39	46	57
Calcium/Magnesium ratio	-	2.15	0.86	1.78	0.79	1.84	1.56	2.04	1.61
Sodium Absorption Ratio (SAR)	-	1.69	1.88	1.17	2.27	3.33	2.06	1.51	1.80
Chlorides (as Cl)	mg/kg	180	121	94	96	79	125	182	186
Sulphates (as SO ₄)	mg/kg	24	26	27	13	7.8	14	16	17
Aluminium (as Al)	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10
Zinc (as Zn)	mg/kg	31	29	51	60	48	34	31	25
Texture	-	Loam	Loam	Loam	Loam	Clay Loam	Sandy Loam	Loam	Loam
S1-Site, S2- Kovvada, S3- Gumpam, S4- Govindapuram, S5- Lankalapallipalem, S6- Kandivalasa, S7- Kanimetta, S8- Chodammaagraharam									

The test results of soil samples collected in the impact area are interpreted referring to the book; “Interpreting soil test results”. The reference tables are presented in **Table 3.3**. The pH of soil samples ranges from slightly acid to mildly alkaline. The cation exchange capacity of the soils is very low in all samples, contributed mainly by Potassium exchangeable ions. The level of nitrogen of the samples is very low to low while the potassium levels are high. The calcium magnesium ratio of the samples reflects calcium is low (6 samples). Bulk density of soil of impact varies from 1.11 – 1.43 g/cc among loamy soils (6 samples). The porosity values range from 46-58 % among loamy (6 samples) soil. Soil texture is predominantly loam.

Table 3.3 Soil Test Results - Reference Tables

General interpretation of pH Measured		
pH	Range	Classification
	<4.5	Extremely Acidic
	4.51 -5.0	Very Strong Acidic
	5.1-5.5	Strong Acid
	5.6- 6.0	Moderately Acid
	6.1-6.5	Slightly acid
	6.6-7.3	Neutral
	7.4-7.8	Mildily Alkaline
	7.9 -8.4	Moderately Alkaline
	8.5-9.0	Strongly Alkaline
	>9.0	Very Strongly Alkaline

Source: Bruce and Rayment (1982).

Ca/mg Ratio	
	Description
<1	Ca Deficient
1-4	Ca (Low)
4-6	Balanced
6-10	Mg (Low)
>10	Mg deficient

Source: Eckert (1987)

Rating of Total Nitrogen	
Rating (% by W)	Description
<0.05	Very low
0.05-0.15	Low
0.15-0.25	Modium
0.25-0.50	High
>0.5	Very High

Source: Bruce and Rayment (1982)

Rating for Cation Exchange Capacity	
	CEC (Cmol+)/kg
Very low	<6 *
Low	6-12
Moderate	12-25
High	25-40
Very High	>40

Source: Metson (1961)

* Soils with CEC less than three are often low in fertility and susceptible to soil acidification.

Extractable Potassium (K)	
	K
low	<150 ppm* (< 0.4 meq/100 g soil)
medium	150–250 ppm (0.4–0.6 meq/100 g soil)
high	250–800 ppm (0.6–2.0 meq/100 g soil)
excessive	>800 ppm (>2.0 meq/100 g soil)

Source: Abbott (1989)

3.3 Water Environment (Terms of Reference No. B.8 & A.18)

Industrial development of any region is contingent on the availability of sufficient water resources, as most of the process industries require water for process or cooling purposes. The potential for exploitation of ground water resources increases as development of new projects increases in industrial and agricultural areas. With the increasing industrialization and urbanization the possibilities of contamination of surface water and ground water sources are rapidly increasing. The water resources in the area broadly fall into following categories; surface water resources consisting of streams, ponds, tanks, rivers, sea etc and ground water resources, mainly dug wells, hand pumps, borewells, in wells etc. which tap accumulated water from deeper strata of ground.

3.3.1 Surface Water Resources (Terms of Reference No. 6(iv))

Kandivalasa gedda, a seasonal stream is flowing from Northwest to southwest direction at a distance of 3.4 km in east direction. There are a few surface water bodies like natural lakes and tanks in the study area. The drainage pattern of the impact area is dendritic and the flow is mainly into Kandivalasa gedda and joins in Bay of Bengal. The drainage pattern of the impact area is presented in [Figure 3.7](#).

3.3.1.1 Surface Water Quality

The sampling locations of both ground and surface water are presented in [Figure 3.8](#). The analytical results of water samples drawn from various locations in the study area are presented in [Table 3.4](#).

Table 3.4 Water Analysis Data –Surface Water

Parameters	SW-1	SW-2	Units	Method of Analysis	IS 2296:1982
Temperature	32	28	°C	IS:3025 part 09:2017	NS
Colour	1	1	Hazen	IS:3025 part 04:2017	5
Turbidity	0.1	<0.1	NTU	IS:3025 part 10:2017	5
pH	8.13	8.26	-	IS:3025 part 11:2017	6.5-8.5
Total Solids	515	537	mg/l	IS:3025 part 15:2014	NS
Total Dissolved Solids	502	521	mg/l	IS:3025 part 16:2017	1500
Total Suspended Solids	13	16	mg/l	IS:3025 part 17:2017	NS
Total Hardness (as CaCO ₃)	260	270	mg/l	IS:3025 part 21:2014	NS
Calcium (as Ca)	54	50	mg/l	IS:3025 part 40:2014	NS
Magnesium (as Mg)	30	35	mg/l	IS:3025 part 46:2014	NS
Sodium (as Na)	96	94	mg/l	IS:3025 part 45:2014	NS
Sodium Absorption Ratio (SAR)	2.98	2.92	-	-	Ns
Potassium (as K)	6.7	6.9	mg/l	IS:3025 part 45:2014	NS
Total Alkalinity (as CaCO ₃)	235	255	mg/l	IS:3025 part 51:2017	NS
Chloride (as Cl)	121	125	mg/l	IS:3025 part 32:2014	600
Sulphates (as SO ₄)	31	34	mg/l	IS:3025 part 24:2014	400
Nitrite Nitrogen (as NO ₃)	13	16	mg/l	IS:3025 part 34:2014	50
Silica (as SiO ₂)	6.9	4.6	mg/l	IS:3025 part 35:2014	NS
Fluoride (as F)	0.39	0.25	mg/l	IS:3025 part 60:2013	1.5
Residual, Free Chlorine	<1.0	<1.0	mg/l	IS:3025 part 26:2014	NS
Mineral Oil	Nil	Nil	mg/l	IS:3025 part 39:2014	NS
Aluminium (as Al)	<0.1	<0.1	mg/l	APHA-3500-Al	NS
Arsenic (as As)	<0.3	<0.3	mg/l	IS:3025 part 37:2014	0.2
Boron (as B)	<0.001	<0.001	mg/l	IS:3025 part 57:2017	NS
Cadmium (as Cd)	<0.1	<0.1	mg/l	IS:3025 part 41:2014	0.01
Hexavalent Chromium (as Cr ⁶⁺)	<0.05	<0.05	mg/l	IS:3025 part 52:2014	0.05
Copper (as Cu)	<0.01	<0.01	mg/l	IS:3025 part 42:2014	1.5
Iron (as Fe)	0.74	0.81	mg/l	IS:3025 part 53:2014	50
Lead (as Pb)	<0.01	<0.01	mg/l	IS:3025 part 47:2014	0.1
Manganese (as Mn)	0.05	0.07	mg/l	APHA-3500-Mn	NS
Mercury (as Hg)	<0.01	<0.01	mg/l	IS:3025 part 48:2014	NS
Nickel (as Ni)	<0.01	<0.01	mg/l	IS:3025 part 54:2014	NS
Selenium (as Se)	<0.001	<0.001	mg/l	IS:3025 part 56:2014	0.05
Zinc (as Zn)	0.94	0.86	mg/l	IS:3025 part 49:2014	15
SW1- Kandivalasa up stream and SW2- Kandivalasa down stream					

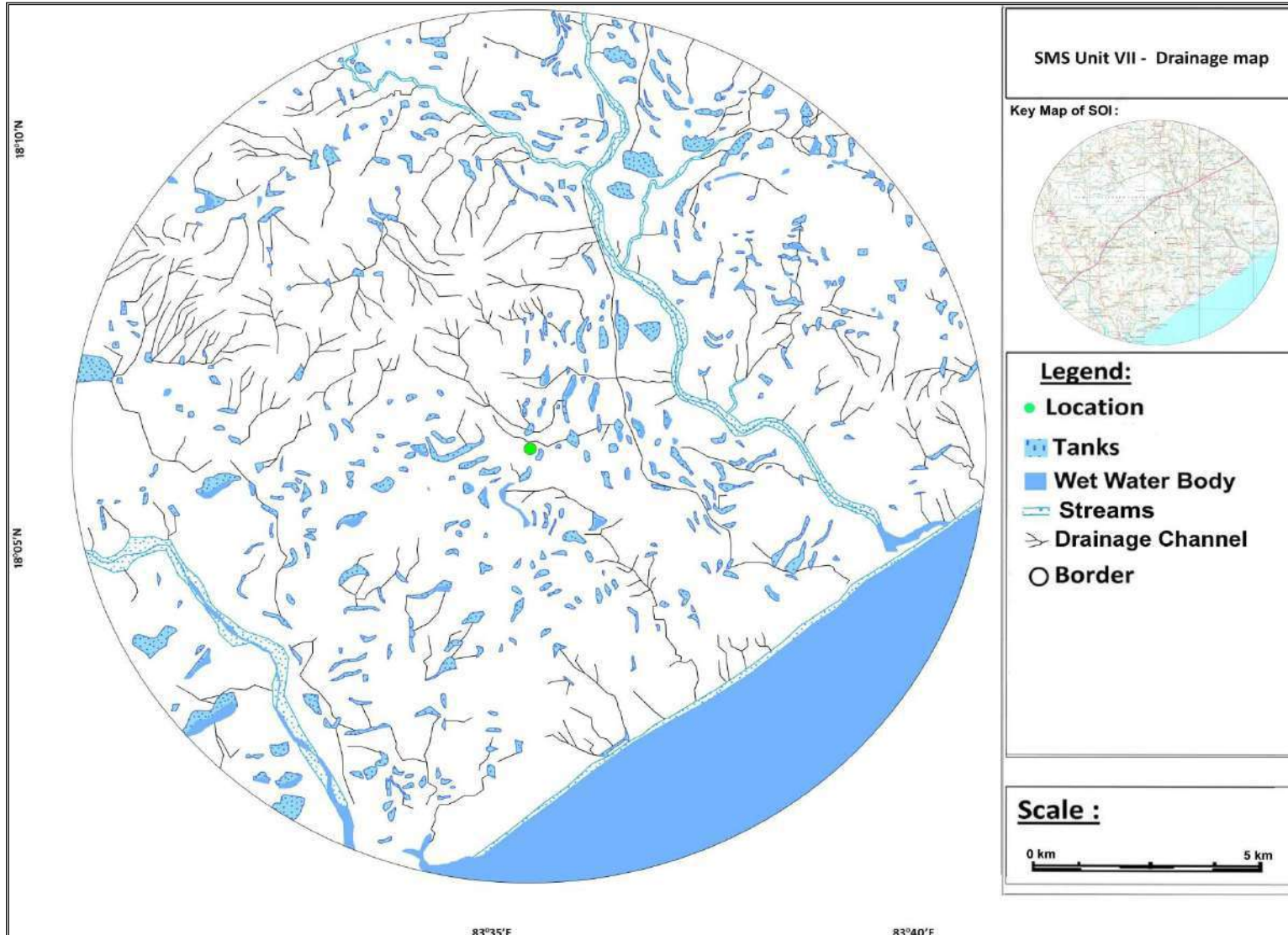


Figure 3.7 Drainage Pattern of the study area (*Terms of Reference No. 4(xi)*)

3.3.1.2 Ground Water Resources *(Terms of Reference No. 6(vi))*

Ground water is the accumulation of water below the ground surface, caused by rainfall and its subsequent percolation through pores and crevices. Percolated water accumulates till it reaches impervious strata consisting of confined clay or confined rocks. Occurrence of ground water is controlled by landform, structure and lithology. Ground water abstraction is by means of dug wells, dug cum driven wells, and bore wells. Every village has a number of traditional wells used for mainly drawing water for domestic usage. The state authorities have also provided tube wells fitted with hand pump for the drinking water requirement of villages in the study area. Presently the drinking water needs are mostly met from the ground water resources.

3.3.1.3 Quality of Ground Water

The quality of ground water occurring in the geological formations in the study area is generally good for drinking after treatment in most of the areas. The representative samples are collected from various dug wells and bore wells in the study area. The list of sample locations is presented in [Table 3.5](#). The analytical results of water samples drawn from various locations in the study area are presented in [Table 3.6](#). The map showing the locations of sample collection ([Figure 3.9](#)) is also presented. Whereas Total dissolved solids are 862.2-1234 mg/l, which is contributed by sodium Iron, Calcium and chlorides and may be attributed to local geology.

Table 3.5 Locations of Ground water Sampling

S. No	Location Name	Direction Form site	Distance From Site (Km)
GW - 1	Site	-	
GW - 2	Kovvada	SW	1.2
GW - 3	Gumpam	S	1.3
GW - 4	Govindapuram	SE	1.8
GW - 5	Lankalapallipalem	NE	2.7
GW - 6	Kandivalasa	NE	2.1
GW - 7	Kanimetta	NW	2.2
GW - 8	Chodammaagraharam	NW	1.9

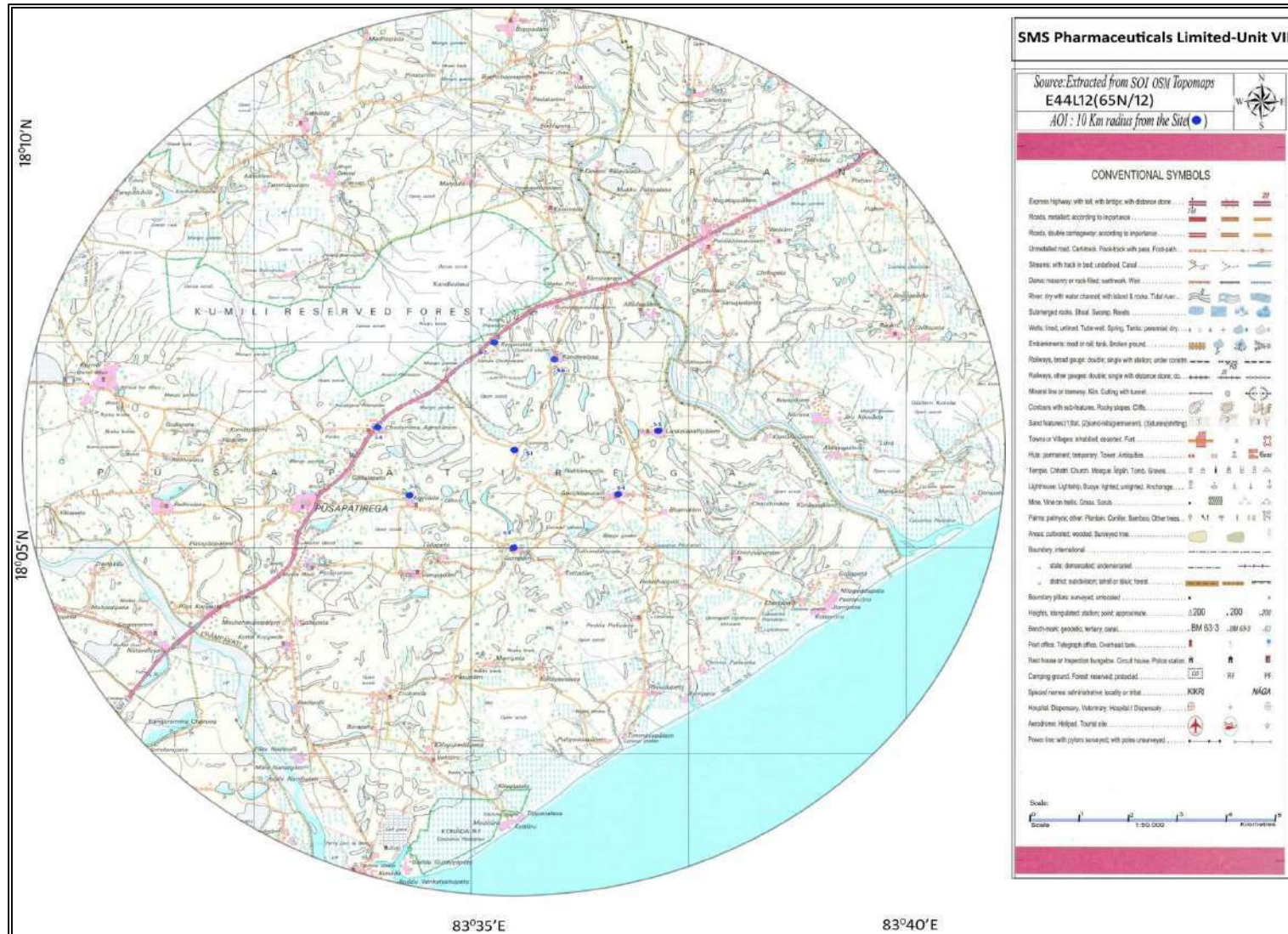


Figure 3.8 Water Sampling Locations

Table 3.6 Water Analysis Data – Ground Water

Parameters	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	Units	Method of Analysis	IS 10500:2012 Standard
Temperature	32	31	32	28	32	30	29	31	°C	IS:3025 part 09:2017	-
Colour	1	1	1	1	1	1	1	1	Hazen	IS:3025 part 04:2017	5
Turbidity	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NTU	IS:3025 part 10:2017	1
pH	7.84	7.46	7.32	7.1	7.84	7.62	7.82	7.62	-	IS:3025 part 11:2017	6.5-8.5
Total Solids	819	839	863	715	893	850	912	830	mg/l	IS:3025 part 15:2014	NS
Total Dissolved Solids	805	826	849	702	877	836	896	814	mg/l	IS:3025 part 16:2017	500
Total Suspended Solids	14	13	14	13	16	14	16	16	mg/l	IS:3025 part 17:2017	NS
Total Hardness (as CaCO ₃)	410	400	640	315	507	355	555	580	mg/l	IS:3025 part 21:2014	200
Calcium (as Ca)	100	122	160	76	124	80	140	112	mg/l	IS:3025 part 40:2014	75
Magnesium (as Mg)	39	23	58	30	53	38	50	73	mg/l	IS:3025 part 46:2014	30
Sodium (as Na)	150	135	89	86	139	183	137	103	mg/l	IS:3025 part 45:2014	NS
Sodium Absorption Ratio	3.6	3.2	1.7	2.3	3.0	4.7	2.8	2.2	-	-	NS
Potassium (as K)	3.7	52	16	92	4.9	10	3.9	6.5	mg/l	IS:3025 part 45:2014	NS
Total Alkalinity (as CaCO ₃)	230	300	245	250	304	245	320	365	mg/l	IS:3025 part 51:2017	NS
Chloride (as Cl)	225	190	275	152	213	179	226	168	mg/l	IS:3025 part 32:2014	250
Sulphate (as SO ₄ ⁻)	120	80	51	63	152	152	86	77	mg/l	IS:3025 part 24:2014	200
Nitrate Nitrogen (as NO ₃ ⁻)	8	9	8	6	7	6	9	8	mg/l	IS:3025 part 34:2014	45
Silica (as SiO ₂)	6.4	8.2	9.1	6.7	4.6	9.6	11	8.9	mg/l	IS:3025 part 35:2014	NS
Fluoride (as F ⁻)	0.37	0.34	0.31	0.3	0.37	0.31	0.52	0.39	mg/l	IS:3025 part 60:2013	1.0
Residual, Free Chlorine	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	mg/l	IS:3025 part 26:2014	0.20
Boron (as B)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/l	IS:3025 part 57:2017	0.50
Manganese (as Mn)	0.03	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.03	mg/l	APHA-3500-Mn	0.10
Zinc (as Zn)	0.94	0.83	0.86	0.94	0.76	82	1.3	1.2	mg/l	IS:3025 part 49:2014	5.0
GW 1-Site, GW 2- Kovvada, GW 3- Gumpam, GW 4- Govindapuram, GW 5- Lankalapallipalem, GW 6- Kandivalasa, GW 7- Kanimetta, GW 8- Chodammaagraharam.											

Note: All values are expressed in mg/l except pH.

3.4 Air Environment

3.4.1 Meteorology

Micro meteorological studies are simultaneously conducted with ambient air quality monitoring. Meteorology plays a vital role in effecting the dispersion of pollutants, once discharged into the atmosphere, their transport, dispersion and diffusion into the environment. The meteorological data is very useful for interpretation of the baseline information and for model study of air quality impacts also. Since meteorological data show wide fluctuations with time, meaningful interpretation can only be drawn from long term and reliable data. Such source of data is the Indian Meteorological Department (IMD), which maintains a network of meteorological stations at several important locations. The normal climatological table of data recorded at IMD station at Kalingapatnam during 1981 - 2010 is presented in [Table 3.7](#).

स्टेशन : कालिंगपट्टनम STATION : Kalingsapatnam		जलवायवी सारणी CLIMATOLOGICAL TABLE												सुरभता																					
		मौसम परिचयना			पवन			पवन की दिशा के दिनों की संख्या का प्रतिशत			सर्व मजल (सभी मजल) सौदा दिनों की संख्या - अउडमंश					निच लरी मजल सौदा दिनों की संख्या - अउडमंश																			
मास	वर्षा 0.3 मि.मि.या अधिक अधिक	के साथ दिनों की संख्या		पवन की गति के साथ दिनों की संख्या (कि.मी. प्र. घं.)		पवन की दिशा के दिनों की संख्या का प्रतिशत						सर्व मजल (सभी मजल) सौदा दिनों की संख्या - अउडमंश			निच लरी मजल सौदा दिनों की संख्या - अउडमंश			दृश्यता सहित दिनों की संख्या																	
		अधिक	अधिक	0.1	1-20	3	SE	S	SW	W	NW	WNW	W	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	1	1-4	4-10	10-20	20							
MONTH	mm	mm	mm	kmph	kmph	%	N	NE	E	SE	S	SW	W	NW	WNW	W	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	0	1	1-4	4-10	10-20	20			
		No. OF DAYS WITH WEATHER PHENOMENA		No. OF DAYS WITH WIND SPEED (Km. p. h.)		PERCENTAGE No. OF DAYS WIND FROM						No. OF DAYS WITH LOW CLOUD AMOUNT (ALL CLOUDS) O.K.T.A.S			No. OF DAYS WITH LOW CLOUD AMOUNT O.K.T.A.S			No. OF DAYS WITH VISIBILITY																	
		THUR	FRIG	DUST	FOG	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP	HAZ	TRK	DRP			
I	1.2	0	0.1	0.6	0	0	0	25	6	22	9	3	1	0	1	4	39	21	10	11	6	3	1	23	6	2	0	0	0	0.1	1.3	23.7	5.9	0	
II	0	0	0	0	0	0	0	3	28	0	0	8	44	19	18	10	0	0	1	7	12	8	3	1	21	8	2	0	0	0	0.1	14.6	16.3	0	
I	2	0	0.4	0.9	0	0	0	22	6	15	8	3	1	1	6	12	33	21	9	11	5	2	1	18	7	3	0	0	0	0.2	0.5	18	9.3	0	
II	0	0	0	0	0	0	0	6	22	0	0	2	20	16	28	32	1	0	1	7	11	7	2	1	16	9	3	0	0	0	0.1	3.7	24.2	0	
I	1.3	0	1.9	1.2	0	0	0	1	26	4	6	3	3	0	2	29	24	21	7	10	9	4	1	14	12	5	0	0	0.1	0.4	10.3	20	0.1		
II	0	0	0	0	0	0	0	12	19	0	0	5	6	29	57	2	1	0	5	11	9	5	1	15	13	3	0	0	0	0.1	2	28.9	0		
I	2.4	0	3.4	0.2	0.1	0	0	5	24	1	1	2	1	4	61	21	5	4	3	10	11	5	1	9	16	5	0	0	0	0	0	1.7	28.2	0.1	
II	0	0	0	0	0	0	0	16	14	0	1	1	3	21	69	4	1	0	2	6	12	8	2	7	18	5	0	0	0	0	0	1.4	28.6	0	
I	5	0	6.5	0.1	0.1	0	0	6	23	2	1	2	4	3	8	53	17	6	1	7	12	8	3	5	17	9	0	0	0	0.2	1.5	29.2	0.1		
II	0	0	0	0	0	0	0	13	18	0	1	1	2	4	23	62	3	2	2	1	6	12	9	3	6	19	7	0	0	0	0.2	2	28.8	0	
I	9.2	0	7.1	0	0	0	0	5	22	3	2	1	2	1	4	49	22	8	11	0	2	9	10	9	4	14	12	0	0	0	0.7	3.4	25.9	0	
II	0	0	0	0	0	0	0	9	20	1	1	2	2	13	64	9	4	3	0	1	7	13	9	3	16	11	0	0	0	0.5	3.6	25.9	0		
I	13.6	0	6.8	0	0	0	0	3	24	4	1	1	1	0	2	46	27	9	13	0	1	6	14	10	2	14	15	0	0	0	1.2	4.3	25.6	0	
II	0	0	0	0	0	0	0	8	21	2	1	0	2	1	8	61	16	6	5	0	1	6	12	12	0	17	14	0	0	0	0	1.2	6	23.8	0
I	15.6	0	7	0	0	0	0	2	24	5	2	1	2	0	1	36	31	11	16	0	1	7	13	10	2	14	15	0	0	0	0.8	4.4	25.8	0	
II	0	0	0	0	0	0	0	5	24	2	1	1	2	2	8	58	17	5	6	0	0	5	15	11	0	14	17	0	0	0	1.2	6.8	23	0	
I	12.9	0	9.9	0	0	0	0	1	22	7	7	5	2	0	2	21	22	17	24	0	3	10	11	6	3	16	11	0	0	0	0.6	3.8	25.5	0	
II	0	0	0	0	0	0	0	3	24	3	2	3	8	6	14	46	8	4	9	0	1	9	13	7	0	17	13	0	0	0	0.6	6.5	22.9	0	
I	10	0	7.4	0.2	0	0	0	1	24	6	18	13	5	1	1	3	7	30	22	2	8	10	7	4	9	15	7	0	0	0	0.8	5.1	25.1	0	
II	0	0	0	0	0	0	0	2	26	3	2	15	38	12	9	10	3	2	9	1	5	11	9	5	5	18	8	0	0	0	0.8	11.3	18.9	0	
I	4.2	0	1.2	0.1	0	0	0	0	26	4	30	15	4	0	0	2	35	14	4	12	7	5	2	16	10	4	0	0	0	0.5	10.4	19.1	0		
II	0	0	0	0	0	0	0	3	26	1	2	19	58	10	4	2	1	0	4	2	9	10	6	3	14	12	4	0	0	0.4	20.7	8.9	0		
I	0.8	0	0	0.1	0	0	0	0	27	4	28	11	2	0	0	2	43	14	8	13	5	4	1	24	6	1	0	0	0	0.6	20.6	9.8	0		
II	0	0	0	0	0	0	0	3	27	1	1	15	60	14	6	2	0	2	4	15	8	3	1	22	8	1	0	0	0	0	23.1	7.9	0		
सर्व मजल सौदा दिनों की संख्या	78.1	0	51.7	3.6	0.1	0	0	28	287	52	11	6	3	1	2	25	16	21	15	44	89	89	84	49	125	150	87	3	0	0.4	7.7	106.3	250.3	0.3	
ANNUAL TOTAL																																			
OR MEAN																																			
NUMBER OF YEARS																																			

Table 3.7 Meteorological data at IMD Station

3.4.2 Meteorological Station at Plant Site *(Terms of Reference No. 6(i))*

The micro meteorological data at the industry site is collected simultaneously with ambient air quality monitoring. The station was installed at height of 10 meters above the ground level and the same is located in such a way that there are no obstructions facilitating free flow of wind. Wind speed, wind direction, humidity, temperature and rainfall are recorded on hourly basis. Salient features of micro meteorological data collected are as follows:

1. Wind Direction and Speed:

The hourly wind speed and wind direction observations are computed during various seasons of study period and the same are presented in **Table 3.8** and the wind rose diagrams are presented in **Figure 3.9**. The following observations can be made from the collected data;

- Calm period is observed to be 1.99 % during the time of monitoring.
- The predominant wind direction is southwest.
- Other than predominant wind directions wind was blowing in west-southwest and south-southwest.
- Mostly the wind speeds are observed to be in the range of 5-10 kmph and 10-15 kmph.

2. Temperature: (a) Maximum: 42.9 °C (b) Minimum: 18.7 °C (c) Average: 28.9 °C

3. Humidity: The daily relative humidity values are observed to range between 29 - 64%.

4. Rain Fall: (a) Maximum: 6.4 mm (b) Minimum: 0 mm (c) Mean: 0.8 mm

Table 3.8 Frequency Distribution of Wind Speeds and Wind Directions

Wind Direction	Wind Speed in kmph					Total
	Calm	1 - 5	5-10	10-15	>15	
N		0.14	0.05	0.09		0.27
NNE		0.50	0.27			0.77
NE		1.68	1.00	1.63	0.18	4.48
ENE		0.54	0.77	0.95	0.41	2.67
E		0.91	0.54	0.09	0.05	1.59
ESE		0.91	0.14			1.04
SE		0.59	0.32			0.91
SSE		1.22	0.91	0.05		2.17
S		1.63	2.90	0.18		4.71
SSW		2.17	3.53	3.08	0.63	9.42
SW		3.49	6.39	10.01	15.53	35.42
WSW		4.53	8.92	5.12	3.67	22.24
W		5.57	2.67	0.23		8.47
WNW		0.91	0.27	0.23	0.05	1.45
NW		0.68	0.23	0.09	0.09	1.09
NNW		0.32	0.63	0.23	0.14	1.31
CALM	1.99					1.99
Total	1.99	25.77	29.53	21.97	20.74	100.00

Monitoring Period: October – December 2017

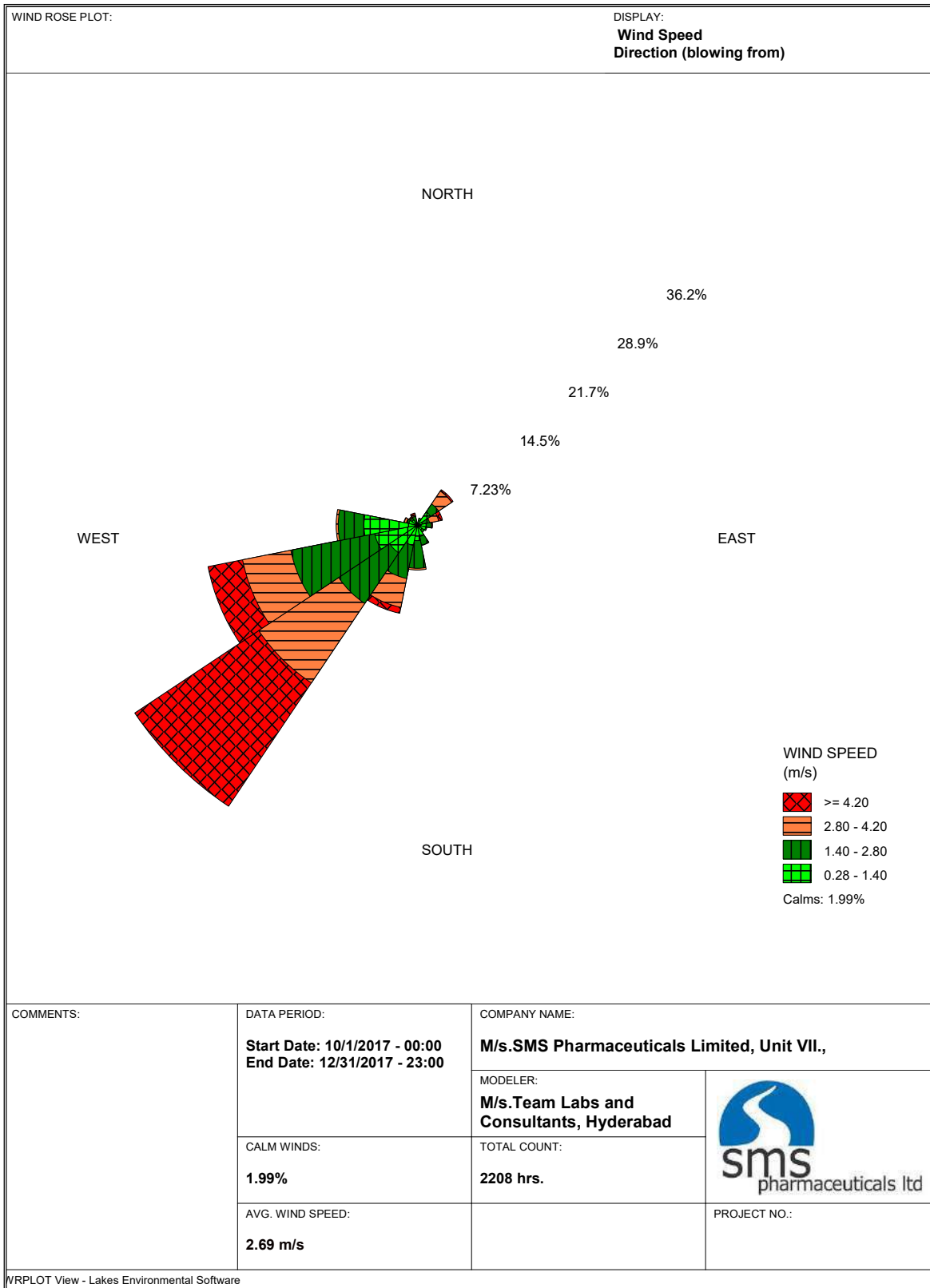


Figure 3.9 Wind Rose Diagram at Site

3.4.3 Ambient Air Quality *(Terms of Reference No. 6(ii))*

Air pollution means the presence in the outdoor atmosphere of one or more combinations thereof in such quantities and of such duration as are or may tend to be injurious to human, plant or animal life or property. Air pollutants include smoke, vapors, soot, fumes, gases, mist, odors, particulate matter, radioactive material or noxious chemicals. Air pollution produces a number of adverse effects including offensive smell, loss of atmospheric clarity, soiling of clothes, building and manufactured goods by smoke and dust. The hazards caused to man, animals, vegetation, environment and climate have been understood in the past decade. The effects of air pollution are briefly discussed below.

a) Effect on human beings

Air borne spores, pollen grains, virus, bacteria, fungi, fur and hairs cause various allergic reactions, bronchial asthma, tuberculosis and other infections. Sulphur dioxide produces drying of the mouth, scratchy throat and smarting eyes. It also causes chest constriction, headache, vomiting and death from respiratory diseases. Sulphur trioxide, Nitrogen oxide and carbon monoxide diffuse in the blood stream. They combine with haemoglobin and reduce its oxygen carrying capacity. Nitrogen oxide in high concentration impairs the functioning of lungs by causing accumulation of water in the air spaces. Hydrocarbons have been reported to cause cancer in man. Hydrogen sulphide causes nausea and irritates eyes and throat. Ammonia attacks upper respiratory passages. Ozone causes dryness of mucous membrane of the mouth, nose and throat. It changes visual capacity, causes headache, pulmonary congestion and oedema. Arsines damage red cells in blood, kidney and cause jaundice. Suspended particles like ash, soot and smoke cause eye irritation, tuberculosis and possible cancer. Fine particles of various metals present in the air cause a number of diseases. Heavy dust fall is one of the major causes of asthma, cough and other diseases of lungs and throat. Lead can damage the brain of young children and may even cause death. It affects the normal functioning of the nervous system in adults. Cadmium is a respiratory poison and may cause high blood pressure and a number of heart diseases. Asbestos fibers have been associated in chronic lung diseases.

b) Effect on animals

Air pollution causes wide spread damage to live-stock. The effect of air pollution on domestic animals living in or near industrial areas is similar to those of human beings. Live stocks ingest various fluorine compounds which fall on fodder crops causing abnormal calcification of bones and teeth. It results in lameness, loss of weight and frequent diarrhea.

c) Effect on plants

Air pollution has serious harmful effects on plants. Sulphur dioxide causes chlorosis. It results in the death of cells and tissues. Forest trees are worst affected by sulphur dioxide pollutants. Fluorides damage leafy vegetables such as lettuce and spinach. Oxides of nitrogen and fluorides reduce crop yields. Photochemical smog bleaches and blazes foliage of plants. Hydrocarbons cause premature fall of leaves and flower buds, discolouration of sepals and curling of petals. Ozone damages cereals, fruits and cotton crops. It also causes premature yellowing and shedding of leaves.

d) Effect on materials

The acid rain and photochemical smog affect metals and buildings. Acid rain pollutes the soil and water sources. Acidic products of the air pollutant cause disintegration of textile, paper. Many small industrial units and sources of locomotive pollutants have been sited to save the famous marble structure, Taj Mahal at Agra. Hydrogen sulphide decolorizes silver and lead paints. Ozone oxidizes rubber goods.

e) Aesthetic loss

Dust and smoke in the air do not allow us to have a clear view of nature's beauty and man-made objects. Smoke and foul smells emitted by factories, automobiles, dirty drains and garbage dumps make the urban life uncomfortable. Smoking in public places affects the health of not only the smoker but also the non-smoker.

f) Change in Climate

A change in the earth's climate due to atmospheric pollution is an alarming global concern. It has been observed that in the recent past, the level of CO₂ in the atmosphere

has increased from 290 ppm to 330 ppm. Approximately one fourth of this rise has occurred in the past decade. Rapid increase in population, deforestation and excessive burning of fossil fuel has been responsible for this increase. It is also predicted that this factor alone could lead to rise in global temperature, causing “Green House Effect” or “Global Warming”.

Green House effect may be defined as the progressive warming up the earth surface due to blanketing effect of man made CO₂ in the atmosphere. The thick CO₂ layer functions like the glass panel of a green house preventing re-radiation of heat to outer space. A rise of global temperature by more than 2 or 3 °C may lead to the melting of polar ice cap and glaciers. This will cause rise in ocean level and consequent flooding of costal towns and submersion of many oceanic islands. This would also affect the rainfall pattern and productivity of agricultural crops.

With proposed activity a range of different pollutants are released into the atmosphere that are dispersed and have a significant impact on neighborhood air environment. Thus collection of base line data of air environment occupies a predominant role in the impact assessment statement. The ambient air quality status across the study zone forms basis for prediction of the impacts due to the project.

The project is located at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh. The data required for assessing air quality impacts in and around neighborhood is achieved by designing such a network, which encompasses micro meteorological conditions, quantity and quality of emissions, locations, duration, resources/monitoring technology and operational criteria. The ambient air quality stations were identified considering the above factors.

3.4.4 Scope of Field Study

The scope of baseline status of the ambient air quality can be assessed through a well-designed ambient air quality stations network. . An intensive ambient air quality monitoring of the study area consisting of 10 km radius with the proposed expansion plant site as the center point was carried out during the study period of October -

December 2017. The ambient air quality was monitored at seven locations spread over entire study area. **Figure 3.10** presents the locations of nine ambient air quality-monitoring stations. At each sampling station monitoring was carried out for 24 hours in a day for 2 days a week, and for three months during post monsoon season. The parameters studied are Particulate Matter (Size Less than 10 μ m) or PM₁₀ μ g/m³, Particulate Matter (Size Less than 2.5 μ m) or PM_{2.5} μ g/m³, Sulfur dioxide and Oxides of Nitrogen. Sampling period, monitoring and analysis of the above variables is according to the guidelines of Central Pollution Control Board. HCl and VOC were also monitored additionally at all sites as major gaseous emissions from process contain HCl and SO₂, while the process operations lead to diffuse emissions of VOC. National Ambient Air Quality Standards is presented in **Table 3.9**.

Table 3.9 National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air		
		IRR	ESA	Methods of Measurement
Sulphur Dioxide (SO ₂)	Annual* 24 Hours**	50 80	20 80	Improved west and Gaeke Ultraviolet fluorescence
Nitrogen Dioxide (NO ₂)	Annual* 24 Hours**	40 80	30 80	Modified Jacob & Hochheiser (Nn-Arsenite) Chemiluminescence
Particulate Matter (Size Less than 10 μ m) or PM ₁₀	Annual* 24 Hours**	60 100	60 100	Gravimetic TOEM Beta Attenuation
Particulate Matter (Size Less than 2.5 μ m) or PM _{2.5}	Annual* 24 Hours**	40 60	40 60	Gravimetic TOEM Beta Attenuation
Ozone (O ₃)	8 hours** 1 hour**	100 180	100 180	UV Photometric Chemiluminescence Chemical Method
Lead (Pb)	Annual* 24 hours**	0.50 1.0	0.50 1.0	AAS /ICP method after sampling on EPM 2000 or equivalent filter paper ED - XRF using Teflon filter.
Carbon Monoxide (CO)	8 hours** 1 hour**	02 04	02 04	Non Dispersive Infra Red Spectroscopy
Ammonia (NH ₃)	Annual* 24 hours**	100 400	100 400	Chemiluminescence Indophenol blue method
Benzene (C ₆ H ₆)	Annual*	05	05	Gas Chromatography based continuous analyzer Absorption and Desorption followed by GC analysis
Benzo (o) Pyrene(BaP) - Particulate Phase	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis

Pollutant	Time Weighted Average	Concentration in Ambient Air		
		IRR	ESA	Methods of Measurement
only,				
Arsenic (As),	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni),	Annual*	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
IRR - Industrial, Residential, Rural and Other Area, ESA- Ecological Sensitive Area (Notified by Central Government)				
G.S.No.826 (E) dated 16 th November, 2009. Vide letter no. F. No. Q-15017/43/2007-CPW				
*Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.				
**24 hourly/8/1 hourly monitored values as applicable, shall be complied with 98 percent of the time in a year.2% of time they may be exceeded the limits but not on two consecutive days of monitoring.				

3.4.5 Description of Sampling Locations

The location of ambient air quality stations is contingent on the meteorological status of the area. Hence the micro meteorological data was collected before initiating the ambient air quality monitoring, and the stations were selected within 5 km of the project site based on wind direction. **Table 3.10** presents the ambient air quality locations and their distances and directions from the plant site.

Table 3.10 Locations of Ambient Air Quality Monitoring Stations

S.No	Location	Direction w.r.t plant site	Distance from Plant site, km
AAQ-1	Site	-	
AAQ-2	Kovvada	SW	1.2
AAQ-3	Gumpam	S	1.3
AAQ-4	Govindapuram	SE	1.8
AAQ-5	Lankalapallipalem	NE	2.7
AAQ-6	Kandivalasa	NE	2.1
AAQ-7	Kanimetta	NW	2.2
AAQ-8	Chodammaagraharam	NW	1.9

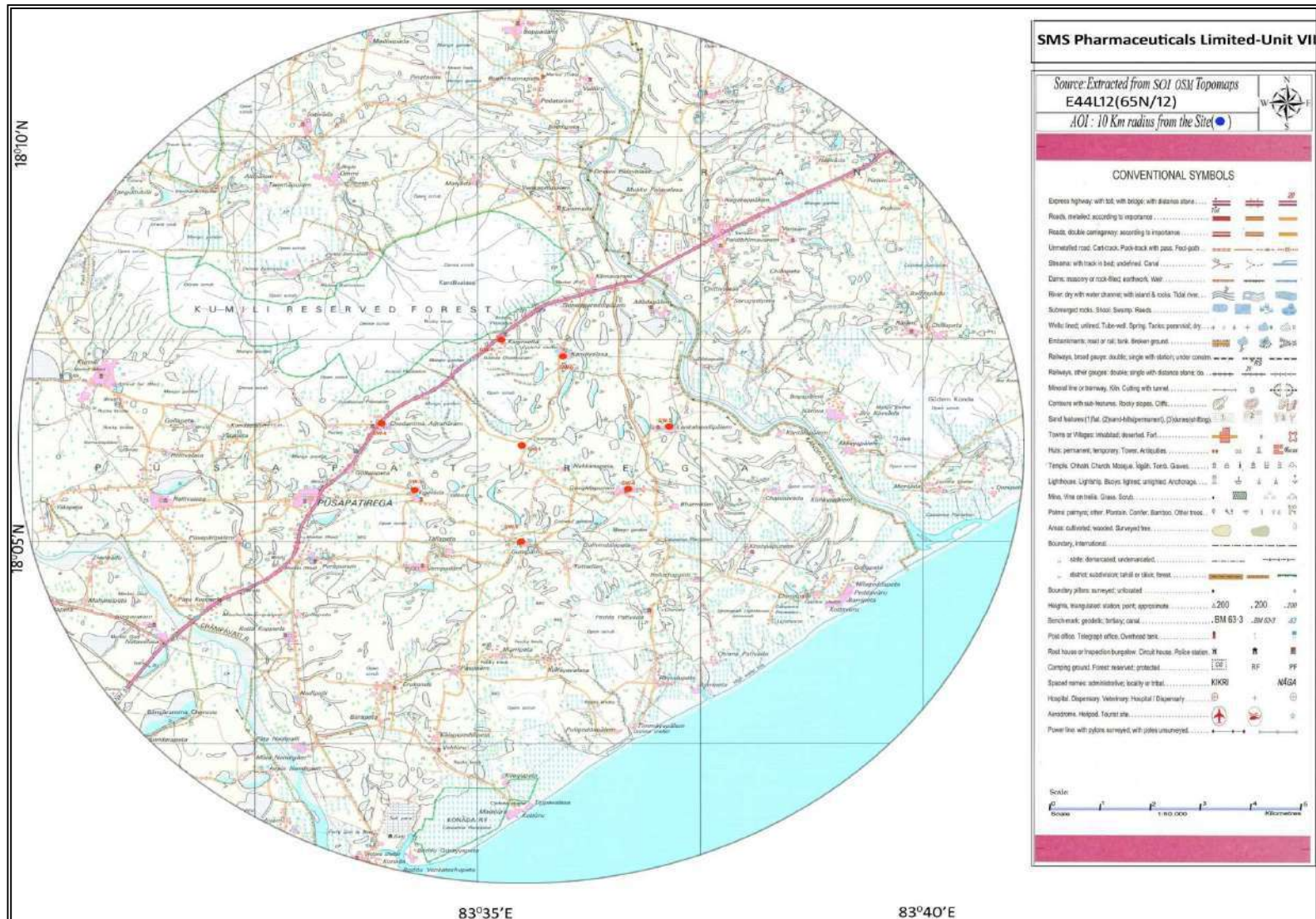


Figure 3.10 Ambient Air Quality Monitoring Locations

3.4.6 Ambient Air Quality Status *(Terms of Reference No. B. 9 & A. 19)*

The existing baseline levels with respect to Particulate Matter (Size Less than 10µm) or PM₁₀ µg/m³, Particulate Matter (Size Less than 2.5 µg/m³) or PM_{2.5} µg/m³, Sulphur dioxide and oxides of nitrogen at 8 locations are presented in **Table 3.11**. The parameters monitored at the site show the following variations; the VOC and HC values are observed below detectable limits other than site, the other parameters of NAAQ standards are found to be below detectable limits except for PM₁₀, PM_{2.5}, SO₂ and NO_x. It may be observed that the all parameters at all stations are well within the limits prescribed by Central Pollution Control Board. Graphical representation of ambient air quality is presented in **Figure 3.11**.

Table 3.11 Summary Ambient Air Quality Status
(Terms of Reference No. 6(iii), Sp. TOR 3)

Pollutant	Maximum	Minimum	Mean	98 Percentile
1) Location: Site				
PM ₁₀	53	36	45.81	56
PM _{2.5}	22	16	18.50	24
SO ₂	15	11	13.19	15
NO _x	15	11	13.08	15
VOC (in PPM)	3.2	0.3	1.8	3.0
HCl	1.7	1.1	1.3	1.6
2) Location: Kovvada				
PM ₁₀	48	33	38.23	48
PM _{2.5}	18	14	15.42	18
SO ₂	11	9	9.77	11
NO _x	11	9	9.54	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
3) Location: Gumpam				
PM ₁₀	46	34	39.04	46
PM _{2.5}	18	14	15.38	18
SO ₂	11	9	9.69	11
NO _x	11	9	9.54	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
4) Location: Govindapuram				
PM ₁₀	46	36	41.65	46
PM _{2.5}	16	14	14.92	16
SO ₂	11	9	9.96	11
NO _x	11	9	9.92	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
5) Location: Lankalapallipalem				
PM ₁₀	45	36	40.54	45

Pollutant	Maximum	Minimum	Mean	98 Percentile
PM _{2.5}	16	14	15.00	16
SO ₂	11	9	10.27	11
NO _x	11	9	10.19	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
6) Location: Kandivalasa				
PM ₁₀	46	36	39.38	46
PM _{2.5}	16	14	14.77	16
SO ₂	11	9	10.19	11
NO _x	11	10	10.50	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
7) Location: Kanimetta				
PM ₁₀	44	36	39.50	44
PM _{2.5}	16	14	14.69	16
SO ₂	11	10	10.50	11
NO _x	11	10	10.50	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL
8) Location: Chodammaagraharam				
PM ₁₀	46	36	41.31	46
PM _{2.5}	16	14	14.58	16
SO ₂	11	9	10.38	11
NO _x	11	10	10.50	11
VOC (in PPM)	BDL	BDL	BDL	BDL
HCl	BDL	BDL	BDL	BDL

- Note: Pollutant concentrations are presented in $\mu\text{g}/\text{m}^3$
- BDL: Below detectable limit
- VOC Monitoring Instrument: Photo Ionization Detector (Phocheck - Tiger S.No. T-105493).

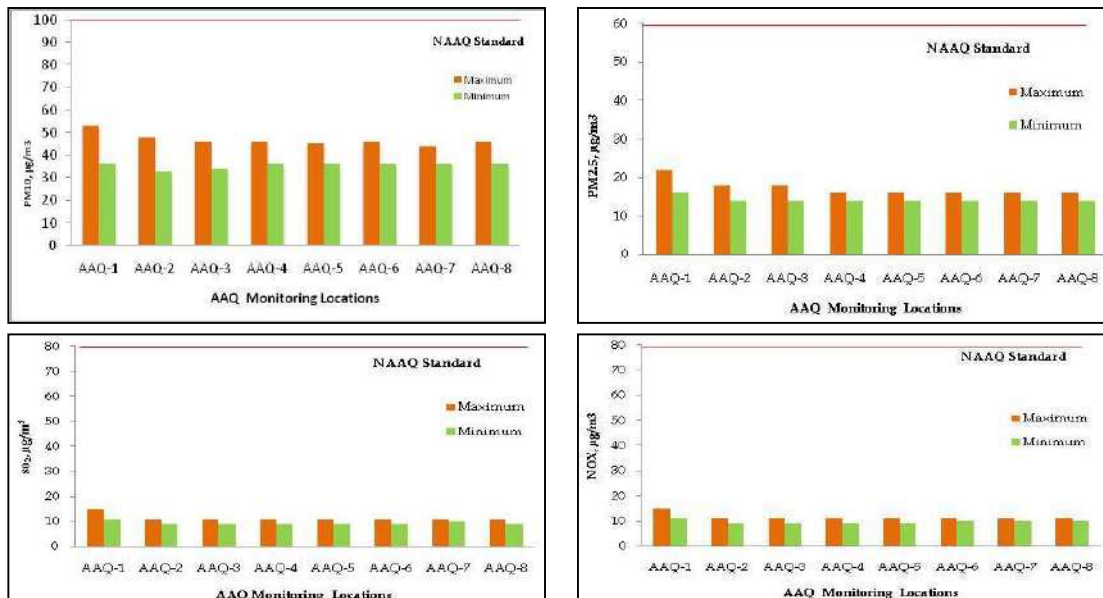


Figure 3.11 Graphs Showing the Results of Ambient Air Quality

3.4.7 Noise Environment *(Terms of Reference No. 6(vii))*

Noise is an unwanted sound without musical quality. Artificial noise and its impact on environment, grown apace with advancing human civilization. Noise pollution is equally hazardous to environment as air, water and other forms of pollution. Various noise measurement units have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common scale is, weighted decibel dB (A), and measured as the relative intensity level of one sound with respect to another sound (reference sound).

The impact of noise depends on its characteristics (instantaneous, intermittent or continuous in nature), time of day (day or night) and location of noise source. **Table 3.12** shows the effects of different noise levels on human beings. The environmental impact of noise can have several effects varying from noise induced hearing loss to annoying depending on noise levels.

The assessment of noise pollution on neighborhood environment due to the proposed plant area was carried out keeping in view, all the considerations mentioned above. The existing status of noise levels is measured at 8 locations at various locations within the study area, consisting of site area, and sensitive receptors in the respective villages like schools, anganwadi, hospitals etc. **Figure 3.12** presents noise level monitoring locations. The monitored noise levels are shown in **Table 3.13**. Noise levels are observed to be within the prescribed limits of rural and residential areas.

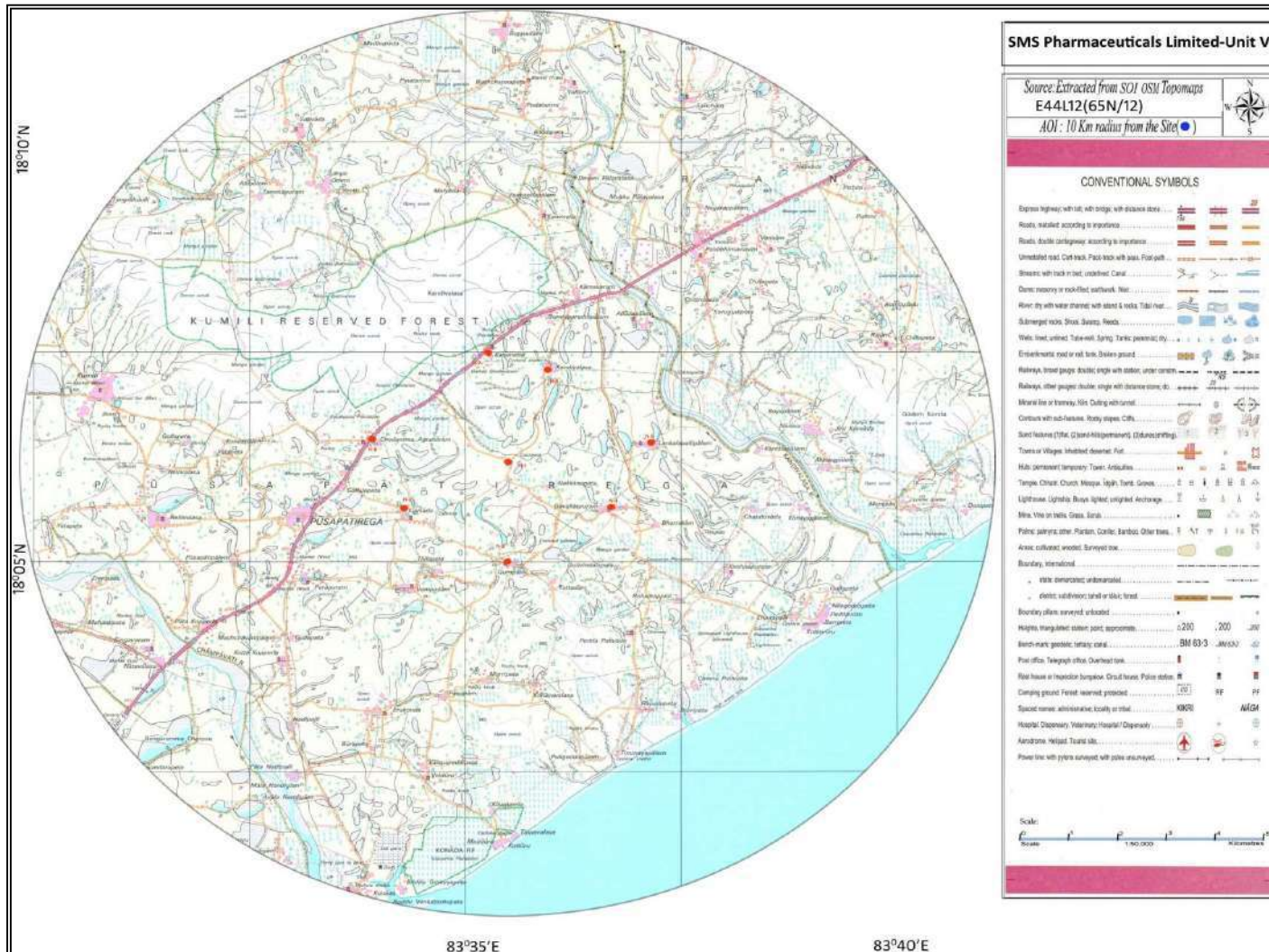


Figure 3.12 Noise Sampling Locations

Table 3.12 Effects on Human Beings at Different Noise Levels

Source	Noise Level B(A)	Effects
Large Rocket Engine (near by)	180	Threshold of Pains
Hydraulic Press (1 m)	130	
Jet take off (60 m)	120	Maximum vocal effort possible
Automobile Horn (1m)	120	
Construction Noise (3m)	110	
Jet Take off (600 m)	110	
Shout, Punch, Press, Circular Saw	100	Very annoying
Heavy Truck (15m), Farm Machinery	90	Prolonged exposure Endangers Lathes, Sports Car, Noisy Machines hearing loss
Automobile (15m)	80	Annoying
Freeway Traffic (15m)	70	Telephone is difficult, intrusive
Loud Conversations	60	
Living Room in Home	50	Quiet
Power Station (15m)	50	
Bed Room in Home	40	
Soft Whisper (5m)	30	Very quiet
Tick of Wall clock (1m)	30	
Low radio Reception	20	
Whisper	20	
Rattling of Leaves by Breeze	10	Barely audible
	0	Threshold of hearing

Table 3.13 Equivalent Noise levels in the Study Area

S.No.	Location	Equivalent Noise Levels dB(A)	
		Leq _{day}	Leq _{night}
1.	Site	55	42
2.	Kovvada	46	34
3.	Gumpam	44	33
4.	Govindapuram	47	34
5.	Lankalapallipalem	48	33
6.	Kandivalasa	48	33
7.	Kanimetta	46	33
8.	Chodammaagraharam	47	31

3.4.8 Traffic Study (Terms of Reference No. 6(ix))

Traffic study was conducted during three alternative days including a holiday to arrive at peak traffic hours. Peak traffic was observed during 8 - 9 AM consisting of mainly employee traffic by two wheelers, cars and buses passengers traffic is 114 PCU. Graphical representation of peak traffic is presented in **Figure 3.13**.

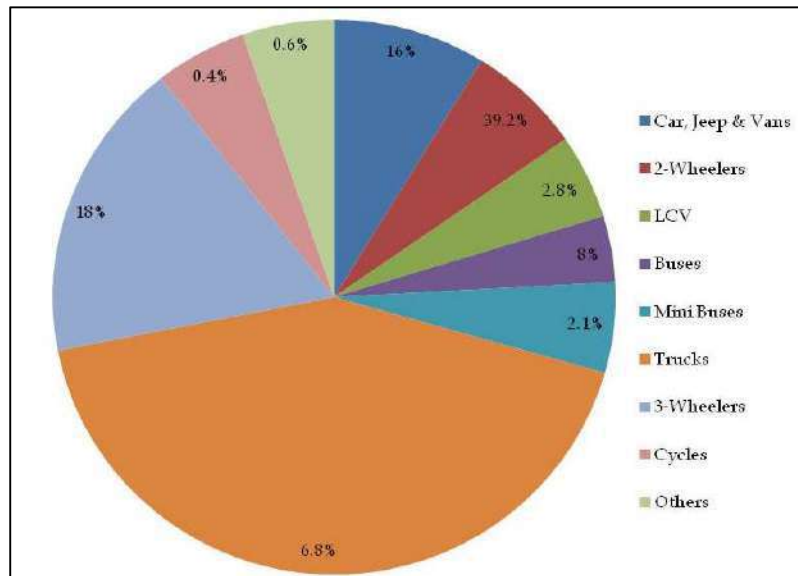


Figure 3.13 Peak Hour Traffic

3.5 Socio Economic Environment (Terms of Reference No. 6(xi))

Industrial development reflects in social development, i.e., growth in infrastructure facilities, growth in employment rates, increased demands for housing, and other amenities etc., which will have a bearing on the socio economic status.

Socio-economic survey is conducted to ascertain the existing socio-economic status to compare the same with the developments due to the project. Baseline data of demographic characteristics- occupational status, literacy, health status and the access to infrastructure facilities for social development in the project area has been studied from the secondary data collected from census department, validated by sample survey and focus group meetings by M/s. Team Labs and Consultants.

Demographic characteristics of the study area falling within 10 km radius of the project site have been compiled to assess the pre-project socio-economic status. Secondary data has been collected from various government agencies i.e., chief planning officer,

Srikakulam district and other government departments of forestry, irrigation etc., and Mandal Development Offices of the relevant government departments. Census 2011 was compiled and presented as follows;

3.6 Demography

The study area falls under the following mandals of Srikakulam district; Ranastalam and Vizianagaram district; Pusapatirega, Nellimarla in Andhra Pradesh. Study area comprises of 77 revenue villages and 16 hamlets.

3.6.1 Population Distribution

The population distribution of the study area is presented in **Table 3.14**. The population density in the study area is less reflecting the rural nature and lack of irrigation facilities. The total population of the area is 124536 consisting of 63394 males and 61142 females. The population density in this area reflects the rural area. The population of the scheduled castes is 12814 consisting of 6665 males and 6149 females, while the scheduled tribe population is 640 consisting of 325 males and 315 females, which is 10.29 and 0.51% of the total population respectively.

Table 3.14 Population Distribution - Study Area

Category	km				Total
	0-3	3-5	5-7	7-10	
Total Population	11500	13946	36810	62280	124536
Total Population - Male	5802	7150	18557	31885	63394
Total Population - Female	5698	6796	18253	30395	61142
Population <6 years	1387	1570	4654	6990	14601
Male <6 years	675	785	2311	3677	7448
Females < 6years	712	785	2343	3313	7153
Scheduled Caste Population	1311	1421	2605	7477	12814
Male - SC	677	724	1288	3976	6665
Female - SC	634	697	1317	3501	6149
Scheduled Tribe Population	16	63	354	207	640
Male - ST	9	31	174	111	325
Female - ST	7	32	180	96	315

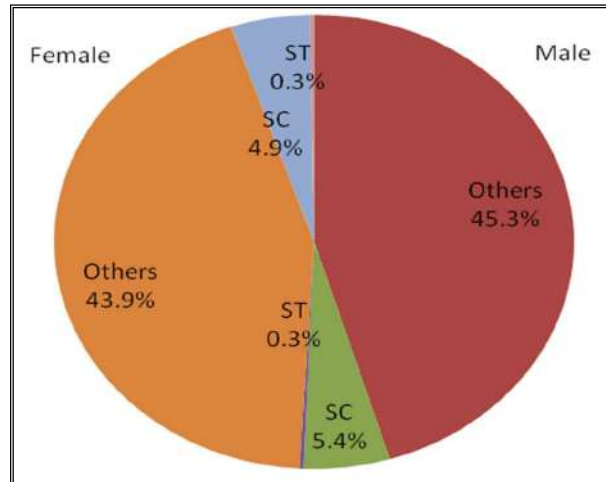


Figure 3.14 Population distribution of the Study Area

3.6.1.1 Literacy

Census operations consider a literate as a person who is above six years old and who can write and read as per the census. **Table 3.15** presents the literacy levels in the study area. The population below six years old is 14601 consisting of 7448 males and 7153 females, which is 11.72% of the study area population. The percentage of literacy level in the study area among males is 5905 and 42.56 among females of total population. It may be observed that the literacy level among females is comparatively less than males.

Table 3.15 Literacy Study Area

Category	km				Total
	0-3	3-5	5-7	7-10	
Total Population	11500	13946	36810	62280	124536
Total Population - Male	5802	7150	18557	31885	63394
Total Population - Female	5698	6796	18253	30395	61142
Population <6 years	1387	1570	4654	6990	14601
Male <6 years	675	785	2311	3677	7448
Females < 6years	712	785	2343	3313	7153
Total Literates	5408	7004	14866	28732	56010
Male -Literates	3103	4112	8660	17159	33034
Female - Literates	2305	2892	6206	11573	22976
Total Illiterates	6092	6942	21944	33548	68526
Male -Illiterate	2699	3038	9897	14726	30360
Female - Illiterate	3393	3904	12047	18822	38166

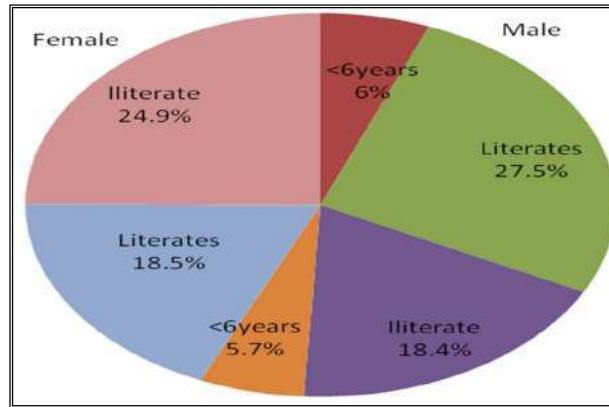


Figure 3.15 Literacy of Study Area

3.6.1.2 Employment/Occupation

Work is defined as participation in any economically productive activity – Physical/ mental. The work force is classified into three categories: a) main workers, b) marginal workers and c) non-workers. Main workers are those who work for a substantial part of the year for a living such as salaried employees, agricultural labor etc. Marginal workers are those who worked the previous year but have not worked for a substantial part of this year. Non-workers constitute students, house wives, dependents, pensioners etc. **Table 3.16** presents the population distribution for employment.

It may be observed that a majority of the study area population falls in the non worker category among 50.16 % of the total population and the marginal workers from about 10.07% of the total population. The male female difference is also significant in all the regions and in all the categories. There are few females among the workers where as there are more non workers and marginal workers among females.

Table 3.16 Employment - Study Area

Category	km				Total
	0-3	3-5	5-7	7-10	
Total Population	11500	13946	36810	62280	124536
Total Population - Male	5802	7150	18557	31885	63394
Total Population - Female	5698	6796	18253	30395	61142
Total Workers	5763	6857	18644	30809	62073
Total Workers - Male	3548	4158	11308	18352	37366
Total Workers - Female	2215	2699	7336	12457	24707
Total Main Workers	4259	5658	14798	24812	49527
Main workers - Male	3126	3817	10105	16111	33159
Main Workers - Female	1133	1841	4693	8701	16368

Total Marginal Workers	1504	1199	3846	5997	12546
Marginal Workers - Male	422	341	1203	2241	4207
Marginal Workers - Female	1082	858	2643	3756	8339
Total Non Workers	5737	7089	18166	31471	62463
Non Workers - Male	2254	2992	7249	13533	26028
Non Workers - Female	3483	4097	10917	17938	36435

The main workers are further classified into; Total cultivators: those who engage a single worker or his family member to cultivate land for payment in money, kind or share; Agricultural labor : those who work in other's lands for wages; household workers: workers involved in manufacturing and processing industries in the house hold industries; and other services; Livestock, forestry, fishing and allied activities; Workers involved in mining and quarrying; Workers involved in manufacturing and processing industries in the house hold industries; non house hold industries; construction workers; workers in trade and commerce; workers involved in transport, storage and communication ; and other services: government employees, teachers, priests, artists etc. **Table 3.17** presents the main workers distribution among the study area population. It may be observed that over 6.5% of the study area population is involved in cultivation or agriculture labor, followed by other services to the tune of 13.82%. It may also be observed that the people involved in non household industry are significantly more reflecting on the industrial nature of the area. Significant differences are observed among the male and female workers, Female workers are found to be more in agricultural activity largely due to more percentage of females being agricultural labor.

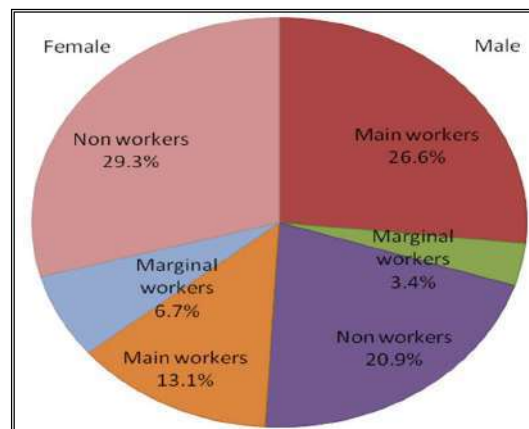


Figure 3.16 Employment - Study Area

Table 3.17 Main workers Study Area

Category	km				Total
	0-3	3-5	5-7	7-10	
Total Population	11500	13946	36810	62280	124536
Total Population – Male	5802	7150	18557	31885	63394
Total Population – Female	5698	6796	18253	30395	61142
Total Main Workers	4259	5658	14798	24812	49527
Main workers – Male	3126	3817	10105	16111	33159
Main Workers – Female	1133	1841	4693	8701	16368
Total Cultivators	1143	1056	1676	4214	8089
Cultivators – Male	838	754	1243	3080	5915
Cultivators- Female	305	302	433	1134	2174
Total Agriculture Labor	1017	1930	6929	13386	23262
Agriculture Labor – Male	534	953	3791	7123	12401
Agriculture Labor – Female	483	977	3138	6263	10861
Total Household Workers	151	124	272	423	970
Household Workers – Male	97	66	162	320	645
Household Workers – Female	54	58	110	103	325
Total Others	1948	2548	5921	6789	17206
Others – Male	1657	2044	4909	5588	14198
Others – Female	291	504	1012	1201	3008

3.6.1.3 Living Standards and Infrastructure

Sustainable development of any area is dependent not only the population but also on the availability of infrastructure which leads to better living standards. The infrastructure facilities are essential in providing education, awareness, health, communication, potable water, transport etc. The standards of living are the sum of the availability of the infrastructure to the subject community, wide variations in terms of income, economic conditions and patterns of spending.

The infrastructure facilities available in the impact zone are reflecting the rural nature of the entire study area.

I. Educational Facilities

The educational facilities available in the rural areas are meager, despite the proximity to urban area of Vizianagaram. There are 67 primary schools, 29 middle schools and 5 high schools in the study area. There is no junior college in the area. Five of the villages in the study area do not have any educational facilities. The higher educational need of the population is met by Ranastalam, Pusapatirega and Sathivada.

Vizianagaram and Srikakulam has a number of engineering colleges, PG colleges, Junior colleges and degree colleges, apart from a Maharajah's Institute of Medical Sciences, Vizianagaram and Andhra University Campus, Vizianagaram. The district capital Vizianagaram caters to the educational needs of surrounding areas as far as 70 kms.

II. Health facilities

The medical and health facilities available in the impact zone are inadequate; there are five PHC, twenty seven PHS and no child welfare centers and 1 RP centre in the entire area. The health needs of the population in this area are met by quacks and other semi qualified persons.

III. Availability of Potable Water

The entire population in this area is dependent on ground water for drinking purposes. There are no protected water supply schemes in all the villages except in 3 villages. About 14 villages in the study area are dependent on tube wells, while the remaining villages are dependent on wells and hand pumps.

IV. Transport and Communication

Transport is essentially provided by the Andhra Pradesh State Road Transport Corporation (APSRTC). Most of the study area has excellent road network in all the villages except in one village, which has kacha roads. APSRTC bus facility is available for the all the villages. However it is observed that a number of private transport vehicles are observed in the area connecting them to Vizianagaram, Ranastalam.

V. Sources of Energy and Availability

The primary source of energy in the study area is electricity, and the entire study area has electricity for agriculture and domestic purpose. The urban areas have LPG facility for their cooking purpose. A significant number of people in the urban area are also dependent on Kerosene for cooking purposes, which is contingent on the vagaries of public distribution system. A majority of the rural area is mostly dependent on Kerosene, dried cow dung cakes, wood from roadside trees for their domestic energy needs.

VI. Post and Telegraph facilities

There are 2 post offices in the area and no post and Telegraph office in the study area. Phone facilities however are extended to some of the villages.

VII. Housing

Census defines the house hold as a group of persons living together and sharing their meals from a common kitchen. The number of households in the impact zone is 31264, while the number of the houses is 30847. The density of the households is approximately five. The traditional houses made up of mud walls and covered by dry common grass and leaves of bourses are commonly found in the rural area, which are not considered pucca houses. The government has been augmenting the housing standards by constructing housing colonies for various weaker sections of the society.

3.6.2 Land Utilization

Land use patterns can be prepared on the basis of revenue records of all the villages falling within 10 km radius, though it is not an exact indicator of the actual use of the land at a given time. Land use is presented under the heads of area under forest cover irrigated land, area under cultivation and cultivable wasteland in [Table 3.18](#).

Table 3.18 Land Utilization Pattern

Category	km				Total Area, Ha
	0-3	3-5	5-7	7-10	
Land Under Miscellaneous Tree Crops etc. Area	49.3	62.62	222.78	35.65	370.35
Permanent Pastures and Other Grazing Land Area	31.55	259.96	158.75	63.31	513.57
Forest Area	0	0	501.71	392.97	894.68
Area under Non-Agricultural Uses	157.67	312.43	771.48	3380.55	4622.13
Culturable Waste Land Area	777.62	381.92	2394.21	1149.72	4703.47
Area Irrigated by Source	388.12	687.2	655.01	4647.67	6378.00
Unirrigated Land Area	955.01	1275.24	2131.19	6065.46	10426.9
Net Area Sown	1177.7	1802	2148.44	7039.1	12167.24

It may be observed that a majority of the study area is Net Area Sown, followed by Unirrigated Land Area.

3.6.3 Project Economy

The proposed expansion will provide employment to 300 people. It will be spending approximately Rs. 75.3 Lakhs of rupees every month on salaries providing bread and succor to 300 families additionally. The proposed project will also generate indirect employment to the locals during construction phase in the order of 150 people for a period of 18-24 months.

The proximity of Vizianagaram will provide access to extensive medical facilities available apart from the ESI medical facilities to the employees and their families. An industrial Canteen is established by the company.

It may be concluded that satisfactory amenities are available for the population of the impact zone, while the amenities are available either within the village or at a minimum distance of 12 km. The chemical complex has been contributing to the industrial growth of the area, which in turn; generates employment, and improve the infrastructure facilities of the area by strengthening the same economically.

3.7 Flora and Fauna *(Terms of Reference No. 6(x))*

The study was carried out in project site and in impact area i.e., 10 km periphery from the project site. The study was carried out scientifically using primary and secondary data in order to bring out factual information on the ecological conditions of the project site and its surroundings. Biological assessment of the site was done to identify the presence of any rare or endangered or endemic or threatened (REET) species of flora or fauna in the project site as well its impact area to identify whether there are any ecologically sensitive areas within the area that is likely to be impacted. The study also designed to suggest suitable mitigation measures if necessary for protection of wildlife habitats conservation of REET species if any.

Objectives of the Study

The basic objectives of the study are to evaluate the status of the flora and fauna of the project site and surrounding area with specific reference to the rare or endangered or endemic or threatened (REET) species. The study is also designed to evaluate the adverse impacts of the proposed project activity, if any and to suggest

remedial/mitigation measures in accordance with the objectives as desired by the IAIA and the Ministry of Environment, Forests and Climate Change (MOEFCC), Government of India (GOI). With these objectives in mind, the following work was undertaken by a team of experienced professionals:

Methods of study

1. Baseline data of Terrestrial and Aquatic biological environment by studying distribution pattern, community structure, population dynamics and species composition of Flora and Fauna. Secondary data is collected from various sources.
2. Areas used by protected, important or sensitive species of Flora or Fauna for breeding, nesting, foraging, resting, over wintering, migration shall be ascertained.
3. Photo documentation of the flora and fauna including local habitats showing the ecological status of the project site.
4. Discussing the predicted impacts by the proposed activity with local villagers and EIA functional area experts on air, water, noise and other pollutants.
5. Impacts quantification through vegetation analysis.
6. Preparation of the mitigation measures if applicable.

Survey Types used

1. Reconnaissance survey (Near Agricultural, water bodies, Human habitations and Road side) to list out general flora and fauna.
2. Quadrant and Line transect methods for quantification of flora.
3. Direct & indirect observations for fauna.
4. Point count method for birds near water bodies.

Methodology

A reconnaissance survey has been made randomly to observe the critical habitats to study in detail. General interviews were made with local people on native animals and medicinal plants used frequently. A thorough review was made at each sampling point and spent about 20-30 minutes at each point. The present environmental condition is observed at site area and adjoining areas.

A detailed survey of flora and fauna was carried out during the study period. Field visits are personally carried by expert members. The project details were collected from EIA coordinator and discussed the possible impacts of the project on flora and fauna. Secondary data collected from the GIS division especially the maps related to Land use

and Land cover, forest type, forest cover, villages / settlements, road, rail network etc. The total area was analyzed in detail and with GIS tools and marked around 12 sampling points by covering the various ecosystems of impact area in all the directions. Only photographs were taken during the field survey and no damage is created to flora and fauna during the sampling. Specimens were not collected and preserved.

Equipment/ Instruments deployed

- Digital Camera (NIKON P510)
- Binoculars
- GPS (Garmin)
- Measuring tape
- Field observation book & data forms

Floral study

Quadrat method has been used for carryout the study of trees, shrubs, herbs and grasses. 20 m X 20 m Quadrates for tree species, 5 m X 5 m quadrates for shrubs and 1 m X 1 m quadrates for herbs. Statistical analysis is made for 10 sampling points. Species were compared with standard floras and identifying the plants need for conservation. The status of the each species was represented by common, sporadic or rare. The data was compared with the list mentioned in red data book to check REET species.

Ecological parameters *viz.*, abundance, density, frequency, Relative abundance (RA), Relative density (RD), Relative frequency (RF), Important value index (IVI), Shannon-Wiener diversity index were derived from the quantitative primary data collected during field survey.

Importance Value Index (IVI): RD + RF + RA

Species Diversity

Shannon Diversity Index (H') has been used for estimating the diversity among the site area and adjoining areas in order to know the species richness and dominance.

$$H' = - \sum P_i \ln P_i$$

S = Number of individuals of one species

Where $P_i = \frac{S}{N}$

N = Total number of all individuals in the sample

\ln = logarithm to the base "e"

Communities with less number of species with high level of dominance or low level of uniformity will have lower diversity. Thus it is a statistical function based on the richness and evenness components. Evenness and dominance are inversely related. This can be also calculated through Statistical Software "PAST".

Faunal study

A detailed study has been carried out for faunal species by direct and indirect methods. Direct sightings were made for aves, reptiles and insects and secondary data on mammals was collected from local villagers. Bird surveys were carried out through point count method at dawn and dusk near water bodies. These techniques are accepted in EIA studies as per the EIA Notification of 2006. The species sighted were photographed and identified with standard pictorial guides. Scheduling of species was done according to Indian Wildlife Protection act (1972) and IUCN is done for each species and checked the REET species. No quantitative data was calculated as some species are listed through secondary source. As the animals were migratory, habitats used by protected, important or sensitive species for breeding, nesting, foraging, resting, over wintering, migration were ascertained.

Rationale for Survey Method

The present proposed project site is within the existing industry. The number of quadrants finalized after taking Area species curve. The wastes and other pollution related aspects are also studied to know the impacts. The landuse and land cover, hydrogeology aspects and soil factors are also considered while studying the impacts. The sampling points are taken in all the directions and ecosystems along with the wind direction pattern.

Identification of Species

Species of flora and fauna are identified through local field guides. Unidentified plants are taken pictures and later confirmed by BSI, ZSI and forest officials.

Secondary Data

List of flora and fauna from Forest Department, Previous studies for EIA and other NGOs research in the study area and local villager's information was taken into consideration while preparing the list and other parts of the report.

The species specific literature is also gathered and checked with primary data.

Flora: Forest department working plan

Within the project site the area is totally covered with small herbs and grass varieties.

The proposed project falls in

- ❖ 6D - Deccan Peninsula Deccan Plateau as per the Biogeography Classification of India.
- ❖ Hot Semi arid type as per the India's Köppen climate classification.

The vegetation of the study area falls under

- ✓ 5A: Southern tropical dry deciduous forests C3: Southern dry mixed deciduous forest;
- ✓ 6A: Southern tropical thorn forests DS1: Southern thorn scrub, 2S1: Secondary dry deciduous forest by revised classification of Indian forest types (Champion and Seth, 1968).

These types of forests are seen throughout the Eastern Ghats and few parts of Western Ghats of the country.

The proposed expansion does not require any additional land acquisition. Further no tree cutting is involved in the project site as the future expansion areas were demarcated as part of implementation of the existing project. Thus no forest Clearance is required for the proposed development. There no Scheduled species recorded within the proposed expansion areas within the existing site.

Wetland

No wetland notified under "The Ramsar Convention - 1971" or listed under "the National wetland Conservation Programme - 2009" is reported within 10 km from project boundary.

Within the Site

The preliminary studies reveal that there are more natural as well as planted species of flora inside the industry. The natural species includes Coconut, Palm trees, *Borassus*,

Neem, Ficus benghalensis, Ficus microcorpe and more number of climbers and grass species. The shrubs include *Calotropis and Datura stramonium*. Ground flora is dominant with common grass varieties. Near the plantation zone, *Cressa cretica, Ipomea prescarpe* are predominant. These two species generally occur near sea shores. *Cressa cretica* is used as medicinal plant and cultivated.

Kumili RF is at a distance of 2.6 km in northeast direction, Konada RF is at a distance of 7.6 km in southwest direction, Damarasingi RF is at a distance of 8.2 km in northwest direction. This RF is predominant of mixed trees, shrubs and various herbs. *Borassus*, coconut and *anacardium occidentale* are the most abundant invasive species in the entire area. It is followed by *Euphorbia caducifolia, Balanites aegyptiaca, Opuntia dillenii*, which could be found even in croplands and along the field bunds. Among the trees found in the core area, *Ficus religiosa, Ficus bengahalensis and Acacia nilotica* are represented by more than a couple of individuals in the entire core area while others like *Azadirachta indica, Butea monosperma, Ponagamia pinnata, Leucaena leucocephala* are represented by few plants only. It is represented by sparse thorny scrub vegetation in between the fallow agriculture land. The major part of the study area is devoid of large trees except *Azadirachta indica, Borassus and Phoenix* and mainly consists of scattered and sparse shrubs i.e. *Euphorbia caducifolia, Balanites aegyptiaca, Opuntia dillenii, Prosopis juliflora, Casia auriculata and Zizyphus numularia* the major grasses include several species of *Cyperus* and herbs such as *Euphorbia hirta, Tridax procumbance*. Within the core zone a huge number of *Anacardium species* with an average GBH of 132 cm and up to 9 m tall. In the remaining patch *Clerodndron inerme, Calotropis procera, Sida acuta, Ziziphus nummularia, Lantana camera, Parthenium histerophorus* are sporadically scattered. There are no rare or endangered or endemic or threatened (REET) plants in the core area. There are no forests or wildlife sanctuaries or biosphere reserves or nesting or breeding grounds for any of the rare species or other protected areas within the core area. The project site is not situated within or adjacent to any cultural heritage sites, protected areas, site area and adjoining area of protected areas, or special areas for protecting biodiversity. As such the area identified for the existing Cement plant site is not ecologically sensitive.

The proposed site is with manmade ecosystem with few selected trees, shrubs and herbs. Entire area is with terrestrial vegetation is without any forest or agriculture land

and it was devoid of any ecologically sensitive biological resources. There are no REET species present in the core zone. No migratory corridors or breeding grounds for faunal species present here.

The common butterflies, Honey bees, dragonflies, birds were sighted here. Within the site, certain trees such as *Polyalthia longifolia*, *Peltophorum pterocarpum*, *Azadiracta indica*, *Terminalia catappa* and *Palm trees* near the entrance and other ornamental species and hedge species raised in the site.

The faunal composition generally with arboreal and semi arboreal based animals. Some very common small animals like Squirrels, rats, skinks and lizards are generally found here. In aves, only spotted doves and blue rock pigeons are seen. Butterflies are fairly attracted to the ornamental plants and water present on grasses.



Dodonaea viscosa



Carissa spinarum



Barleria prionitis



Carissa carandas



Cressa cretica



Dactyloctenium aegyptium

Study area is mostly with human habitations, mainly non cultivable waste land. This area has few trees and shrubs with Mesophytic adaptation. The faunal composition was also estimated based on the direct and indirect evidences. *Eucalyptus globules*, *Casuarina equisetifolia*, *Thespecia populnea*, *Delonix regia*, *Dalbergia sisso*, *Pongamia pinnata* and *Polyalthia longifolia*, *Phoenix aculis*, *Borassus flabellifera*, *Azadirachta indica*, *Prosopis spicegera*, *Ficus sp*, *Acacia sp*, *Tribulus terrstris*, *Achyranthus aspera*, *Euphorbia caudifolia*, *E. tirucelli*, *Opuntia* are mainly restricted to waste and culturable waste lands. *Albizia procera*, *Albizia lebbeck*, *Delonix regia*, *Azadirchta indcia*, *Peltoforum sp.*, *Terminalia catapa*, *Psidium guava*, *Dalbergia sisso* and *Tamarindus indica* are predominant near surrounding villages.

Endemic, Threatened and Endangered Plant Species

In the floristic checklist, the study area shows rich floristic diversity. Number of floral species in the study area are 155. A good number of species are commercially cultivated in orchards. Number of plant species have medicinal value and also important for other non-timber produces. From the present survey it appears that none of the endangered plant species exist in the study area.

Vegetation structure

Trees: The most common tree species occurring are *Pongamia pinnata*, *Polyalthia longifolia*, *Albizia lebbeck*, *Bauhinia purpurea*, *Casuarina equisetifolia*, *Eucalyptus globulus*, *Bauhinia purpurea*, *Plumeria alba*, *Ficus benghalensis*, *Azadirachta indica*, *Phoenix sylvestris*, *Alstonia scholaris*, *Acacia*

auriculiformis, *Pithecellobium dulce*, *Caesalpinia pulcherrima*, *Ficus microcape*, *Grewia hirsuta*, *Peltophorum pterocarpum*, *Anacardium occidentale* and *Bambusa arundinacea*.

Shrubs: The most common shrubs are *Lantana camera*, *Hyptis suaveolens*, *Cassia auriculata*, *Calotropis procera*, *Prosopis juliflora*, *Acacia leucocephala*, *Catunaregam spinosa*, *Caesalpinia bonducella*, *Canthium parviflorum*, *Carissa carandas*, *Capparis sepiaria*, *Celastrus paniculata*.

Herbs: The most common herbs are *Tridax procumbens*, *Cassia occidentalis*, *Crotan bonplantianum*, *Datura metel*, *Eclipta alba*, *Boerhavia diffusa*, *Tephrocia purpuria*, *Achyranthes aspera*. *Cassia tora*, *Abutilon indicum* *Ipomoea macrantha*

Climbers: The commonly seen climbers are *Capparis horrida* *Abrus precatorius*, *Hemidesmus indicus*, *Clitoria ternatea*, *Cuscuta reflexa*, *Desmodium triflorum*, *Pergularia daemia*, *Desrris scandans*, *Hemidesmus indicus*, *Ipomoea pes-caprae*, *Ipomoea nil*, *Ipomoea macrantha*, *Mucuna pruriens*, *Evolvulous alsinoides*, *Gloriosa superba*.

Grasses: The common grass species are *Chloris barbata*, *Cyperus castaneus*, and *Cynodon dactylon* *Dactyloctenium aegyptium*, *Digitaria ciliaris*, *Eragrostis tenella*, *Fimbristylis cymosa*, *Ilaloipsis binata* and *Imperata cylindrica*.

Table 3.19 List of Floral Species (* primary data)

S.No	Scientific Name	Family	Habit	Status
1*	<i>Acacia auriculiformis</i>	Leguminosae	Tree	Common
2*	<i>Acacia chundra</i>	Mimosaceae	Tree	Common
3*	<i>Acacia leucophloea</i>	Leguminosae	Tree	Common
4	<i>Acacia nilotica</i>	Leguminosae	Tree	Common
5*	<i>Acacia pennata</i>	Leguminosae	Tree	Common
6	<i>Ailanthus excelsa</i>	Simaroubaceae	Tree	Rare
7*	<i>Ailanthus triphysa</i>	Simaroubaceae	Tree	Rare
8	<i>Alangium salviifolium</i>	Cornaceae	Tree	Rare
9*	<i>Albizia amara</i>	Leguminosae	Tree	Common
10	<i>Albizia lebbeck</i>	Leguminosae	Tree	Common
11*	<i>Alstonia scholaris</i>	Apocynaceae	Tree	Common
12*	<i>Anacardium occidentale</i>	Anacardiaceae	Tree	Common
13*	<i>Annona squamosa</i>	Annonaceae	Tree	Common
14	<i>Antidesma diandrum</i>	Euphorbiaceae	Tree	Common
15*	<i>Artocarpus heterophyllus</i>	Moraceae	Tree	Common
16	<i>Atlantia monophilla</i>	Rutaceae	Tree	Common
17*	<i>Azadirachta indica</i>	Meliaceae	Tree	Common
18	<i>Bambusa arundinacea</i>	Poaceae	Tree	Common
19*	<i>Barringtonia acutangula</i>	Barringtoniaceae	Tree	Common
20	<i>Bauhinia purpurea</i>	Leguminosae	Tree	Common
21*	<i>Bauhinia racemosa</i>	Leguminosae	Tree	Common
22*	<i>Bauhinia retusa</i>	Leguminosae	Tree	Sparse

S.No	Scientific Name	Family	Habit	Status
23*	<i>Bauhinia variegata</i>	Leguminosae	Tree	Sparse
24*	<i>Borassus flabellifer</i>	Arecaceae	Tree	Common
25*	<i>Bridelia tomentosa</i>	Euphorbiaceae	Tree	Common
26	<i>Butea monosperma</i>	Leguminosae	Tree	Sparse
27*	<i>Caesalpinia pulcherrima</i>	Fabaceae	Tree	Common
28	<i>Canthium dicocum</i>	Rubiaceae	Tree	Sparse
29*	<i>Cassia fistula</i>	Leguminosae	Tree	Common
30	<i>Cassia siamea</i>	Leguminosae	Tree	Common
31	<i>Casuarina equisetifolia</i>	Casuarinaceae	Tree	Common
32	<i>Cedreala toona</i>	Meliaceae	Tree	Rare
33	<i>Ceiba pentandra</i>	Malvaceae	Tree	Common
34	<i>Chloroxylon swietenia</i>	Meliaceae	Tree	Sparse
35*	<i>Cipadessa fruticosa</i>	Meliaceae	Tree	Rare
36*	<i>Cocos nucifera</i>	Arecaceae	Tree	Common
37*	<i>Cordia myxa</i>	Ehretiaceae	Tree	Rare
38*	<i>Cretaeva religiosa</i>	Capparidaceae	Tree	Rare
39	<i>Dalbergia paniculata</i>	Leguminosae	Tree	Common
40*	<i>Dalbergia sissoo</i>	Leguminosae	Tree	Common
41	<i>Dalbergia spinosa</i>	Leguminosae	Tree	Common
42	<i>Delonix regia</i>	Leguminosae	Tree	Common
43*	<i>Dichrostachys cinerea</i>	Leguminosae	Tree	Sparse
44*	<i>Diospyrous clyloroxylon</i>	Ebenaceae	Tree	Sparse
45*	<i>Diospyrous crispera</i>	Ebenaceae	Tree	Sparse
46*	<i>Diospyrous ferrea</i>	Ebenaceae	Tree	Sparse
47	<i>Diospyrous montana</i>	Ebenaceae	Tree	Sparse
48	<i>Diospyrous sylvatica</i>	Ebenaceae	Tree	Sparse
49*	<i>Elaeodendron glaucum</i>	Celastraceae	Tree	Rare
50*	<i>Erythroxyton monogynum</i>	Linaceae	Tree	Sparse
51*	<i>Eucalyptus globulus</i>	Myrtaceae	Tree	Common
52*	<i>Ficus benghalensis</i>	Moraceae	Tree	Common
53*	<i>Ficus hispida</i>	Moraceae	Tree	Sparse
54	<i>Ficus microcape</i>	Moraceae	Tree	Common
55	<i>Ficus racemosa</i>	Moraceae	Tree	Common
56*	<i>Ficus religiosa</i>	Moraceae	Tree	Common
57	<i>Ficus retusa</i>	Moraceae	Tree	Common
58*	<i>Ficus tomentosa</i>	Moraceae	Tree	Rare
59	<i>Ficus tsiela</i>	Moraceae	Tree	Rare
60*	<i>Garcinia spicata</i>	Clusiaceae	Tree	Rare
61	<i>Gmelina arborea</i>	Lamiaceae	Tree	Sparse
62	<i>Gmelina asiatica</i>	Verbenaceae	Tree	Sparse
63*	<i>Grewia hirsuta</i>	Tiliaceae	Tree	Common
64	<i>Grewia laevigata</i>	Tiliaceae	Tree	Common
65	<i>Grewia pilosa</i>	Tiliaceae	Tree	Common
66*	<i>Grewia tiliaefolia</i>	Tiliaceae	Tree	Common
67*	<i>Gymnosporia spinosa</i>	Celastraceae	Tree	Sparse
68*	<i>Helectres isora</i>	Sterculiaceae	Tree	Sparse
69	<i>Holarrhena antidysenterica</i>	Apocynaceae	Tree	Sparse
70	<i>Hymenodycton excelsum</i>	Rubiaceae	Tree	Sparse

S.No	Scientific Name	Family	Habit	Status
71	<i>Lannea coromandalica</i>	Anacardiaceae	Tree	Common
72*	<i>Leucaena leucocephala</i>	Leguminosae	Tree	Common
73*	<i>Limonia acidissima</i>	Rutaceae	Tree	Sparse
74*	<i>Mangifera indica</i>	Anacardiaceae	Tree	Common
75*	<i>Manikera hexandra</i>	Sapotaceae	Tree	Common
76	<i>Mimosops elangi</i>	Sapotaceae	Tree	Common
77	<i>Morinda tinctoria</i>	Rubiaceae	Tree	Common
78*	<i>Moringa oleifera</i>	Moringaceae	Tree	Common
79	<i>Murraya paniculata</i>	Rutaceae	Tree	Common
80*	<i>Nerium odoratum</i>	Apocynaceae	Tree	Common
81	<i>Ochna jabotapita</i>	Ochnaceae	Tree	Sparse
82*	<i>Peltophorum pterocarpum</i>	Leguminosae	Tree	Common
83*	<i>Petrospermum suberifolium</i>	Sterculiaceae	Tree	Rare
84*	<i>Phoenix sylvestris</i>	Arecaceae	Tree	Common
85*	<i>Phyllanthus emblica</i>	Phyllanthaceae	Tree	Sparse
86	<i>Pithecellobium dulce</i>	Leguminosae	Tree	Common
87*	<i>Plumeria alba</i>	Apocynaceae	Tree	Common
88*	<i>Plumeria rubra</i>	Apocynaceae	Tree	Sparse
89	<i>Polyalthia cerasoides</i>	Annonaceae	Tree	Rare
90	<i>Polyalthia longifolia</i>	Annonaceae	Tree	Common
91*	<i>Pongamia pinnata</i>	Leguminosae	Tree	Common
92*	<i>Prosopis chilensis</i>	Leguminosae	Tree	Common
93*	<i>Prosopis juliflora</i>	Leguminosae	Tree	Sparse
94*	<i>Pterocarpus marsupium</i>	Leguminosae	Tree	Sparse
95	<i>Pterolobium indicum</i>	Caesalpinaceae	Tree	Sparse
96*	<i>Samanea saman</i>	Sapindaceae	Tree	Common
97	<i>Sapindus emarginatus</i>	Sapindaceae	Tree	Common
98*	<i>Semecarpus anacardium</i>	Anacardiaceae	Tree	Sparse
99*	<i>Spondias mangifera</i>	Anacardiaceae	Tree	Sparse
100	<i>Streblus asper</i>	Moraceae	Tree	Sparse
101	<i>Syzygium cumini</i>	Myrtaceae	Tree	Common
102*	<i>Tamarindus indica</i>	Leguminosae	Tree	Common
103	<i>Tecoma stans</i>	Bignoniaceae	Tree	Common
104*	<i>Tectona grandis</i>	Lamiaceae	Tree	Common
105	<i>Terminalia arjuna</i>	Combretaceae	Tree	Common
106*	<i>Terminalia bellarica</i>	Combretaceae	Tree	Common
107*	<i>Terminalia catappa</i>	Combretaceae	Tree	Sparse
108*	<i>Terminalia chebula</i>	Combretaceae	Tree	Common
109	<i>Thespesia populnea</i>	Malvaceae	Tree	Common
110*	<i>Vitex negundo</i>	Verbenaceae	Tree	Sparse
111*	<i>Wrightia tinctoria</i>	Apocynaceae	Tree	Sparse
112*	<i>Ziziphus mauritiana</i>	Rhamnaceae	Tree	Common
113	<i>Ziziphus xylopyrus</i>	Rhamnaceae	Tree	Common
114*	<i>Acacia intsia</i>	Mimosodeae	Shrub	Rare
115*	<i>Acanthus ilicifolius</i>	Acanthaceae	Shrub	Sparse
116*	<i>Agave americana</i>	Asparagaceae	Shrub	Sparse
117*	<i>Caesalpinia bonducella</i>	Caesalpinaceae	Shrub	Common
118*	<i>Calotropis procera</i>	Apocynaceae	Shrub	Common

S.No	Scientific Name	Family	Habit	Status
119*	<i>Canthium parviflorum</i>	Rubiaceae	Shrub	Sparse
120	<i>Capparis sepiaria</i>	Capparidaceae	Shrub	Sparse
121*	<i>Carissa carandas</i>	Apocynaceae	Shrub	Common
122	<i>Carissa spinarum</i>	Apocynaceae	Shrub	Common
123	<i>Casearia tomentosa</i>	Flacourtiaceae	Shrub	Rare
124*	<i>Cassia auriculata</i>	Leguminosae	Shrub	Common
125	<i>Celastrus paniculata</i>	Celastraceae	Shrub	Sparse
126*	<i>Clerodendrum infortunatum</i>	Verbenaceae	Shrub	Sparse
127*	<i>Dodonaea viscosa</i>	Sapindaceae	Shrub	Common
128*	<i>Euphorbia cactus</i>	Euphorbiaceae	Shrub	Common
129	<i>Euphorbia lactea</i>	Euphorbiaceae	Shrub	Common
130	<i>Euphorbia nivulia</i>	Euphorbiaceae	Shrub	Sparse
131	<i>Euphorbia tirucalli</i>	Euphorbiaceae	Shrub	Common
132*	<i>Euphorbia trigona</i>	Euphorbiaceae	Shrub	Common
133	<i>Flacourtia ramontchi</i>	Flacourtiaceae	Shrub	Common
134*	<i>Flacourtia sepiaria</i>	Fabaceae	Shrub	Common
135*	<i>Glycosmis pentaphylla</i>	Rutaceae	Shrub	Common
136	<i>Hugonia mystax</i>	Linaceae	Shrub	Common
137*	<i>Ipomoea carnea</i>	Convolvulaceae	Shrub	Common
138*	<i>Ixora coccinea</i>	Rubiaceae	Shrub	Sparse
139*	<i>Jasminum cuspidatum</i>	Oleaceae	Shrub	Sparse
140	<i>Jasminum roxburghianum</i>	Oleaceae	Shrub	Common
141*	<i>Jatropha glandulifera</i>	Euphorbiaceae	Shrub	Sparse
142*	<i>Lantana camara</i>	Verbenaceae	Shrub	Common
143*	<i>Memecylon edule</i>	Melastromaceae	Shrub	Rare
144*	<i>Mimosa pudica</i>	Mimosodeae	Shrub	Sparse
145*	<i>Opuntia dillenii</i>	Cactaceae	Shrub	Common
146	<i>Opuntia elatior</i>	Cactaceae	Shrub	Common
147*	<i>Pandanus fascicularis</i>	Pandanaceae	Shrub	Rare
148	<i>Parkinsonia aculeata</i>	Leguminosae	Shrub	Rare
149	<i>Pavetta indica</i>	Rubiaceae	Shrub	Sparse
150*	<i>Randia dumetorum</i>	Rubiaceae	Shrub	Common
151	<i>Randia malabarica</i>	Rubiaceae	Shrub	Common
152*	<i>Salvadora persica</i>	Salvadoraceae	Shrub	Sparse
153	<i>Tarenna asiatica</i>	Rubiaceae	Shrub	Sparse
154*	<i>Vernonia divergens</i>	Asteraceae	Shrub	Sparse
155*	<i>Xanthium indicum</i>	Asteraceae	Shrub	Rare
156*	<i>Xanthium strumarium</i>	Asteraceae	Shrub	Rare
157	<i>Ziziphus oenopolia</i>	Rhamnaceae	Shrub	Common
158	<i>Ammannia baccifera</i>	Lythraceae	Hydrophyte	Common
159	<i>Aponogeton natans</i>	Aponogetonaceae	Hydrophyte	Sparse
160*	<i>Azolla pinnata</i>	Salviniaceae	Hydrophyte	Common
161	<i>Eichornia crassipes</i>	Pontederiaceae	Hydrophyte	Sparse
162	<i>Hydrilla verticillata</i>	Hydrocharitaceae	Hydrophyte	Common
163*	<i>Ipomoea aquatica</i>	Convolvulaceae	Hydrophyte	Rare
164*	<i>Lemna minor</i>	Araceae	Hydrophyte	Common
165	<i>Limnophila</i>	Plantaginaceae	Hydrophyte	Rare
166	<i>Marsilea quadrifolia</i>	Marsileaceae	Hydrophyte	Common

S.No	Scientific Name	Family	Habit	Status
167*	<i>Nelumbo nucifera</i>	Nelumbonaceae	Hydrophyte	Common
168	<i>Neptunia oleracea</i>	Leguminosae	Hydrophyte	Sparse
169	<i>Nymphaea pubescens</i>	Nymphaeaceae	Hydrophyte	Rare
170	<i>Nymphoides hydrophylla</i>	Menyanthaceae	Hydrophyte	Rare
171*	<i>Operculina turpethum</i>	Convolvulaceae	Hydrophyte	Common
172*	<i>Pistia</i>	Araceae	Hydrophyte	Common
173*	<i>Typha angustata</i>	Typhaceae	Hydrophyte	Common
174	<i>Vallisneria</i>	Hydrocharitaceae	Hydrophyte	Sparse
175*	<i>Abutilon indicum</i>	Malvaceae	Herb	Common
176*	<i>Acalypha indica</i>	Euphorbiaceae	Herb	Common
177*	<i>Achyranthes aspera</i>	Amaranthaceae	Herb	Common
178*	<i>Aerva lanata</i>	Amaranthaceae	Herb	Common
179	<i>Ageratum conyzoides</i>	Asteraceae	Herb	Sparse
180*	<i>Alternanthera sessilis</i>	Amaranthaceae	Herb	Common
181	<i>Alysicarpus heterophyllus</i>	Fabaceae	Herb	Rare
182	<i>Amaranthus spinosus</i>	Amaranthaceae	Herb	Common
183	<i>Amaranthus viridis</i>	Amaranthaceae	Herb	Common
184*	<i>Argemone mexicana</i>	Papaveraceae	Herb	Common
185	<i>Barleria prionitis</i>	Acanthaceae	Herb	Sparse
186*	<i>Blepharis maderaspatensis</i>	Acanthaceae	Herb	Common
187	<i>Blumea mollis</i>	Asteraceae	Herb	Common
188	<i>Boerhavia diffusa</i>	Nyctaginaceae	Herb	Common
189	<i>Boerhavia erecta</i>	Nyctaginaceae	Herb	Common
190	<i>Caralluma umbellata</i>	Apocynaceae	Herb	Sparse
191*	<i>Cassia occidentalis</i>	Leguminosae	Herb	Common
192	<i>Cassia tora</i>	Leguminosae	Herb	Common
193*	<i>Catharanthus roseus</i>	Apocynaceae	Herb	Sparse
194*	<i>Cleome viscosa</i>	Cleomaceae	Herb	Common
195*	<i>Colius aromaticus</i>	Lamiaceae	Herb	Sparse
196	<i>Commelina benghalensis</i>	Commelinaceae	Herb	Common
197	<i>Corchorus trilocularis</i>	Malvaceae	Herb	Sparse
198*	<i>Cressa cretica</i>	Convolvulaceae	Herb	Common
199	<i>Crotalaria retusa</i>	Leguminosae	Herb	Sparse
200	<i>Crotalaria verrucosa</i>	Leguminosae	Herb	Common
201*	<i>Croton bonplandianus</i>	Euphorbiaceae	Herb	Common
202*	<i>Datura metel</i>	Solanaceae	Herb	Rare
203*	<i>Datura stramonium</i>	Solanaceae	Herb	Common
204*	<i>Eclipta alba</i>	Asteraceae	Herb	Sparse
205*	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb	Common
206*	<i>Euphorbia pulcherima</i>	Euphorbiaceae	Herb	Rare
207	<i>Hyptis suaveolens</i>	Lamiaceae	Herb	Common
208*	<i>Indigofera linnaei</i>	Leguminosae	Herb	Sparse
209	<i>Leucas aspera</i>	Lamiaceae	Herb	Common
210	<i>Leucas cephalotes</i>	Lamiaceae	Herb	Rare
211	<i>Ludwigia perennis</i>	Onagraceae	Herb	Common
212*	<i>Mimosa pudica</i>	Leguminosae	Herb	Sparse
213	<i>Mollugo cerviana</i>	Molluginaceae	Herb	Rare
214	<i>Mollugo nudicaulis</i>	Molluginaceae	Herb	Common

S.No	Scientific Name	Family	Habit	Status
215*	<i>Ocimum sanctum</i>	Lamiaceae	Herb	Common
216*	<i>Oldenlandia umbellata</i>	Rubiaceae	Herb	Sparse
217	<i>Oxalis corniculata</i>	Oxalidaceae	Herb	Sparse
218*	<i>Parthenium hysterophorus</i>	Asteraceae	Herb	Common
219*	<i>Pavonia zeylanica</i>	Malvaceae	Herb	Sparse
220	<i>Pedaliium murex</i>	Pedaliaceae	Herb	Common
221*	<i>Phyllanthus amarus</i>	Phyllanthaceae	Herb	Common
222	<i>Phyllanthus virgatus</i>	Phyllanthaceae	Herb	Rare
223	<i>Physalis minima</i>	Solanaceae	Herb	Sparse
224	<i>Portulaca quadrifida</i>	Portulacaceae	Herb	Common
225	<i>Rhynchosia beddomei</i>	Leguminosae	Herb	Sparse
226*	<i>Salicornia brachiata</i>	Chenopodiaceae	Herb	Common
227*	<i>Sesamum alatum</i>	Pedaliaceae	Herb	Common
228*	<i>Sida acuta</i>	Malvaceae	Herb	Common
229*	<i>Sida cordifolia</i>	Malvaceae	Herb	Common
230*	<i>Sida spinosa</i>	Malvaceae	Herb	Sparse
231*	<i>Solanum nigrum</i>	Solanaceae	Herb	Common
232*	<i>Solanum surattense</i>	Solanaceae	Herb	Common
233*	<i>Spermacoce stricta</i>	Rubiaceae	Herb	Sparse
234	<i>Sphaeranthus indicus</i>	Asteraceae	Herb	Sparse
235	<i>Striga angustifolia</i>	Orobanchaceae	Herb	Sparse
236*	<i>Trichodesma indicum</i>	Boraginaceae	Herb	Rare
237*	<i>Tridax procumbens</i>	Asteraceae	Herb	Common
238*	<i>Triumfetta pentandra</i>	Malvaceae	Herb	Sparse
239*	<i>Urena lobata</i>	Malvaceae	Herb	Common
240*	<i>Waltheria indica</i>	Malvaceae	Herb	Sparse
241*	<i>Zizyphus nummularia</i>	Rhamnaceae	Herb	Common
242	<i>Andropogon contortus</i>	Poaceae	Grass	Common
243*	<i>Aristida setacea</i>	Poaceae	Grass	Common
244*	<i>Brachiaria eruciformis</i>	Poaceae	Grass	Common
245	<i>Chloris barbata</i>	Poaceae	Grass	Common
246*	<i>Chrysopogon montanus</i>	Poaceae	Grass	Common
247	<i>Cymbopogon citratus</i>	Poaceae	Grass	Sparse
248	<i>Cymbopogon martini</i>	Poaceae	Grass	Sparse
249*	<i>Cyperus flavidus</i>	Cyperaceae	Grass	Common
250*	<i>Cyperus rotundus</i>	Cyperaceae	Grass	Common
251*	<i>Dactyloctenium aegyptium</i>	Poaceae	Grass	Rare
252*	<i>Digitaria ciliaris</i>	Poaceae	Grass	Common
253*	<i>Eragrostis tenella</i>	Poaceae	Grass	Rare
254	<i>Fimbristylis cymosa</i>	Cyperaceae	Grass	Common
255*	<i>Ilaloipsis binata</i>	Poaceae	Grass	Common
256*	<i>Imperata cylindrica</i>	Poaceae	Grass	Common
257*	<i>Ischaemum pilosum</i>	Poaceae	Grass	Common
258*	<i>Phragmites karka</i>	Poaceae	Grass	Common
259	<i>Saccharum spontaneum</i>	Poaceae	Grass	Common
260	<i>Schima nervosum</i>	Poaceae	Grass	Common
261*	<i>Spinifex littoreus</i>	Poaceae	Grass	Common
262	<i>Trachys muricata</i>	Poaceae	Grass	Sparse

S.No	Scientific Name	Family	Habit	Status
263*	<i>Zizania latifolia</i>	Poaceae	Grass	Common
264	<i>Abrus precatorius</i>	Leguminosae	Climber	Common
265	<i>Aristolochia bracteata</i>	Aristolochiaceae	Climber	Rare
266*	<i>Asparagus racemosus</i>	Asparagaceae	Climber	Sparse
267	<i>Capparis horrida</i>	Capparidaceae	Climber	Common
268*	<i>Cardiospermum halicacabum</i>	Sapindaceae	Climber	Rare
269*	<i>Cissus quadrangularis</i>	Vitaceae	Climber	Common
270*	<i>Cissus quadrangularis</i>	Vitaceae	Climber	Sparse
271*	<i>Clitoria ternatea</i>	Leguminosae	Climber	Common
272*	<i>Coccinia grandis</i>	Cucurbitaceae	Climber	Rare
273*	<i>Cuscuta reflexa</i>	Cuscutaceae	Climber	Common
274	<i>Desmodium triflorum</i>	Leguminosae	Climber	Common
275	<i>Desrris scandans</i>	Fabaceae	Climber	Common
276*	<i>Dioscorea hispida</i>	Dioscoreaceae	Climber	Rare
277	<i>Evolvulus alsinoides</i>	Convolvulaceae	Climber	Common
278*	<i>Gloriosa superba</i>	Liliaceae	Climber	Rare
279*	<i>Hemidesmus indicus</i>	Asclepiadaceae	Climber	Common
280	<i>Ichnocarpus frutescens</i>	Liliaceae	Climber	Rare
281*	<i>Ipomoea hederifolia</i>	Convolvulaceae	Climber	Rare
282	<i>Ipomoea macrantha</i>	Convolvulaceae	Climber	Common
283	<i>Ipomoea nil</i>	Convolvulaceae	Climber	Common
284	<i>Ipomoea obscura</i>	Convolvulaceae	Climber	Common
285	<i>Ipomoea pes-caprae</i>	Convolvulaceae	Climber	Common
286*	<i>Leptadenia reticulata</i>	Asclepiadaceae	Climber	Sparse
287	<i>Luffa cylindrica</i>	Cucurbitaceae	Climber	Rare
288	<i>Merremia tridentata</i>	Convolvulaceae	Climber	Rare
289*	<i>Mimisa rubicailis</i>	Mimosaceae	Climber	Common
290*	<i>Mucuna pruriens</i>	Fabaceae	Climber	Sparse
291*	<i>Oxystelma esculentum</i>	Apocynaceae	Climber	Sparse
292	<i>Pergularia daemia</i>	Apocynaceae	Climber	Common
293*	<i>Plumbago zeylanica</i>	Plumbaginaceae	Climber	Rare
294	<i>Smilax zylanicum</i>	Smilacaceae	Climber	Rare
295*	<i>Tinospora cardifolia</i>	Minispermaceae	Climber	Rare
296*	<i>Vanda tessellata</i>	Orchidaceae	Climber	Sparse

Fauna within study area

There common mongoose, Squirrels are sighted apart from few reptilian species. From the secondary source (local people working in the plant) it is also revealed that presence of jackals and snakes exists here.

Avifaunal diversity

Common bird species such as Herons, Paddy egrets, Green bee eaters, Indian rollers, Parakeets, White headed babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows are sighted here.

List of Mammals

S.No.	Scientific Name	Common Name	WPA Status	IUCN
1	<i>Bendicota bengalensis</i>	Indian mole rat		LC
2	<i>Bendicota indica</i>	Bandicoot rat		LC
3	<i>Mus booduga</i>	Little Indian Field mouse		LC
4	<i>Mus musculus</i>	House Mouse		LC
5	<i>Rattus rattus</i>	House rat		LC
6	<i>Cynopterus sphinx</i>	Short-Nosed Fruit Bat	Schedule V	LC
7	<i>Rousettus leschnaulti</i>	Fruit bat	Schedule V	
8	<i>Funambulus palmarum</i>	Three striped palm squirrel		LC
9	<i>Herpestes edwardsii</i>	Indian grey Mongoose	Part II of Schedule II	LC
10	<i>Sus scrofa</i>	Wild pig		
11	<i>Felis chaus</i>	Jungle cat		LC
12	<i>Viverricula indica</i>	Civet Cat		LC
13	<i>Vulpes bengalensis</i>	Common Fox		LC
14	<i>Lepus nigricollis</i>	Black-naped Hare	S-IV	LC
15	<i>Macaca mulatta</i>	Macaque Rhesus		LC
16	<i>Semnopithecus entellus</i>	Deccan Hanuman Langur	Part II of Schedule II	LC

Aves

All the listed birds are Least Concern under IUCN and Schedule - IV under Indian Wildlife

Protection Act (1972)

S. No	Scientific Name	Common Name	I - WPA	IUCN
1	<i>Accipiter badius</i>	Crested Shikra (Indian Shikra)	S-IV	LC
2	<i>Accipiter nisus</i>	Eurasian Sparrow Hawk	S-IV	LC
3	<i>Accipiter virgatus</i>	Besra Sparrow Hawk	S-IV	LC
4	<i>Acridotheres ginginianus</i>	Bank Myna	S-IV	LC
5	<i>Acridotheres tristis</i>	Common Myna	S-IV	LC
6	<i>Acrocephalus agricola</i>	Paddy Field Warbler	S-IV	LC
7	<i>Acrocephalus stentoreus</i>	Reed Warbler	S-IV	LC
8	<i>Actitis hypoleucos</i>	Common Sandpiper	S-IV	LC
9	<i>Alcedo atthis</i>	Small blue Kingfisher	S-IV	LC
10	<i>Allauda gulugula</i>	Eastern-Sky lark	S-IV	LC
11	<i>Amaurornis phoenicurus</i>	White Breasted water hen	S-IV	LC
12	<i>Ammemamea phoenicurus</i>	Rufous tailed Finch lark	S-IV	LC
13	<i>Anas acuta</i>	Northern Pintail	S-IV	LC
14	<i>Anastomus oscitans</i>	Asian Open bill Stork	S-IV	LC
15	<i>Anhinga melanogaster</i>	Darter or Snake Bird	S-IV	LC
16	<i>Anthus rufulus</i>	Paddy filed pipit	S-IV	LC
17	<i>Apus affinis</i>	House Swift	S-IV	LC
18	<i>Ardea alba</i>	Large Egrets	S-IV	LC
19	<i>Ardea cinerea</i>	Grey Heron	S-IV	LC
20	<i>Ardea intermedia</i>	Medium Egret	S-IV	LC
21	<i>Ardea purpurea</i>	Purple Heron	S-IV	LC
22	<i>Ardeola grayii</i>	Indian Pond Heron	S-IV	LC
23	<i>Artamus fuscus</i>	Ashy Swallow Shrike	S-IV	LC
24	<i>Athene brama</i>	Spotted Owlet	S-IV	LC

S. No	Scientific Name	Common Name	I - WPA	IUCN
25	<i>Aythya ferina</i>	Common Pochard	S-IV	LC
26	<i>Bubulcus ibis</i>	Cattle Egret	S-IV	LC
27	<i>Calandrella raytal</i>	Indian Short-toed lark	S-IV	LC
28	<i>Calidris ferruginea</i>	Curlew sand piper	S-IV	LC
29	<i>Calidris minuta</i>	Little Stint	S-IV	LC
30	<i>Calidris temminckii</i>	Temminck's Stint	S-IV	LC
31	<i>Casmerodius albus</i>	Large Egret	S-IV	LC
32	<i>Centropus parroti</i>	Southern Coucal	S-IV	LC
33	<i>Centropus sinensis</i>	Crow Pheasant	S-IV	LC
34	<i>Ceryle rudis</i>	Lesser Pied Kingfisher	S-IV	LC
35	<i>Cettia major</i>	Chestnut-crowned Bush Warbler	S-IV	LC
36	<i>Charadrius alexandrinus</i>	Kentish Plovers	S-IV	LC
37	<i>Charadrius hiaticula</i>	Common Ringed Plover	S-IV	LC
38	<i>Charadrius leschenaultia</i>	Sand Plover	S-IV	LC
39	<i>Chroicocephalus ridibundus</i>	Black Headed Gull	S-IV	LC
40	<i>Cinnyris asiaticus</i>	Purple Sunbird	S-IV	LC
41	<i>Circus aeruginosus</i>	Eurasian Marsh Harrier	S-IV	LC
42	<i>Cisticola juncidis</i>	Streaked Fantail Warbler	S-IV	LC
43	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	S-IV	LC
44	<i>Columba livia</i>	Blue Rock Pigeon	S-IV	LC
45	<i>Copsychus saularis</i>	Oriental Magpie Robin	S-IV	LC
46	<i>Coracana novachollandiae</i>	Large Cuckoo Shrike	S-IV	LC
47	<i>Coracias benghalensis</i>	Indian Roller	S-IV	LC
48	<i>Corous Macrorhynchos</i>	Jungle Crow	S-IV	LC
49	<i>Corous splendens</i>	House Crow	S-IV	LC
50	<i>Cuculus micropterus</i>	Indian Cuckoo	S-IV	LC
51	<i>Cyornis tickelliae</i>	Tickell's Blue-Flycatcher	S-IV	LC
52	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	S-IV	LC
53	<i>Delichon urbicum</i>	Northern House Martin	S-IV	LC
54	<i>Dendrocitta vagabunda</i>	Rufous Treepie	S-IV	LC
55	<i>Dendrocygna javanica</i>	Lesser whistling- Duck	S-IV	LC
56	<i>Dicrurus caerulescens</i>	White-Bellied Drango	S-IV	LC
57	<i>Dicrurus macrocercus</i>	Black Drongo	S-IV	LC
58	<i>Dinopium benghalense</i>	Lesser Golden backed Woodpecker	S-IV	LC
59	<i>Dumetia hyperythra</i>	Rufus-bellied Babbler	S-IV	LC
60	<i>Egretta garzetta</i>	Little Egret	S-IV	LC
61	<i>Egretta garzetta</i>	Western Reef Egret	S-IV	LC
62	<i>Egretta intermedia</i>	Smaller Egret	S-IV	LC
63	<i>Elanus caeruleus</i>	Black Winged Kite	S-IV	LC
64	<i>Eremopterix grisea</i>	Ashy-crowned sparrow-lark	S-IV	LC
65	<i>Eudynamys scolopacea</i>	Asian Koel	S-IV	LC
66	<i>Euodice malabarica</i>	White Throated Munia	S-IV	LC
67	<i>Falco tinnunculus</i>	Common kestrel	S-IV	LC
68	<i>Francolinus pondicerianus</i>	Grey Partridge	S-IV	LC
69	<i>Fulica atra</i>	Common Coot	S-IV	LC
70	<i>Galerida cristata</i>	Common Crested Lark	S-IV	LC
71	<i>Gallixrex cinerea</i>	Water Cock	S-IV	LC

S. No	Scientific Name	Common Name	I - WPA	IUCN
72	<i>Gallinago gallinago</i>	Common Snipe	S-IV	LC
73	<i>Gallinula chloropus</i>	Common(Indian) Moorhen	S-IV	LC
74	<i>Gelochelidon nilotica</i>	Gull-billed Tern	S-IV	LC
75	<i>Gracupica contra</i>	Asian Pied starling	S-IV	LC
76	<i>Halcyon smyrnensis</i>	White breasted kingfisher	S-IV	LC
77	<i>Haliaeetus leucogaster</i>	White bellied sea eagle	S-IV	LC
78	<i>Haliastur Indus</i>	Brahamimy Kite	S-IV	LC
79	<i>Himantopus himantopus</i>	Black-winged Stilt	S-IV	LC
80	<i>Hirundo daurica</i>	Red Rumped Swallows	S-IV	LC
81	<i>Hirundo rustica</i>	Common Swallow	S-IV	LC
82	<i>Hydrophasianus chirurgus</i>	Pheasant Tailed Jacana	S-IV	LC
83	<i>Ixobrychus sinensis</i>	Yellow Bittern	S-IV	LC
84	<i>Lanius cristatus</i>	Brown shrike	S-IV	LC
85	<i>Lanius schach</i>	Long tailed shrike	S-IV	LC
86	<i>Lanius schach</i>	Rufus Backed Shrike	S-IV	LC
87	<i>Lanius vittatus</i>	Bay-backed Shrike	S-IV	LC
88	<i>Larus brunnicephalus</i>	Brown Headed Gull	S-IV	LC
89	<i>leptocoma zeylonica</i>	Purple Rumped Sunbird	S-IV	LC
90	<i>Lonchura atricapilla</i>	Black Headed Munia	S-IV	LC
91	<i>Lonchura punctulata</i>	Scaly-breasted munia	S-IV	LC
92	<i>Lonchura punctulata</i>	Spotted Munia	S-IV	LC
93	<i>Megalaima haemacephala</i>	Coppersmith Barbet	S-IV	LC
94	<i>Merops orientalis</i>	Small Bee-eater	S-IV	LC
95	<i>Metopidius indicus</i>	Bronze-winged Jacana	S-IV	LC
96	<i>Milvus migrans</i>	Black kite(Pariah Kite)	S-IV	LC
97	<i>Mirafra erythroptera</i>	Red-winged Bush-lark	S-IV	LC
98	<i>Monticola solitaries</i>	Blue Rock Thrush	S-IV	LC
99	<i>Motacilla alba</i>	White wagtail	S-IV	LC
100	<i>Motacilla cinerea</i>	Grey Wagtail	S-IV	LC
101	<i>Motacilla citreola</i>	Yellow Headed Wagtail	S-IV	LC
103	<i>Motacilla flava</i>	Yellow wagtail	S-IV	LC
102	<i>Motacilla flava</i>	Yellow Wagtail	S-IV	LC
104	<i>Motacilla maderaspatensis</i>	Pied wagtail/ White browed wagtail	S-IV	LC
105	<i>Mycteria leucocephala</i>	Painted Stork	S-IV	LC
106	<i>Nectarinia asiatica</i>	Purple Sunbird	S-IV	LC
107	<i>Nectarinia zeylonica</i>	Purple-Rumped Sunbird	S-IV	LC
109	<i>Nettapus coromandelianus</i>	Cotton Teal	S-IV	LC
108	<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose	S-IV	LC
110	<i>Numenius arquata</i>	Eurasian curlew	S-IV	LC
111	<i>Numenius phaeopus</i>	whimbrel	S-IV	LC
112	<i>Nyctyornis athertoni</i>	Blue tailed Bee eaters	S-IV	LC
113	<i>Ocyrceros birostris</i>	Grey Hornbills	S-IV	LC
114	<i>Oriolus oriolus</i>	Eurasian golden oriole	S-IV	LC
115	<i>Orthotomus sutorius</i>	Common Tailor Bird	S-IV	LC
116	<i>Passer domesticus</i>	House Sparrow	S-IV	LC
117	<i>Pellorneum ruficeps</i>	Spotted Babbler	S-IV	LC
118	<i>Phalacrocorax carbo</i>	Cormorant Great	S-IV	LC

S. No	Scientific Name	Common Name	I - WPA	IUCN
119	<i>Phalacrocorax niger</i>	Little Cormorant	S-IV	LC
120	<i>Phylloscopus maculipennis</i>	Ashy Warblers	S-IV	LC
121	<i>Podiceps cristatus</i>	Great crested Grebe	S-IV	LC
122	<i>Polceus philippinus</i>	Baya Weaver	S-IV	LC
123	<i>Porphyrio porphyrio</i>	Purple Moorhen	S-IV	LC
124	<i>Prina socialis</i>	Ashy Prinia	S-IV	LC
125	<i>Prinia hodgsonii</i>	Grey Breasted Prinia	S-IV	LC
126	<i>Psittacula eupatria</i>	Alexandrian parakeet	S-IV	LC
127	<i>Psittacula krameri</i>	Rose Ringed Parakeet	S-IV	LC
128	<i>Pycnonotus cafer</i>	Red vented Bulbul	S-IV	LC
129	<i>Saxicola caprata</i>	Pied Bush Chat	S-IV	LC
130	<i>Saxicoloides fulicata</i>	Indian Robin	S-IV	LC
131	<i>Sterna acuticauda</i>	Black billed Tern	S-IV	LC
132	<i>Sterna albifrons</i>	Little Tern	S-IV	LC
133	<i>Sterna aurantia</i>	Indian river tern	S-IV	LC
134	<i>Sterna hirundo</i>	Common Terns	S-IV	LC
135	<i>Streptopelia chinensis</i>	Spotted Dove	S-IV	LC
136	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	S-IV	LC
137	<i>Streptopelia orientalis</i>	Spotted dove	S-IV	LC
138	<i>Streptopelia senegalensis</i>	Laughing Dove	S-IV	LC
139	<i>Streptopelia turtur</i>	Turtle Doves	S-IV	LC
140	<i>Stur nus roseus</i>	Rosy Starling(Rosy Pastor)	S-IV	LC
141	<i>Sturnia pagodarum</i>	Brahminy Starlings	S-IV	LC
142	<i>Sturnus contra</i>	Asian Pied Starling(Pied Myna)	S-IV	LC
143	<i>Sturnus Malabaricus</i>	Grey Headed Starling(Myna)	S-IV	LC
144	<i>Sturnus vulgaris</i>	Common Starling	S-IV	LC
145	<i>Surniculus lugubris</i>	Drongo Cuckoo	S-IV	LC
146	<i>Tachybaptus ruficollis</i>	Little Grebe	S-IV	LC
147	<i>Tadona ferruginea</i>	Brahminy Shelduck (Duck)	S-IV	LC
148	<i>Tephrodornis pondiceria</i>	Common Wood Shrike	S-IV	LC
149	<i>Terpsiphone paradise</i>	Asian Paradise-Flycatcher	S-IV	LC
150	<i>Threskiornis melanocephalus</i>	Oriental white ibis	S-IV	LC
151	<i>Tringa glareola</i>	Wood Sandpiper	S-IV	LC
152	<i>Tringa ochropus</i>	Green sandpiper	S-IV	LC
153	<i>Turdoides caudatus</i>	Common Babbler	S-IV	LC
154	<i>Turdoides malcolmi</i>	Large Grey Babblers	S-IV	LC
155	<i>Turdoides striata</i>	Jungle Babbler	S-IV	LC
156	<i>Upupa epops</i>	Common Hoopoe	S-IV	LC
157	<i>Vanellus indicus</i>	Red wattled lapwing	S-IV	LC
158	<i>Vanellus sp.</i>	Yellow wattled lapwing	S-IV	LC
SIV- Schedule IV				

Reptiles

S.No	Scientific Name	Common Name	IWPA	IUCN
1	<i>Calotes versicolor</i>	Common Garden Lizard		LC
2	<i>Sitana ponticeriana</i>	Fan-throated lizard		LC
3	<i>Calotes rouxi</i>	Forest Calottes		LC
4	<i>Chameleo zylanicus</i>	Chameleon	S-II	LC
5	<i>Dendrelaphis tristis</i>	Common Indian Bronze back		LC
6	<i>Lycodon aulicus</i>	Common Wolf Snake		LC
7	<i>Ptyas mucosa</i>	Indian Rat Snake	S-II	LC
8	<i>Ahaetulla nasutus</i>	Common green tree Snake		LC
9	<i>Enhydris enhydris</i>	Common Smooth Water Snake		LC
10	<i>Macropisthodon plumbicolor</i>	Green keel back		LC
11	<i>Xenochrophis piscator</i>	Checkered Keel back	S-II	LC
12	<i>Bungarus caeruleus</i>	Common Indian Krait		LC
13	<i>Hemidactylus brooki</i>	Brook's Gecko		LC
14	<i>Hemidactylus flaviviridis</i>	Northern house Gecko		LC
15	<i>Mabuya carinata</i>	Common Skink		LC
16	<i>Varanus bengalensis</i>	Indian Monitoring Lizard	S-II	LC
17	<i>Vipera russelli</i>	Russell's viper	S-II	LC
18	<i>Naja naja</i>	Indian Cobra	S-II	LC
19	<i>Ophiophagus hannah</i>	King cobra	S-II	LC
20	<i>Echis carinatus</i>	Saw scaled viper		LC

Amphians

S.No	Scientific Name	Common Name	Family	Status	IWPA
1	<i>Bufo melanostictus</i>	Common Indian Toad	Bufoidea	LC	S-IV
2	<i>Euphlyctis cyanophlyctis</i>	Skittering Frog	Ranidae	LC	S-IV
3	<i>Euphlyctis hexadactylus</i>	Indian Pond Frog	Ranidae	LC	S-IV
4	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	Ranidae	LC	S-IV
5	<i>Polypedates maculates</i>	Common Tree Frog	Rhacophoridae	LC	S-IV

Fishes

Taxonomic composition of fish fauna from Secondary source

SNo.	Scientific Name	Common Name	Population Status	IUCN Status	CAMP Status
1	<i>Notopterus notopterus</i>	Grey feather back	C	LC	LRnt
2	<i>Catla catla</i>	Catla	A	VU	LRnt
3	<i>Labeo ariza</i>	Reba carp	C	LC	NE
4	<i>Labeo rohita</i>	Rohu	A	LC	LRnt
5	<i>Labeo calbasu</i>	Black rohu	M	LC	LRnt
6	<i>Cirrhinus mrigala</i>	Mrigal	C	LC	LRnt
7	<i>Cirrhinus reba</i>	Reba carp	C	LC	VU
8	<i>Ctenopharyngodon idella</i>	grass carp	M	LC	NE
9	<i>Cyprinus carpio</i>	Common carp	M	VU	NE
10	<i>Hypophthalmichthys</i>	Silver carp	M	NT	DD

SNo.	Scientific Name	Common Name	Population Status	IUCN Status	CAMP Status
	<i>molitrix</i>				
11	<i>Osteobrama cotio cotio</i>	Cotio	A	LC	LRnt
12	<i>Puntius chola</i>	Swamp barb	A	LC	VU
13	<i>Puntius ticto</i>	Ticto barb	C	LC	LRnt
14	<i>Puntius sarana</i>	Olive barb	C	LC	VU
15	<i>Puntius sophore</i>	Spot-fin swamp barb	A	LC	LRnt
16	<i>Puntius terio</i>	Onespot barb	C	LC	LRnt
17	<i>Puntius dorsalis</i>	Long snouted barb	C	LC	EN
18	<i>Puntius pethia gelius</i>	Golden barb	C	LC	NE
19	<i>Rasbora daniconius</i>	Slender rasbora	M	LC	LRnt
20	<i>Salmostoma bacaila</i>	Large razorbelly minnow	A	LC	LRlc
21	<i>Salmostoma phulo</i>	Fine scale razor belly minnow	C	NE	NE
22	<i>Amblypharyngodon microlepis</i>	Indian carplet	A	LC	NE
23	<i>Amblypharyngodon microlepismola</i>	Mola carplet	A	LC	LRlc
24	<i>Danio devario</i>	Devario danio,	C	EN	NE
25	<i>Schistura corica</i>	Polka Dotted	R	LC	NE
26	<i>Aplocheilus panchax</i>	Blue panchax	C	LC	DD
27	<i>Mystus bleeker</i>	Day's mystus	A	LC	VU
28	<i>Mystus cavasius</i>	Gangetic mystus	A	LC	LRnt
29	<i>Mystus gulio</i>	Long WhiskersCatfish	C	LC	NE
30	<i>Mystus tengara</i>	Tengara mystus	A	LC	NE
31	<i>Mystus vittatus</i>	Striped dwarfcatfish	A	LC	VU
32	<i>Ompok bimaculatus</i>	Butter Catfish	M	NT	EN
33	<i>Ompok pabda</i>	Pabdah catfish	R	NT	EN
34	<i>Wallago attu</i>	Boal	M	NT	LRnt
35	<i>Pangasius pangasius</i>	Pangas catfish	R	LC	NE
36	<i>Eutropiichthys vacha</i>	Air breathingcatfishes	R	LC	VU
37	<i>Clarias batrachus</i>	Batchwa vacha	C	LC	VU
38	<i>Clarias gariepinus</i>	African catfish	R	NE	NE
39	<i>Heteropneustes fossilis</i>	Stinging catfish	R	LC	VU
40	<i>Anguilla bengalensis</i>	Indian Long fin eel	M	LC	EN
41	<i>Xenentodon cancila</i>	Freshwater garfish	A	LC	LRnt
42	<i>Channa orientalis</i>	Walking snakehead	C	NE	VU
43	<i>Channa panctatus</i>	Giant snakehead	C	LC	LRnt
44	<i>Channa striatus</i>	Bandedsnakehead	C	LC	LR-lc
45	<i>Mastacembelus aral</i>		R	LC	LRnt
46	<i>Mastacembelus armatus</i>	Zig zag spiny eel	M	LC	VU
47	<i>Mastacembelus pancalus</i>	Barred spiny eel	A	LC	LRnt
48	<i>Glossogobius giuris</i>	Tank/Bar-eyed goby	A	LC	LRnt
49	<i>Gobiopsis macrostoma</i>	Long Jawed goby	R	NE	NE
50	<i>Trichogaster faciatius</i>	Banded gaurami	M	LC	LRnt
51	<i>Oreochromis mossambicus</i>	Mozambique Tilapia	C	NT	NE
52	<i>Anabas testudineus</i>	Climbing perch	M	DD	VU

SNo.	Scientific Name	Common Name	Population Status	IUCN Status	CAMP Status
53	<i>Etroplus maculatus</i>	Ornange chromid	A	LC	NE
54	<i>Chanda nama</i>	Elongate glass perchlet	C	LC	NE
55	<i>Ambassis ranga</i>	Indian glassy	C	LC	NE

A= Abundant (76-100%); C = Common (51-75%); M = Moderate (26-50%); R = Rare (1-25%)

EN- Endangered; VU- Vulnerable; LRnt- Lower risk near threatened; LRLc- Lower risk least concern; LC- Least concern; DD- Data Deficient; NE- Not evaluated, NT: Near threaten.

Invertebrates

S. No.	Scientific Name	Common Name	Family
1	<i>Acraea violae</i>	Tawny Coster	Nymphalidae
2	<i>Anax guttatus</i>	Dragon fly	Aeshnidae
3	<i>Anax immaculifrons</i>	Dragon fly	Aeshnidae
4	<i>Appias albina darada</i>	Common Albatross	Pieridae
5	<i>Badamia exclamationis</i>	Brown Awl	Hesperiidae
6	<i>Belenois aurota aurota</i>	Indian Pioneer	Pieridae
7	<i>Borbo bevani</i>	Bevan's Swift	Hesperiidae
8	<i>Borbo cinnara</i>	Rice Swift	Hesperiidae
9	<i>Brachythemis contaminata</i>	Dragon fly	Libellulidae
10	<i>Castalius rosimon rosimon</i>	Continental Common Pierrot	Lycaenidae
11	<i>Catochrysops strabo strabo</i>	Oriental Forget-me-not	Lycaenidae
12	<i>Catopsilia pyranthe pyranthe</i>	Mottled Emigrant	Pieridae
13	<i>Catopsilia crocale</i>	Lemon Emigrant	Pieridae
14	<i>Cepora nerissa nerissa</i>	Common Gull	Pieridae
15	<i>Chilades lajus lajus</i>	Indian Lime Blue	Lycaenidae
16	<i>Colias fieldii fieldii</i>	Himalyan Dark Clouded Yellow	Pieridae
17	<i>Colotis danae danae</i>	Crimson Tip	Pieridae
18	<i>Colotis etrida</i>	Small Orange Tip	Pieridae
19	<i>Colotis eucharis eucharis</i>	Plain Orange Tip	Pieridae
20	<i>Crocothemis servilia servilia</i>	Dragon fly	Libellulidae
21	<i>Curetis thetis</i>	Indian Sunbeam	Lycaenidae
22	<i>Danaus chrysippus chrysippus</i>	Plain Tiger	Nymphalidae
23	<i>Danaus genutia genutia</i>	Striped Tiger	Nymphalidae
24	<i>Delias eucharis</i>	Common Jezebel	Pieridae
25	<i>Diplacodes trivialis</i>	Dragon fly	Libellulidae
26	<i>Euchrysops cnejus cnejus</i>	Oriental Gram Blue	Lycaenidae
27	<i>Euploea core core</i>	Common Crow	Nymphalidae
28	<i>Eurema brigitta rubella</i>	Red-line Small Grass Yellow	Pieridae
29	<i>Eurema hecabe simulata</i>	Oriental Common Grass Yellow	Pieridae
30	<i>Euthalia aconthea meridionalis</i>	Baron	Nymphalidae
31	<i>Everes lacturnus syntala</i>	Dakhan Cupid	Lycaenidae
32	<i>Freyeria trochylus trochylus</i>	African Grass Jewel	Lycaenidae

S. No.	Scientific Name	Common Name	Family
33	<i>Graphium agamemnon menides</i>	Dakhan Tailed Jay	Papilionidae
34	<i>Graphium nomius nomius</i>	Indian Spot Sword Tail	Papilionidae
35	<i>Graphium sarpedon teredon</i>	Dakhan Blue Bottle	Papilionidae
36	<i>Hasora chromus chromus</i>	Oriental Banded Awl	Hesperiidae
37	<i>Hypolimnias bolina jacintha</i>	Oriental Great Eggfly	Nymphalidae
38	<i>Hypolimnias misippus</i>	Danaid Eggfly	Nymphalidae
39	<i>Ictinogomphus rapax</i>	Damsel fly	Gomphidae
40	<i>Ischnura senegalensis</i>	Damsel fly	Coenagrionidae
41	<i>Ixias marianne</i>	White Orange Tip	Pieridae
42	<i>Ixias pyrene sesia</i>	Yellow Orange Tip	Pieridae
43	<i>Jamides celeno celeno</i>	Oriental Common Cerulean	Lycaenidae
44	<i>Junonia almana almana</i>	Oriental Peacock Pansy	Nymphalidae
45	<i>Junonia hierta hierta</i>	Oriental Yellow Pansy	Nymphalidae
46	<i>Junonia iphita iphita</i>	Oriental Chocolate Pansy	Nymphalidae
47	<i>Junonia lemonias lemonias</i>	Chinese Lemon Pansy	Nymphalidae
48	<i>Junonia orithya ocyale</i>	Dark Blue Pansy	Nymphalidae
49	<i>Leptotes plinius plinius</i>	Asian Zebra Blue	Lycaenidae
50	<i>Melanitis leda leda</i>	Oriental Common Evening Brown	Nymphalidae
51	<i>Melanitis phedima bela</i>	Dark Evening Brown	Nymphalidae
52	<i>Melanitis zitenius zitenius</i>	Himalian Great Evening Brown	Nymphalidae
53	<i>Moduza procris undifragus</i>	Commander	Nymphalidae
54	<i>Neptis hylas varmona</i>	Common Sailer	Nymphalidae
55	<i>Pachliopta aristolochiae aristolochiae</i>	Common Rose	Papilionidae
56	<i>Pachliopta hector</i>	Crimson Rose	Papilionidae
57	<i>Papilio demoleus</i>	Lime Butterfly	Papilionidae
58	<i>Papilio polytes polytes</i>	Common Mormon (polytes)	Papilionidae
59	<i>Papilio polytes romulus</i>	Common Mormon (romulus)	Papilionidae
60	<i>Papilio polytes stichius</i>	Common Mormon (stichius)	Papilionidae
61	<i>Pareronia valeria hippia</i>	Common Wanderer	Pieridae
62	<i>Phalanta phalantha phalantha</i>	Common Leopard	Nymphalidae
63	<i>Polyura athamas athamas</i>	Common Nawab	Nymphalidae
64	<i>Prosotas nora</i>	Common Line Blue	Lycaenidae
65	<i>Pseudozizeeria maha ossa</i>	Dakhan Pale Grass Blue	Lycaenidae
66	<i>Spialia galba galba</i>	Indian Grizzled Skipper	Hesperiidae
67	<i>Symphhaedra nais</i>	Baronet	Nymphalidae
68	<i>Tarucus nara</i>	Rounded Pierrot	Lycaenidae
69	<i>Telicota ancilla bambusae</i>	Dark Palm Dart	Hesperiidae
70	<i>Tirumala limniace exoticus</i>	Blue Tiger	Nymphalidae
71	<i>Urothemis signata signata</i>	Dragon fly	Libellulidae
72	<i>Zizeeria karsandra</i>	Dark Grass Blue	Lycaenidae
73	<i>Zizina otis indica</i>	Lesser Grass Blue	Lycaenidae

Identification of local Protected Species

As per Botanical Survey of India records and available published literature pertaining to the study area and current detailed study of project site, no threatened, endangered and rare plant

species were observed from the study area. The topomap indicating the absence of National park, Sanctuary, Elephant/Tiger Reserve, Migratory routes/ Wildlife corridor with in 10 km radius indicates that this region is not ecologically very significant. As per the Indian Wildlife Protection Act (1972), those animals, which have been enlisted in the schedules of the Act, have been presented below. The schedules are based on the species namely, rare, endangered, threatened, vulnerable etc. According to threat of extinction Schedule-I contains those species which need topmost priority, while II, III, IV and V have lesser degree of threat. Most of the avi-fauna has been listed in Schedule-IV. As per the list of avi-faunal species, these are mostly local migrant species only.

Table 3.20 Threatened and Endangered Animal Species

<i>Herpestes javanicus</i>	Common Indian Mongoose	Part II of Schedule II	LC
<i>Semnopithecus entellus</i>	Deccan Hanuman Langur	Part-II of Sch-II	LC
<i>Chameleo zylanicus</i>	Chameleon	S-II	LC
<i>Ptyas mucosa</i>	Indian Rat Snake	S-II	LC
<i>Xenochrophis piscator</i>	Checkered Keel back	S-II	LC
<i>Varanus bengalensis</i>	Indian Monitoring Lizard	S-II	LC
<i>Vipera ruselli</i>	Russell's viper	S-II	LC
<i>Naja naja</i>	Indian Cobra	S-II	LC
<i>Ophiophagus hannah</i>	King cobra	S-II	LC

CHAPTER 4.0 ANTICIPATED ENVIRONMENTAL IMPACTS

4.1 Identification of Impacts

Identification of Impacts is one of the basic analytical steps of EIA for subsequent prediction and evaluation of impacts. Impact is a change in baseline due to interaction of a development activity with environment, or interaction of environment with development activity, or change in baseline due to a manmade emergency. SMS Pharmaceuticals Limited, Unit VII proposed to increase manufacturing capacity of Synthetic Organic Chemicals (API) with a capacity of 740.76 TPM with inclusion of a captive power plant of 2 x 2 MW capacity in existing site area of 95.56 acres. The expansion of capacity requires additional construction of manufacturing blocks, utilities, process, capacity enhancement of effluent treatment system and Upgradation of process equipment. The impacts were assessed for construction stage, operation stage and emergency cases. Initially the assessment was done to identify impacts due to the proposed development activity using net work method which mainly follows cause condition and effect relationship. The interaction of project activity on the environment was assessed by posing questions related to each aspect of project activity envisaged as part of expanding the plant.

4.1.1 Impact Networks

The purpose of identifying impacts is that it aids in making appropriate decision to mitigate adverse consequences if any. It may be pointed out that the distinction between magnitude and importance of impact should be appreciated. Thus the degree of extensiveness and scale of impacts and the consequences based on value judgments are generalized while identifying impacts; as it is imperative that the impact will normally lead to a chain of reactions. The construction of network charts brings out to certain extent the appropriate levels of risks that may occur due to the interventions while interacting with biophysical and socioeconomic components of environment. **Figure 4.1 to 4.6** present the identified impacts for various components of environment viz. air, noise, water, land and socio economic aspects. In the above-mentioned Figure the lines mean -- "has an effect on."

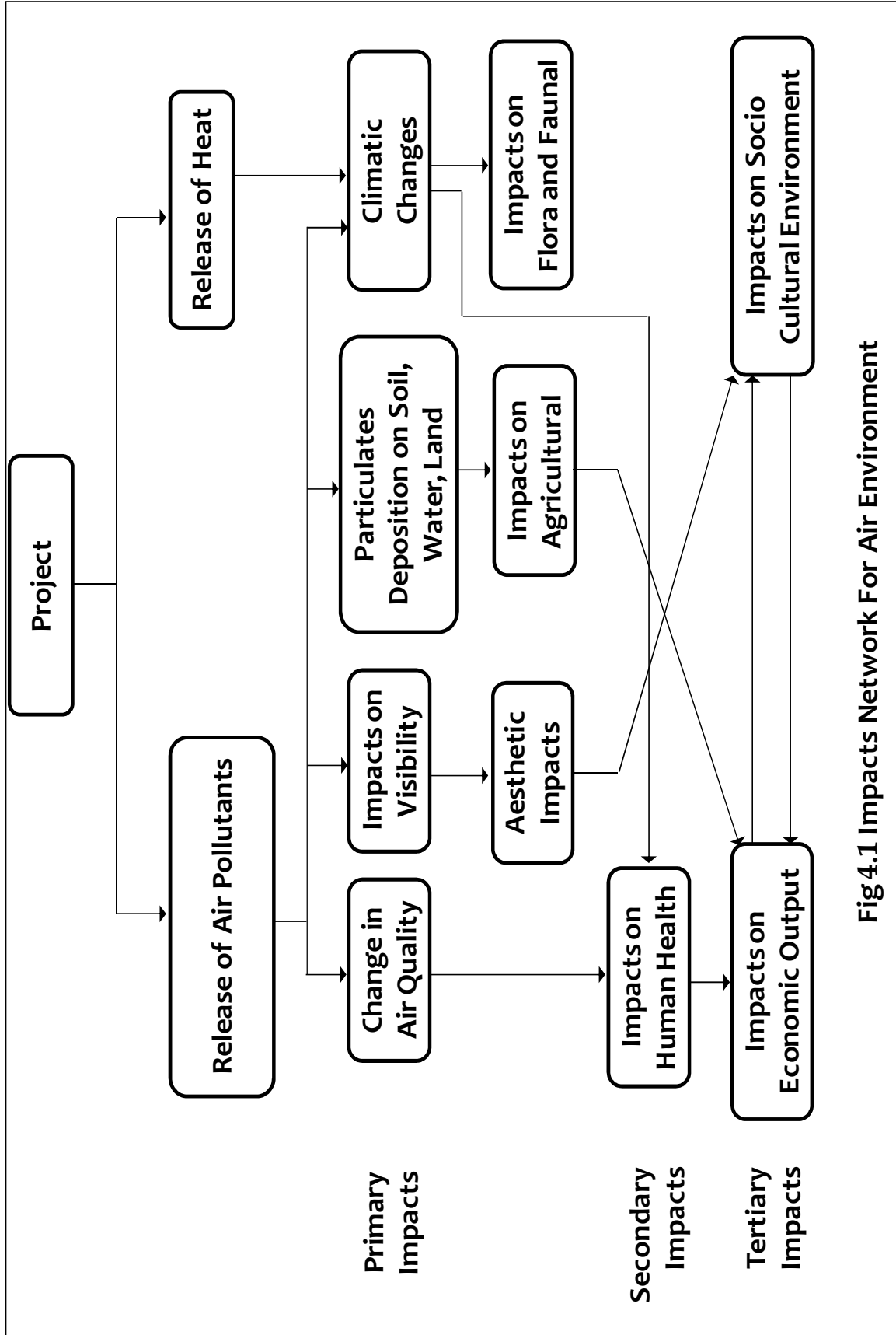


Fig 4.1 Impacts Network For Air Environment

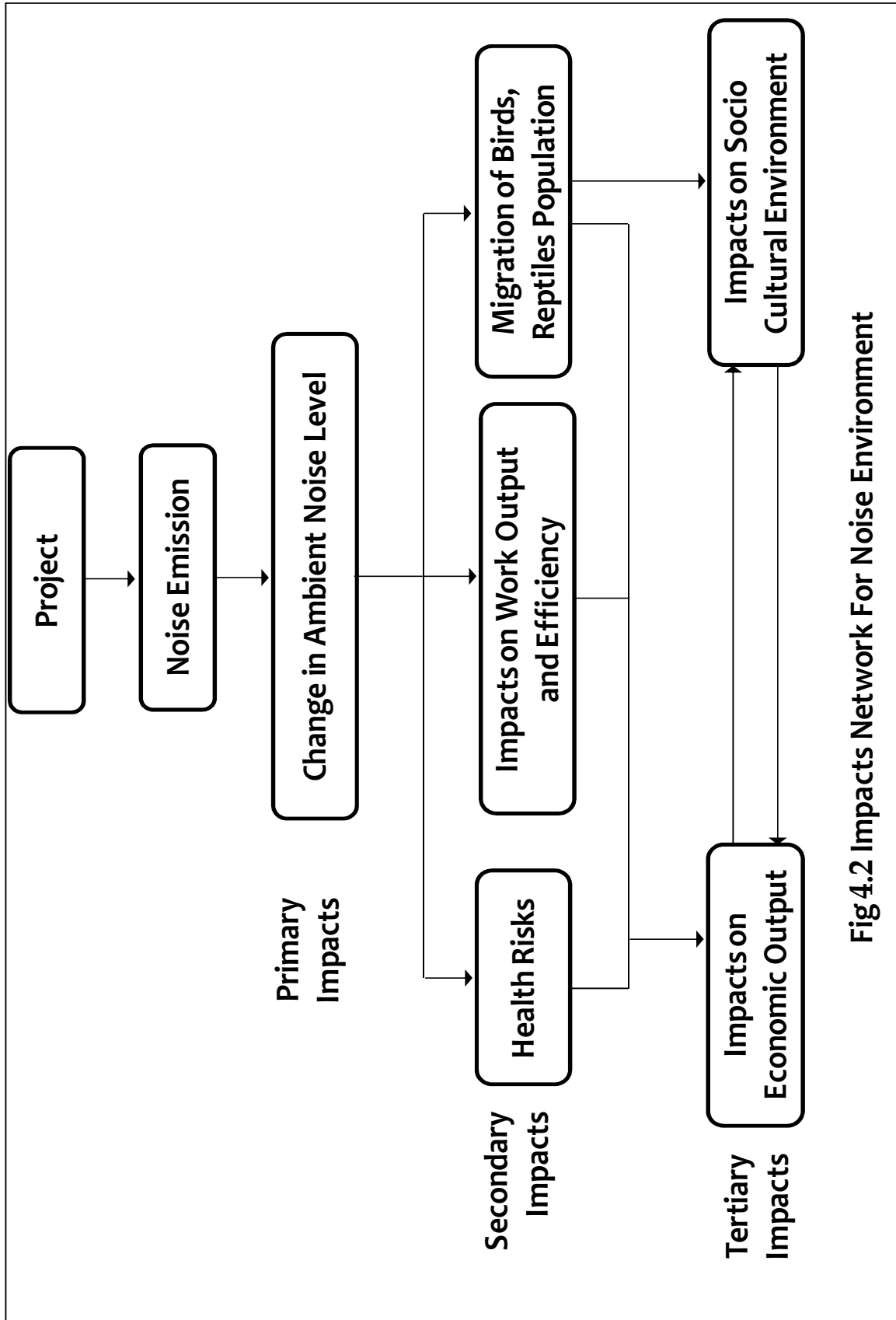


Fig 4.2 Impacts Network For Noise Environment

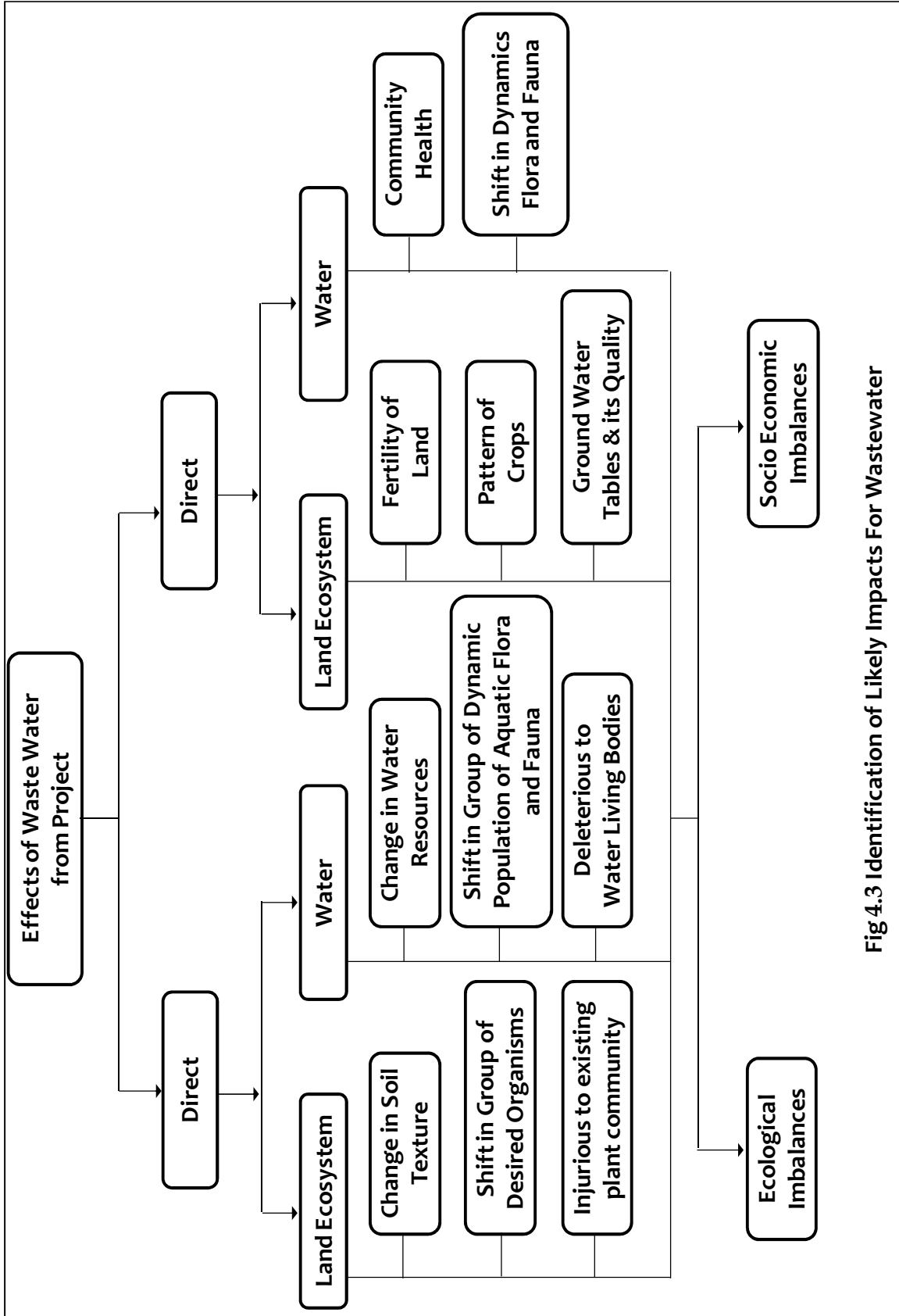


Fig 4.3 Identification of Likely Impacts For Wastewater

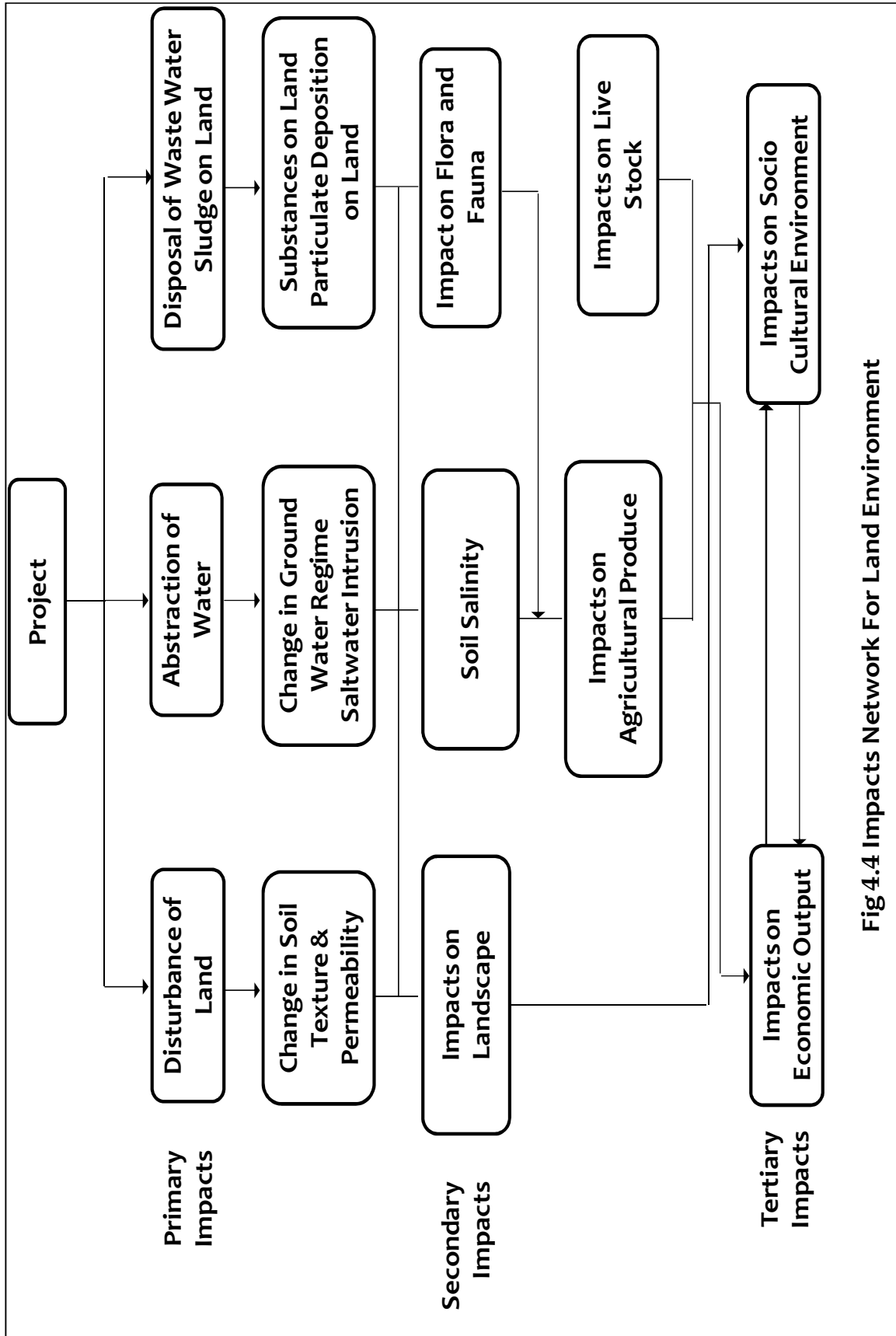


Fig 4.4 Impacts Network For Land Environment

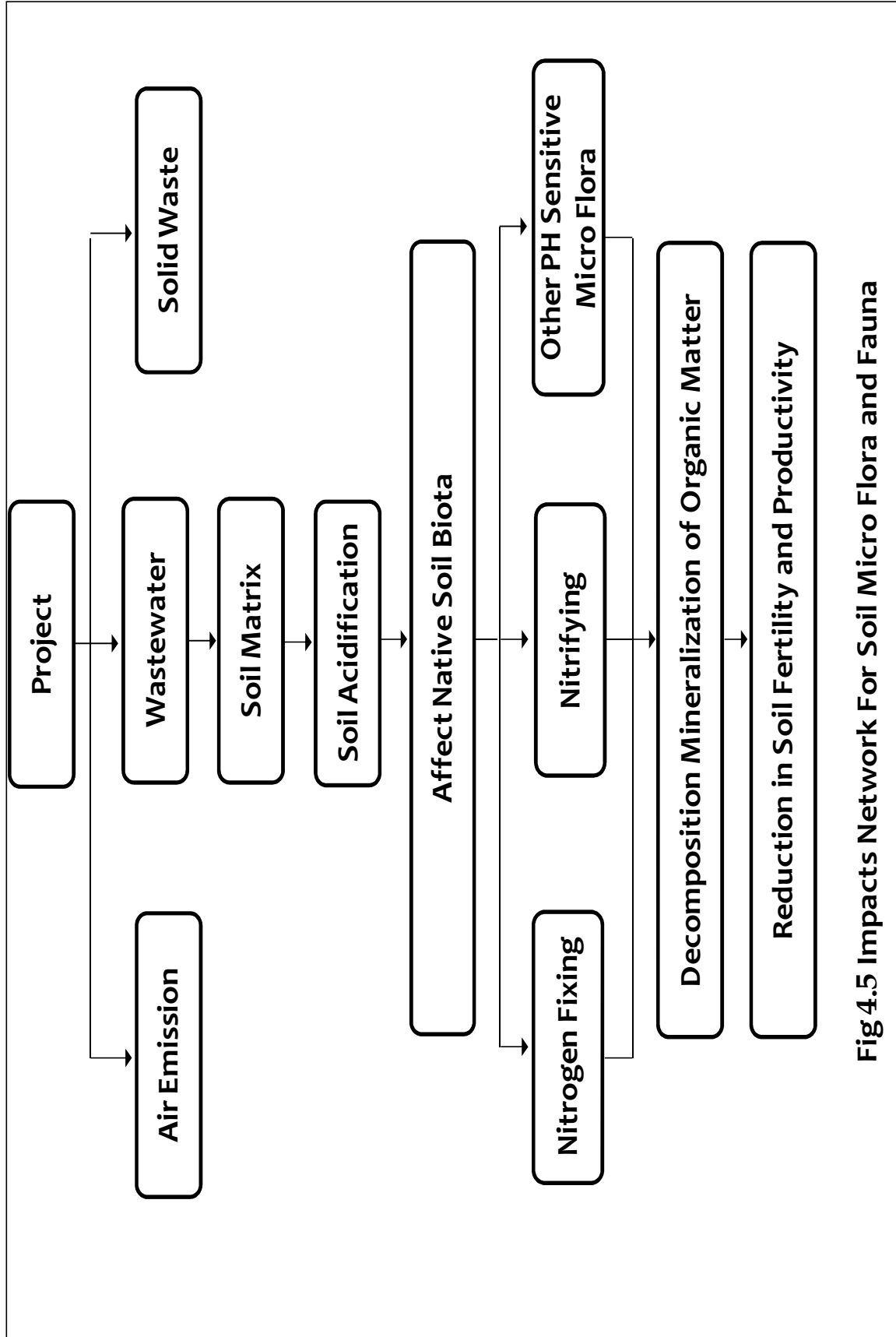


Fig 4.5 Impacts Network For Soil Micro Flora and Fauna

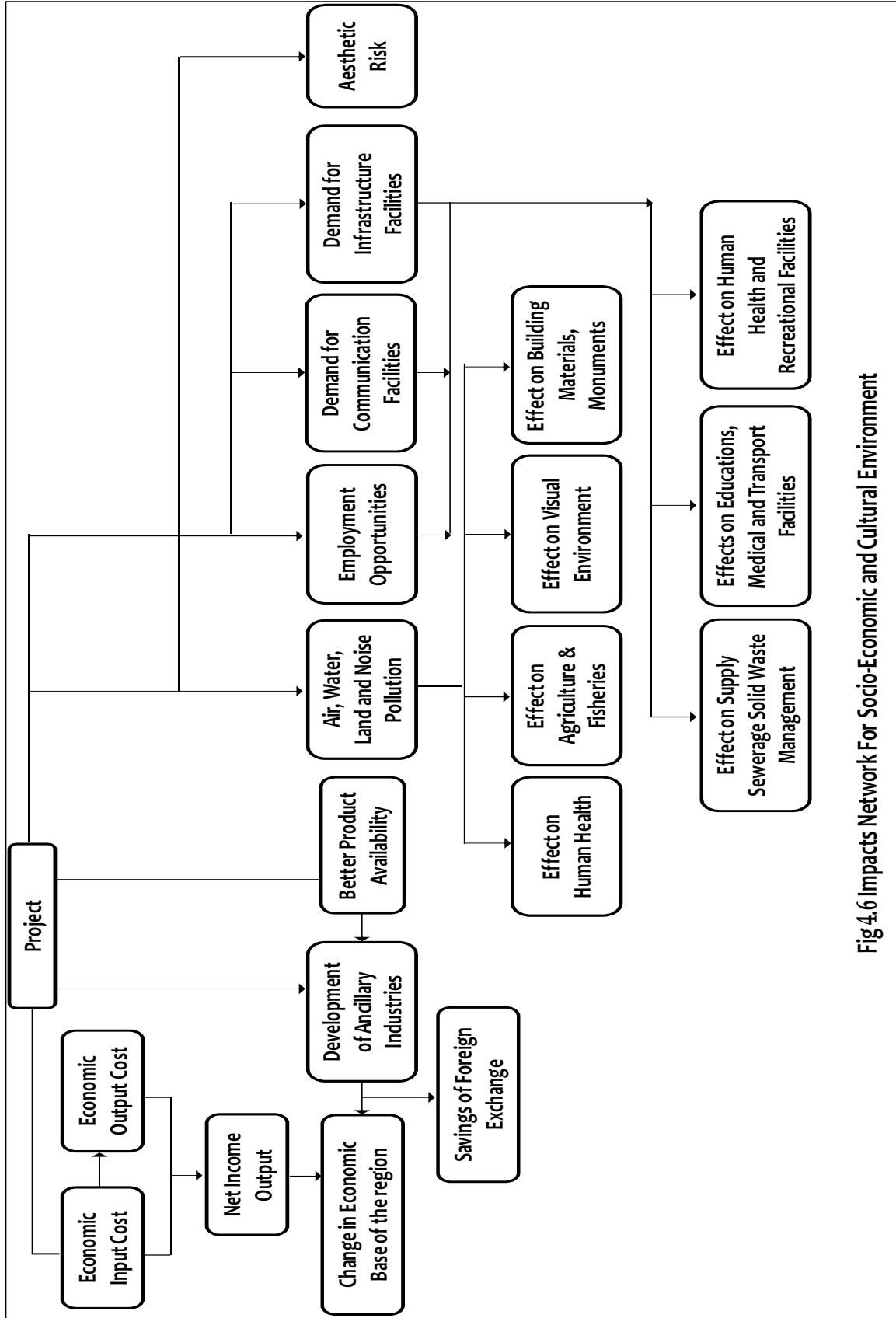


Fig.4.6 Impacts Network For Socio-Economic and Cultural Environment

4.2 Prediction of Impacts

The identified impacts are assessed by posing questions related each activity of proposed expansion project and their interaction with environment. The statutory limits of ambient air quality, noise, emissions and discharges as mandated by the MoEFCC was considered to classify the quantifiable impacts as acceptable or not acceptable. However, there are few impacts that cannot be quantified, which need to be qualitatively assessed. There are a number of methods for qualitatively assessing the impacts to arrive at the significance of impact. The qualitative assessment of impacts require characterization with respect to its magnitude, geographic extent, duration, frequency, reversibility, probability of occurrence, confidence rating and impact rating. The manual published by MOEFCC prescribes the following process for determining the significance of impact; first, an impact is qualified as being either negative or positive. Second, the nature of impacts such as direct, indirect, or cumulative is determined using the impact network. Third, a scale is used to determine the severity of the effect; for example, an impact is of low, medium, or high significance. Accordingly, it was proposed to quantify the impacts which are a direct result of the activities contingent on availability of reliable prediction tools. In case the quantification is not feasible, a subjective assessment of the impact significance being low, medium or high was proposed.

4.2.1 Air Environment

The sources of air pollution in the proposed expansion activity are utility emissions from boilers and DG sets, process emissions from reactions and operations, emissions from pollution control facilities, and storages. The direct impact of utility emissions consisting of particulate matter, sulfur dioxide, and oxides of nitrogen results in change in criteria air contaminants in ambient air quality. The process emissions of Ammonia, carbon dioxide, carbon monoxide, Hydrogen, Nitrogen, nitrous oxide, Oxygen, Hydrogen chloride, and Sulfur dioxide and Hydrogen Bromide are hazardous resulting in change in health and wellbeing of the receptors both flora, and fauna including humans. The adoption of adequate mitigation measures shall reduce the impact to low levels. The storage of solvents may also lead to diffuse emissions unless adequate

mitigation measures like breather valves, double lined storage and condensers are adopted. All these emissions impact air qualities negatively, resulting in health impacts indirectly. These impacts have medium significance in case mitigation measures are in place and shall have high significance in case of anthropogenic and natural emergencies as well as in case no mitigation measures are proposed. The change in ambient air quality due to the utility emissions of the proposed expansion project, is predicted by using an air quality impact prediction model. The impacts due to the proposed expansion shall be felt mainly within the plant area and the immediate surroundings.

4.2.1.1 Details of Mathematical Modeling

The principle behind the Gaussian dispersion models is Gaussian probability distribution of concentration in both vertical and horizontal cross wind directions about the plume central line. Predictions of ground level concentrations of the pollutants were carried out based on site meteorological data collected during the study period. For calculation of predicted ground level concentrations, ISCST3 model of Lakes Environmental based on USEPA, ISCST3 algorithms, was used; as it's based on more sophisticated algorithm incorporating deposition, better algorithm for area sources, etc. The salient features of the ISCST3 model are presented below in [Table 4.1](#).

Table 4.1 Salient Features of the ISCST3 Model

S.No	Item	Details
1	Model name	ISCST3 (Based on USEPA algorithm)
2	Source Types	Point, Area, Volume, Open Pits
3	Dispersion Equation	Steady State Gaussian Plume Equation
4	Diffusion Parameters	Pasquill Gifford Co-efficient
5	Plume Rise	Briggs Equation
6	Time Average	1 hr to Annual/Period Has Short Term and Long Term modeling options
7	Deposition	Both Dry and Wet Deposition
8	Application Input Data:	
	(i) Source Data	Stack co-ordinates
	(ii) Receptor Data	Grid interval, number of receptors, receptor elevations
	(iii) Meteorological Data	Hourly meteorological data i.e. wind speed, direction, ambient temperature, stability and mixing heights

Meteorological Data

Data recorded by the weather monitoring station at site on wind speed, direction, solar isolation, temperature and cloud cover at one hourly interval for three months i.e. One

full season has been used for computations. The frequency distribution table of site meteorological data and the wind rose diagram are presented in **Chapter 3.0, Table 3.8 and Figure 3.9** respectively.

Mixing Height

The mixing heights for ambient air quality predictions are adopted from Atlas of Hourly Mixing Height and Assimilative Capacity of Atmosphere in India by S.D Attri, Siddartha Singh, B. Mukhopadhyaya and A.K Bhatnagar, Published by Indian Metrological Department, New Delhi. 2008. The mixing heights range from 300 to 1450 m during summer season. There is no record of inversion for this area (Reference: Atlas of Hourly Mixing Height and Assimilative Capacity of Atmosphere in India by S.D Attri, Siddartha Singh, B. Mukhopadhyaya and A.K Bhatnagar, Published By Indian Metrological Department, New Delhi. 2008). There is no record of inversion in this area as observed from the IMD data.

4.2.1.2 Utility Emissions

The sources of air pollution from proposed expansion are boilers, Thermic Fluid Heaters and DG sets. The major pollutants generated from the fuel combustion are SO₂, NO_x and Particulate Matter. Based on fuel analysis and combustion details the emission rates of above pollutants are calculated. The emission rates of SO₂, NO_x and Particulate Matter from each stack are presented in **Table 4.2**.

Table 4.2 Emission Details of Pollutants from Stack

S. No	Stack Connected to	Stack Ht (m)	Dia of stack at top(m)	Temp. of exhaust gases (°C)	Exit Velocity (m/sec)	Pollutant Emission Rate (g/sec)		
						PM	SO ₂	NO _x
Existing								
1	1 x 6 TPH Coal fired Boiler *	30	1.3	140	6.2	0.5	0.42	0.15
2	1 x 3 TPH Coal Fired Boiler *	30	0.83	128	8.5	0.15	0.4	0.21
3*	1 x 125 kVA DG set	2.2	0.15	320	5	0.001	0.01	0.02
Proposed								
1	1 x 20 TPH Coal Fired Boiler	40	1.8	180	15	1.8	3.2	4.6
2	1 x 12 TPH Coal fired Boiler *	40	1.3	140	6.2	0.8	1.5	2.4

3	2 x 10 TPH Coal Fired Boilers	30	1.5	180	10	0.5	1.2	1.9
4	1 x 10 Lakh Kcal Thermic Fluid Heaters	30	1.2	170	7.5	0.08	0.12	0.19
5	1 x 2 Lakh Kcal Thermic Fluid Heaters	15.2	0.4	180	6	0.04	0.08	0.12
6**	7 x 1500 kVA DG sets	12	0.2	180	10	0.02	0.03	0.5

* standby

**DG sets will be used during load shut down by AP TRANSCO

4.2.1.3 Air Quality Predictions (Terms of Reference No. 7(i))

Predictions of ground level concentrations of the pollutants were carried out based on site meteorological data collected during October – December 2017. A grid of 10 km X 10 km with a receptor interval of 400 meters is considered for calculation of ground level concentrations.

The composition of particulate matter was obtained from USEPA AIRCHIEF AP-42 and the same was considered in determining the source concentration of PM₁₀ and PM_{2.5} for prediction purpose. The predicted maximum 24 hourly ground level concentrations of Suspended Particulate Matter, PM₁₀, PM_{2.5}, SO₂ and NO_x and distance of occurrence during different seasons of study period are presented in [Table 4.3](#).

It may be observed that the annual predicted maximum 24 hourly GLC's of PM, PM₁₀, PM_{2.5}, SO₂ and NO_x are 4.08, 1.66, 0.73, 8.06 and 15.72µg/m³ respectively and the maximum values are observed at a distance of 1.0 km from the center of plant site in northeast direction. However it may be noted that the predicted values of the SO₂ and NO_x are based on the assumption that the DG sets are used constantly, where as the DG set usage is only during load shut down from APTRANSCO.

The GLC's are also predicted at air quality monitoring locations and the predicted GLC's are presented in [Tables 4.4](#) and the cumulative concentrations at various villages are tabulated in [Table 4.5](#). It may be observed from the table that the predicted results show that the incremental rise over existing base line status of ambient air quality is within the limits prescribed by National Ambient Air Quality

standards (NAAQ), and hence the impact due to the addition of utility for expansion is low on ambient air quality. Hence the control measures and height of stack is sufficient to disperse the pollutants into the atmosphere and keeping the baseline levels within the prescribed limits. The predicted ground level concentrations are graphically displayed for SPM, PM₁₀, PM_{2.5}, SO₂, and NO_x respectively in **Figure 4.7 - 4.11**.

Table 4.3 Maximum Predicted 24 hourly GLC's

S.No	Parameter	Predicted GLC ($\mu\text{g}/\text{m}^3$)	Distance, km	Direction
1	SPM	4.08	1.0	NE
2	PM ₁₀	1.66	1.0	NE
3	PM _{2.5}	0.73	1.0	NE
4	SO ₂	8.06	1.0	NE
5	NO _x	15.72	1.0	NE

Table 4.4 Predicted GLC's at Monitoring Locations

S.No	Monitoring Location	Direction	Distance, km	Predicted GLC ($\mu\text{g}/\text{m}^3$)				
				PM	PM ₁₀	PM _{2.5}	SO ₂	NO _x
1	Kovvada	SW	1.2	0.60	0.24	0.11	1.06	0.60
2	Gumpam	S	1.3	1.65	0.67	0.30	2.90	1.65
3	Govindapuram	SE	1.8	1.12	0.46	0.20	1.96	1.12
4	Lankalapallipalem	NE	2.7	0.04	0.02	0.01	0.07	0.04
5	Kandivalasa	NE	2.1	0.04	0.01	0.01	0.06	0.04
6	Kanimetta	NW	2.2	0.12	0.05	0.02	0.21	0.12
7	Chodammaagraharam	NW	1.9	0.72	0.29	0.13	1.27	0.72
<i>Reserved Forest</i>								
1	Kumili RF	NE	2.6	0.98	0.40	0.18	1.73	3.79
2	Konada RF	SW	7.6	0.08	0.03	0.01	0.14	0.31
3	Damarasingi RF	NW	8.2	0.08	0.03	0.01	0.13	0.30

Table 4.5 Cumulative Concentrations at Various Villages and Reserved Forests

Station	Distance, Km	Baseline Concentration, $\mu\text{g}/\text{m}^3$				Predicted GLC, $\mu\text{g}/\text{m}^3$				Cumulative Concentration, $\mu\text{g}/\text{m}^3$			
		PM ₁₀	PM _{2.5}	SO ₂	NO _x	PM ₁₀	PM _{2.5}	SO ₂	NO _x	PM ₁₀	PM _{2.5}	SO ₂	NO _x
		Kovvada	1.2	48	18	11	11	0.24	0.11	1.06	2.32	48.24	18.11
Gumpam	1.3	46	18	11	11	0.67	0.30	2.90	6.37	46.67	18.30	13.90	17.37
Govindapuram	1.8	46	16	11	11	0.46	0.20	1.96	4.31	46.46	16.20	12.96	15.31
Lankalapallipalem	2.7	45	16	11	11	0.02	0.01	0.07	0.15	45.02	16.01	11.07	11.15
Kandivalasa	2.1	46	16	11	11	0.01	0.01	0.06	0.14	46.01	16.01	11.06	11.14
Kanimetta	2.2	44	16	11	11	0.05	0.02	0.21	0.45	44.05	16.02	11.21	11.45
Chodammaagraharam	1.9	46	16	11	11	0.29	0.13	1.27	2.79	46.29	16.13	12.27	13.79
<i>Reserved Forest</i>													
Kumili RF	2.6	-	-	-	-	0.40	0.18	1.73	3.79	0.40	0.18	1.73	3.79
Konada RF	7.6	-	-	-	-	0.03	0.01	0.14	0.31	0.03	0.01	0.14	0.31
Damarasingi RF	8.2	-	-	-	-	0.03	0.01	0.13	0.30	0.03	0.01	0.13	0.30

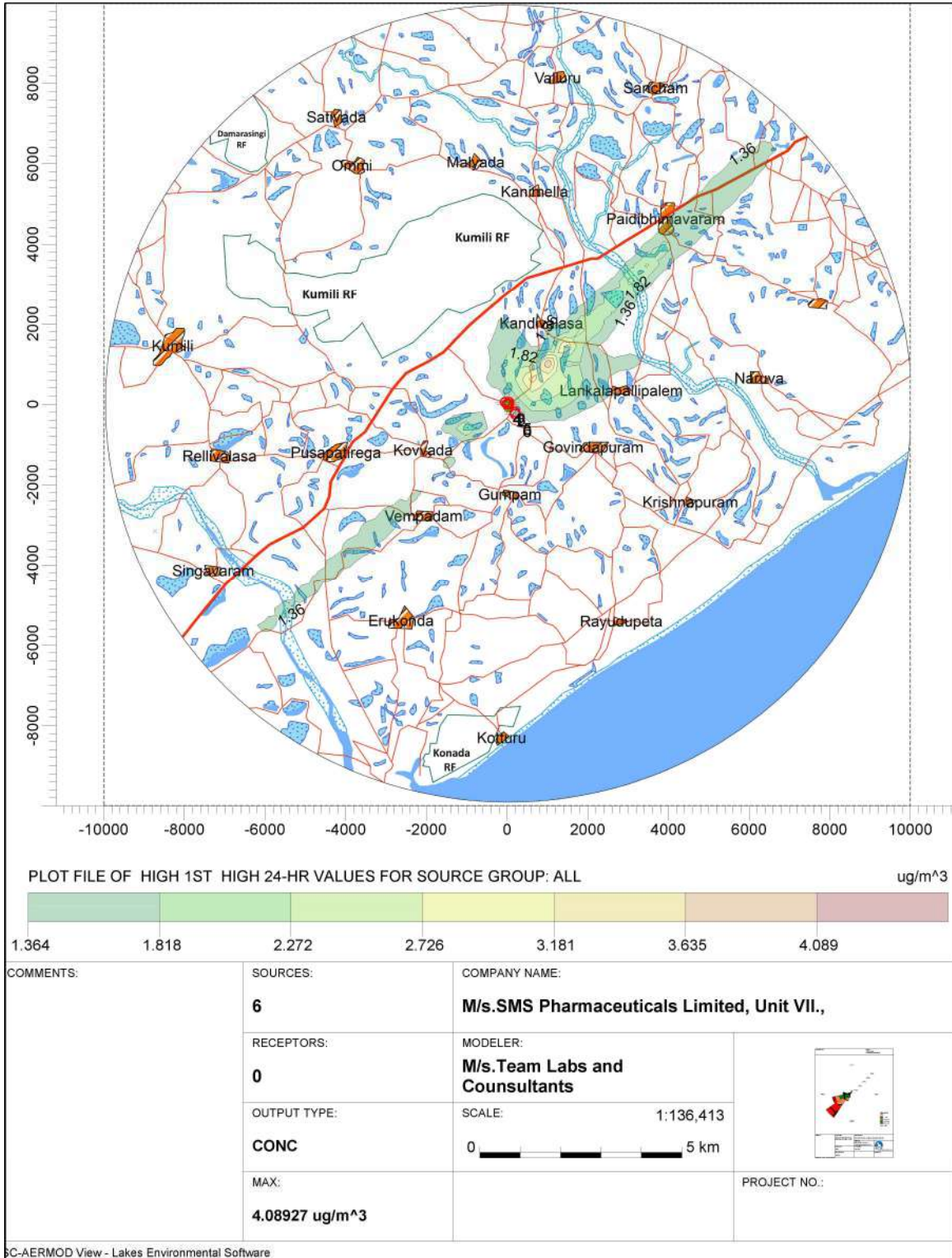


Figure 4.7 Isopleths Showing 24 Hourly GLC's of SPM

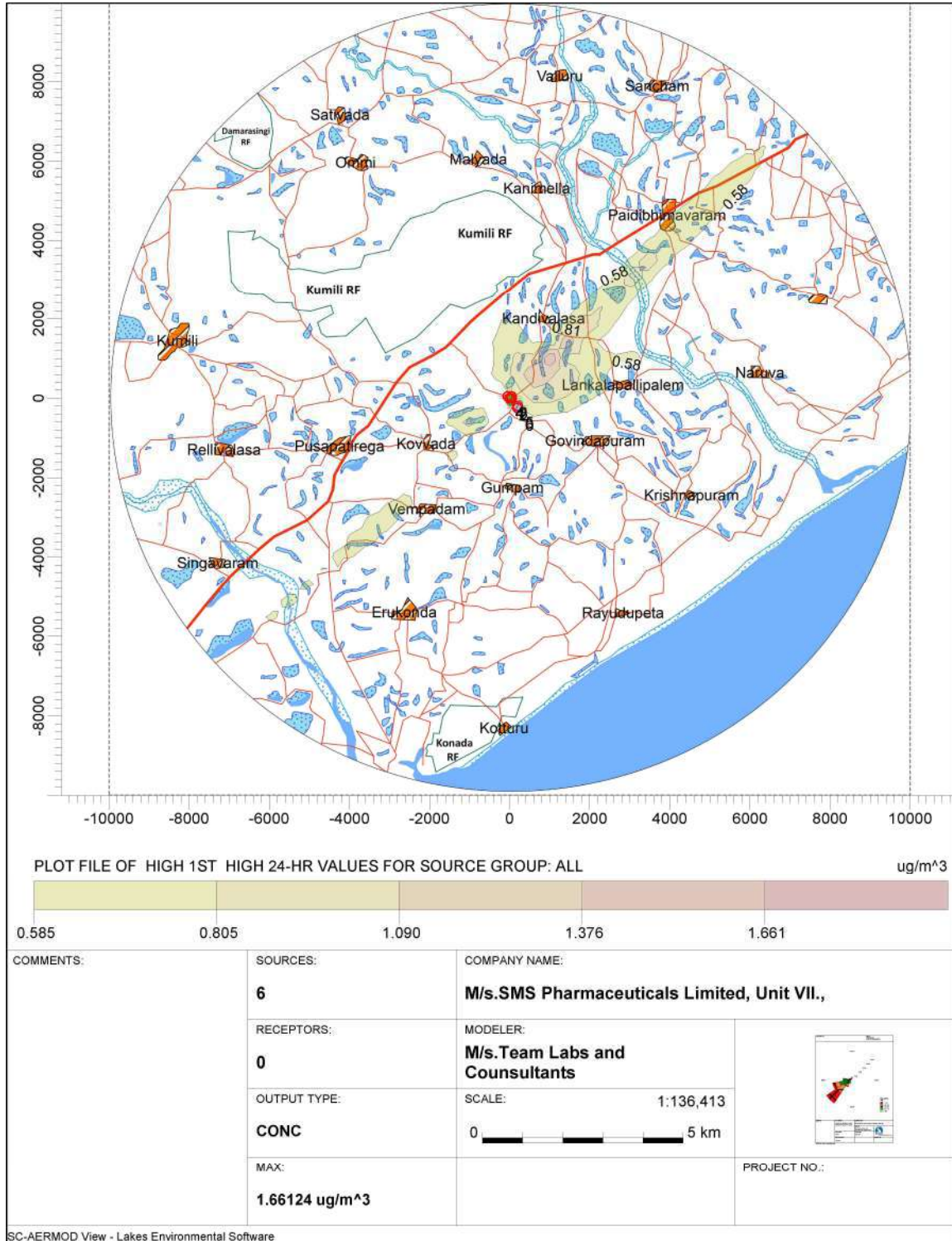


Figure 4.8 Isopleths Showing 24 Hourly GLC's of PM₁₀

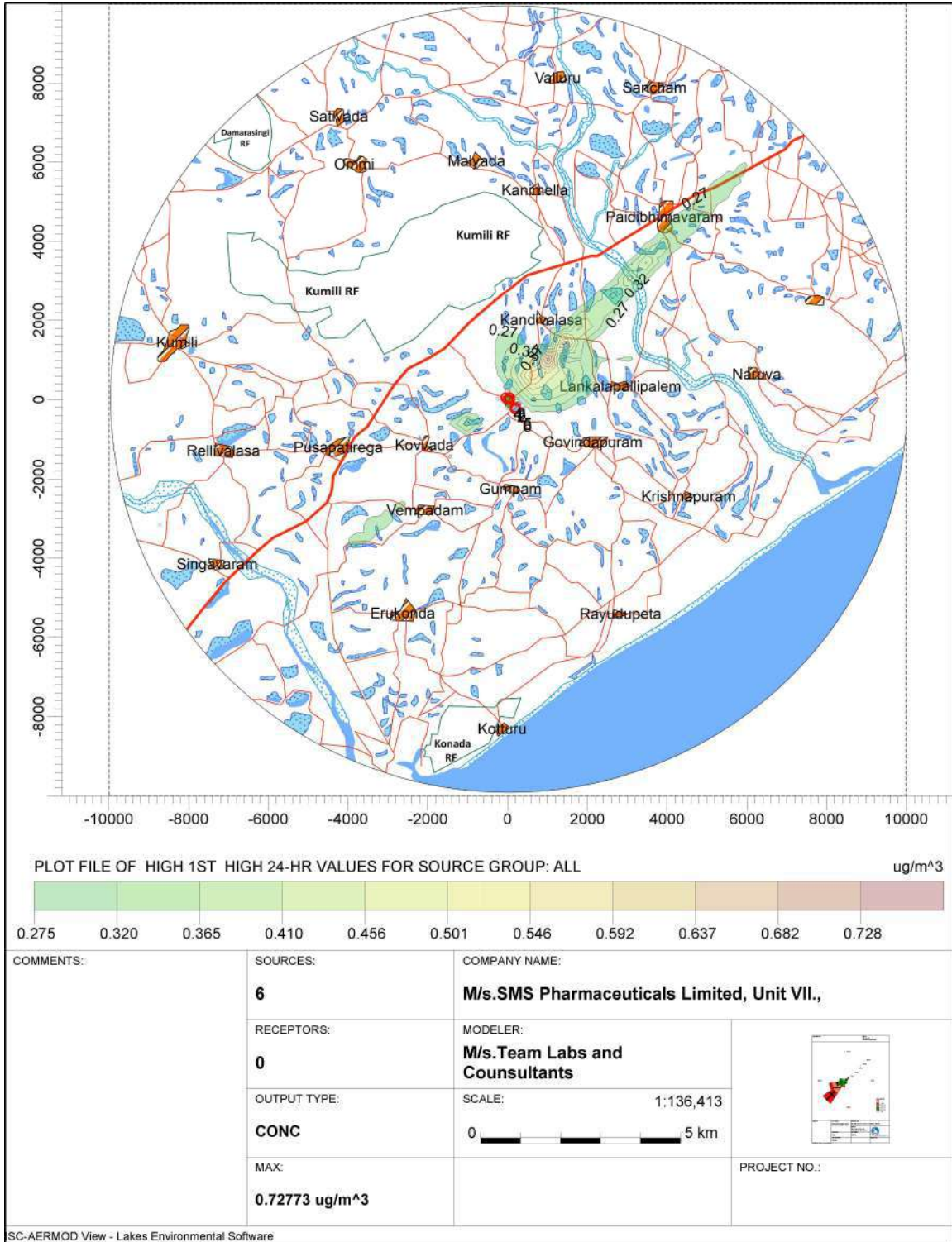


Figure 4.9 Isopleths Showing 24 Hourly GLC's of PM_{2.5}

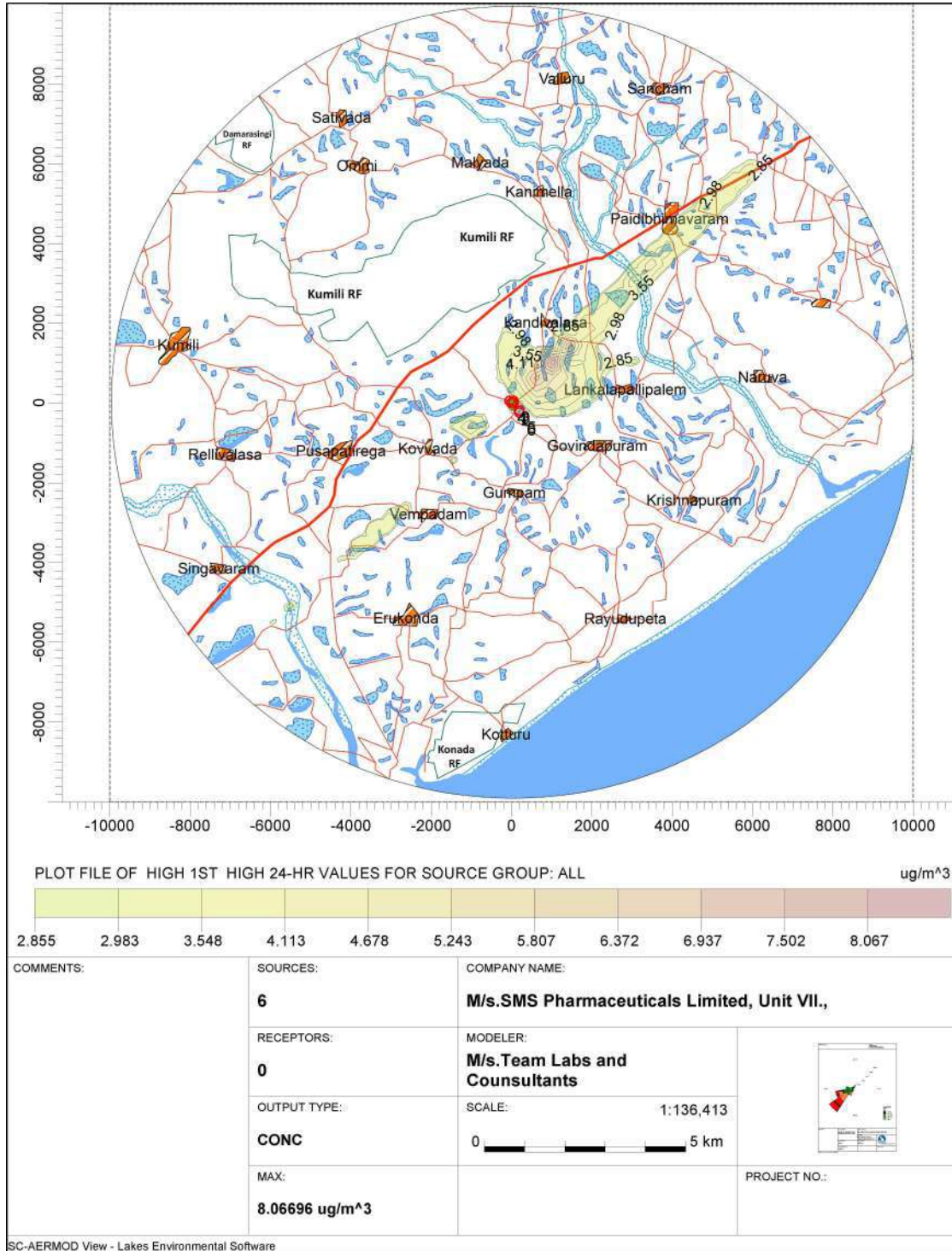


Figure 4.10 Isopleths Showing 24 Hourly GLC's of SO₂

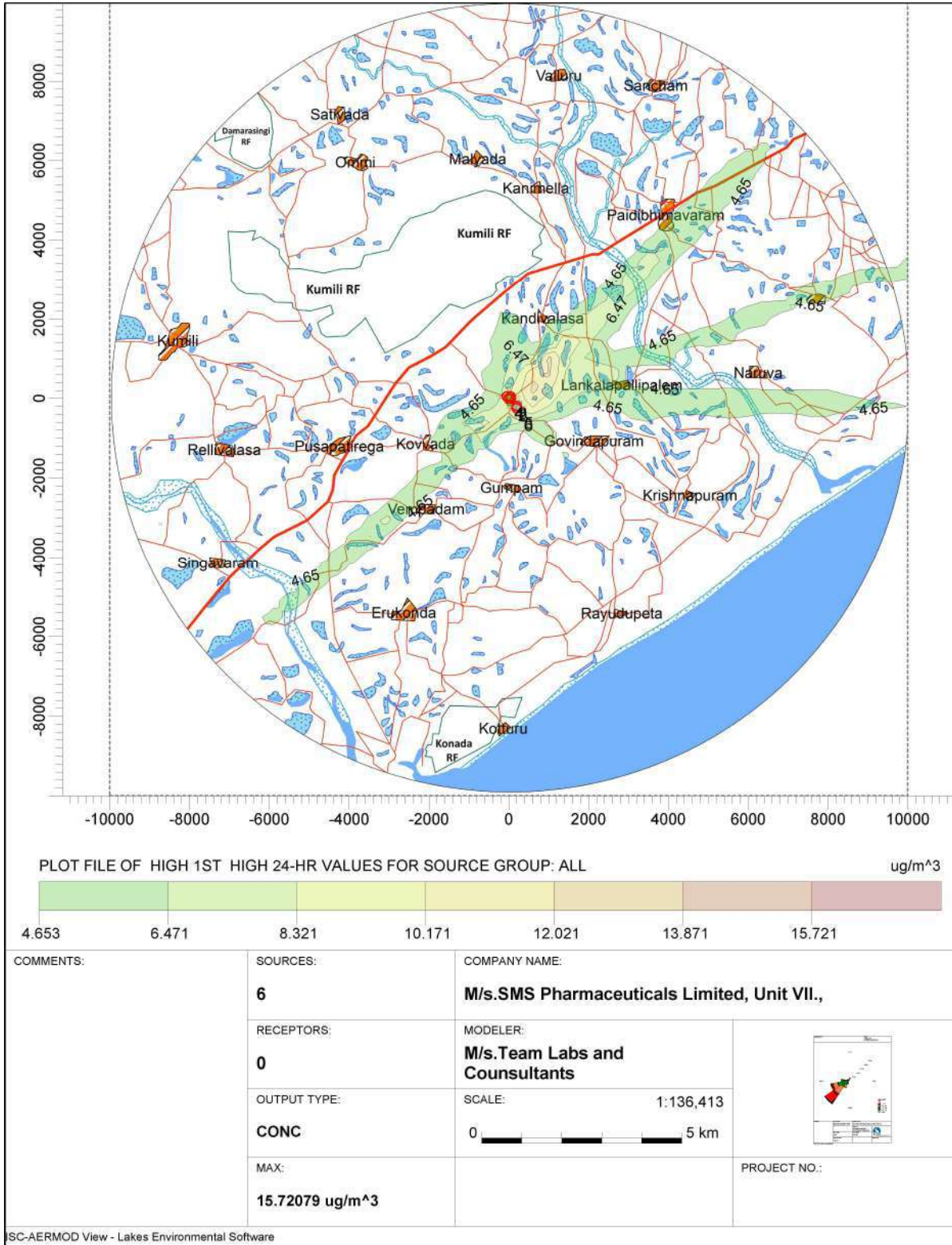


Figure 4.11 Isopleths Showing 24 Hourly GLC's of NO_x

4.2.1.4 Prediction of Concentration of Solvents in the Indoor Environment Due to Solvent Loss and Fugitive Emissions

A simple Box Model (EVAPMOD) was used to calculate the solvent concentration in the indoor environment, as solvents are mainly used as reaction medium involving significant quantities. The methodology adopted was to calculate the resultant concentration due to solvent loss in the work room area, which will have significance negative impact, if it exceeds the TLV value of respective solvent. It may however be noted that usage of solvent mixtures and atmospheric interaction of various solvents and chemicals released are not studied due to lack of literature.

General Box Model:

Indoor air pollution models developed and used by USEPA and others consider the conservation of air contaminant mass in a volume or "box" of workroom air. Airborne concentrations are derived by solving the following general equation (Jay jock, 1988):

$$C = (A_{in} - A_{out}) / \text{Volume of Box} \quad (1)$$

Where

- C = Concentration at time t_i (assume $C=0$ @ $t_0 = 0$)
- A_{in} = Mass of contaminant that went into the box during time interval $t_i - t_0$
- A_{out} = Mass of contaminant that left the box during time interval $t_i - t_0$

The diffusion coefficient and the generation rate of the contaminant were calculated to arrive at the airborne concentration in the environment.

For the General Ventilation Model, the overall estimate of the airborne concentration of a contaminant is obtained by use of following equation.

$$C_v = \frac{(1.7 \times 10^5) T_a \cdot G}{M \cdot Q \cdot m}$$

- Where:
- C_v = Contaminant concentration in workplace (ppm)
 - T_a = Ambient temperature of the air ($^{\circ}K$)
 - G = Vapor generation rate (gm/sec)
 - M = Molecular Weight (gm/gm-mole)
 - Q = Ventilation rate (ft^3/min)
 - m = Mixing factor (dimensionless)

The predicted airborne concentrations of the various solvents are tabulated in the **Table 4.6**. It may be noted that all the predicted work room concentrations are within the prescribed TLV values and that the release of the same into atmosphere may further dilute the ambient concentrations, thereby resulting in least impact on ecology and human health.

Table 4.6 Solvent Loss and the Predicted Airborne Concentrations

S.No	Name of Solvent	Fugitive Loss (kg/day)	Air borne Solvent Conc. (ppm)	TLV (ppm)
1	Acetic acid	13.0	6.4	10
2	Acetone	99.1	50.6	1000
3	Acetonitrile	35.3	25.5	40
4	Chloroform	79.7	19.8	50
5	Cyclohexane	109.2	38.5	300
6	Dichloromethane	86.4	30.2	50
7	Dichloroethane	6.6	2.0	50
8	Diethylether	0.2	0.1	10
9	Diisopropyl ether	13.1	3.8	250
10	Dimethyl acetamide	11.6	4.0	10
11	Dimethyl formamide	21.7	8.8	10
12	Dimethyl sulfoxide	27.4	10.4	50
13	Dioxane	25.6	8.6	100
14	Ethanol	109.2	70.4	1000
15	Ethyl acetate	428.4	144.2	400
16	Hexane	56.9	19.6	50
17	Isopropyl alcohol	256.0	126.3	400
18	Isopropyl acetate	30	8.7	100
19	Isopropyl ether	6	1.8	500
20	Methanol	95	87.9	200
21	Methyl tert-butyl ether	42.5	14.3	50
22	N,N-Dimethylformamide	7.3	3.0	10
23	n-Heptane	46.1	13.6	500
24	N-Methyl-2-Pyrrolidone	3.7	1.1	25
25	n-Propyl Alcohol	31.2	15.4	200
26	O-xylene	5.4	1.5	100
27	Pet. Ether	8.3	2.9	300
28	Tetrahydrofuran	164.2	67.5	200
29	Toluene	212.8	68.5	200
30	Triethylamine	8.6	2.5	25

4.2.2 Water Environment

The required water for expansion shall be drawn from bore wells. The source of wastewater is process, utilities and domestic usage. The total fresh water required of quantity after expansion is 2035 KLD. The effluent generation in the plant may have a direct negative impact with high significance, on both ground and surface water regimes, if mitigation measures are not adopted and the effluents are disposed without treatment. The release of effluents may change ground water quality, change in run off quality, change in ground water and surface water interaction, change in channel morphology leading to deterioration of production levels of both terrestrial and aquatic flora and fauna, resulting in higher concentrations of chemicals in food chain. The treated effluent from proposed expansion is sent to Marine Outfall system after meeting marine disposal standards prescribed CPCB. The mitigation measure shall hence ensure that the impact is of low significance and ensure sustainability of water resource. The impacts of these activities are both direct and indirect effecting soil.

4.2.3 Noise Environment

The project activities that have an impact on noise environment are operation of motors, pumps, compressors, turbines, DG sets resulting in direct impact of increasing ambient noise levels both within the work room area and outside. Excessive noise will trigger health risks such as headaches, depression, deafness and retardation of sensory mechanisms in the impact area population. The incremental noise levels due to these activities were predicted and the values reflect low impact outside the premises. The increase in noise levels shall have low impact, restricted to within site area due to its low magnitude and occasional frequency. The incremental noise levels however shall have direct negative impact on the noise levels, with low significance due to mitigation measures and also due to absence of sensitive receptors within 1.7 km of the sources.

4.2.3.1 Prediction of Impact on Noise Quality

The sound pressure level generated by noise source decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure levels also occurs with increasing distance from the source due to atmospheric effect or interaction with the objects in the transmission path. This is due to excess attenuation.

The sound pressure level is also affected by medium of travel and environmental conditions. The propagation model has been devised to take into account these factors and predict the noise levels at various distances round a single or a multiple source. The model uses the following formula as a basis for such predictions.

$$(L_{ob}) = (L_r) - (L_{div}) - (L_{atm})$$

Where (L_{ob}) = Observed noise level at a distance R from source

(L_r) = Noise level of source measured at reference distance r

(L_{div}) = Loss due to divergence at distance R from source
= $20 \log (R/r)$

(L_{atm}) = Attenuation due to atmosphere at distance R from the source.
= $a \times R/100$, where a is atmospheric attenuation coefficient in dB (A)/100m.

For hemispherical wave divergence in a homogenous loss free atmosphere $(L_{atm}) = 0$.

The total impact of all sources at particular place is then estimated by adding as the contribution of noise from each of the following sources as follows;

$$(L_{eq}) = 10 \log \sum_{i=1}^{i=n} \{10^{(L_{ob})^i/10}\}$$

Where n = total number of sources

The calculated noise levels are further super imposed (logarithmically) on the background noise levels. The model assumes that the noise spectrum is mainly centered on a spectrum of 1000 Hz and attenuation due to building materials is also at the same frequency.

The major sources of noise generation are DG sets, soot blowing of boiler, compressors and motors, which emit noise level of maximum 90 dB (A) - 110 dB (A) at a reference distance of 1m from the source. The predicted cumulative noise levels due to the source and the existing level as calculated from the logarithmic model without noise attenuation ranged between 55 and 75 Db (A) at distances ranging between 62 to 185 m which falls within the plant boundary. The impact of noise on the population in the surrounding area will be negligible, as the nearest habitation is 1.7 km away from the site.

4.2.4 Land Environment

The proposed expansion plan involves construction of additional production blocks, enhancement of treatment system and storage. There is no alteration of terrain as the

expansion is done on plain land, and may lead to additional sealing of land due to increased foot print due to addition of civil structures. The proposed expansion shall also result in increased generation of solid waste, mainly process residue and solvent residue which will be sent to cement plants as auxiliary fuel for co-processing. Handling of hazardous waste has a potential to contaminate soil, ground water, land capability and permeability of soil. However as long as it is not affecting the soil quality chemistry and sedimentation, the impact is not an undesirable one. The impact on land environment is mainly due to accidental spillages of chemicals, effluents and wastes. The expansion project has neutral impact on land environment, terrain and soils as there is no additional land requirement, and the impacts if any are restricted to within the site with negligible magnitude and is felt mainly during expansion work only. The operational phase impacts shall be low due to effective implementation of mitigative measures in handling, storing and transferring wastes, effluents and chemicals. It may however be noted that significant negative impacts may occur due to accidental releases of chemicals, effluents and wastes on soil.

4.2.5 Biological Environment

The proposal is on expansion of existing drug manufacturing unit and it has not been in the list of any of the notified ecological sensitive zones suggested by any authority. No existing forest cover will be disturbed and forest and timber resources are never be used during any phase of the project.

The proposed activities affect environmental segments of the surrounding region not very significant. The effects on biological environment are divided into two parts, viz. the effect on biodiversity and habitat. Effect on flora is due to two main reasons, land clearing due to construction activities.

Table 4.6 Ecological factors

Species diversity	No reduction
Habitat loss or fragmentation	Nil
Affect on any additional risk or threat to the rare or endangered or endemic or threatened (REET) species	Nil
Any impairment of ecological functions such as (i) disruption of food chains, (ii) decline in species population and or (iii) alterations in predator-prey relationships	Nil

Is it possible to attain the global objectives of “no net loss” of biodiversity	Yes
Is it possible to improve the biological diversity through the proposed mitigation activity	Yes

From the above table, it is very clear that proposed activity shall not impact on the biodiversity of the region. Hence it is recommended to construct the proposed project in the proposed locality by following certain conservation measures. However, habitat and species conservation at large scale may give some benefit to the surrounding region.

Positive benefits of the existing plantation activities undertaken by Project authority:

Benefits in terms of enhanced biodiversity

Due the present plantation activities within the boundary of the project site, the species diversity will be enhanced. More ornamental, palm trees, uncommon varieties of the climbers and shrubs which are suitable to the region can be taken into criteria.

Aesthetics

The beauty of the region will be enhanced through various flowering plants which intern attracts bird species of the region.

Carbon sink

Planting new forests, rehabilitating degraded forests and enriching existing forests contribute to mitigating climate change as these actions increase the rate and quantity of carbon sequestration in biomass. Introduction of trees on non-forest or degraded forestlands, industrial plantations, Village plantations, restoration of natural forest, watershed protection, orchards and perennial cultures, agro-forestry activities enhance the ecological and economic values.

There are no migratory corridors, nesting and Breeding sites within the core zone. No species specific measures are needed in this connection. From the list of floral and faunal species it is very clear that there are no Rare or Endangered or Endemic or

Threatened (REET) species present in site area and adjoining area. Hence there is no need to take mitigation measures in this connection.

The direct impacts

No direct impact on present vegetation. No destruction of biodiversity within plant site and natural ecosystems through removal of natural soils, plants and the floral dependent animals. As per the interaction with the plant staff, no flora and faunal species are going to be disturbed or removed. No wildlife population is present in the study area except the common type of birds and domestic animals. No significant long-term residual impacts on fauna due to project are expected.

Indirect Impacts

No indirect impact on present vegetation. Even though three reserve forests are located in the impact area and the impact from the emissions are not going to affect the flora or fauna. The impact intensity may be moderate at initial stage but it might be high when it is in full stretched operation condition. The terrestrial habitat is going to be modified as per the green belt plan. The proposed activity is not going to affect the local plants, birds, reptiles and amphibians. The producers are grass species, herbs, shrubs and trees. The consumers are reptiles, aves and lesser mammals.

Flora and Fauna can be affected by emissions from pharmaceutical plants and by loss of habitats such as vegetation and water bodies. The site area and the adjoining areas share similar habitat and thus clearing of ground will not eliminate habitat of any species permanently. Overall, there are no threats for increasing the rarity of any species under this criterion. The vehicular movement and road traffic sometimes results in introduction of unwanted species but the site already has existing traffic and population interaction so the probability increase in weed species is unlikely thus is of low sensitivity.

The project site does not overlap with any of the recognized Ramsar sites. The construction phase does not envisaged excavation or alteration in water bodies hence shall not entail changes in aquatic biodiversity. The construction does not involve diversion or change in the major rivers, canals, backwaters and creeks.

Considering these predicted impacts, a comprehensive green belt development plan and Wildlife management plan are proposed which shall improve the existing status of ecosystems and associated biodiversity in the nearby area. These habitat improvement efforts shall not only cover the project core area but adjoining areas as well.

Effect on Ecosystems, Food Chain and Food web

Effect on Ecosystems

There is no mangrove ecosystem present in the study region and hence impact intensity may be nil. The terrestrial habitat is going to be cleared which is within the plant premises. No grassland habitat is going to be disturbed. One must be very concerned towards ecology of the area while altering the habitats.

Food Chain and Food web effect

The present activity will not affect the local and resident birds, reptiles and amphibians of the site area and adjoining area. The producers are grass species, herbs, shrubs and trees. The consumers are reptiles, aves and lesser and higher mammals. There are certain reptilian such as fan throated lizard and skinks found in the proposed site and they will be severely affected during construction phase. But overall they are the part of food chain and food web which may be ultimately affected.

Effect on Migratory corridors, Nesting and Breeding sites

There are no migratory corridors, nesting and breeding sites within the proposed site or in the study area. No need to take any mitigation measures in this connection.

Effect on REET species

From the list of floral and faunal species, it is very clear there are no Rare or Endangered or Endemic or Threatened (REET) species or any species listed in Schedule- I of the Wildlife (Protection) Act. Hence species specific and habitat specific mitigation measures are not needed in this connection.

Conservation Aspects

As the present activity is required to operate and maintain the vaporous emissions and effluents within the limits specified by the CPCB / State PCB, the direct effects on

the flora and fauna of the study area are very less. Neither the storm water nor the effluent water nor any other kind of waste water from the activity shall get into the drinking water resources. Further tall, wind resistant evergreen trees will be grown in the green belt to act a wind break around the project area. Hence, the anticipated environmental impacts on the flora and fauna of the study area are manageable and easily reversible up to certain extent. A comprehensive green belt programme will improve the ecological condition of the region.

4.2.6 Socio-economic Environment

The expansion project envisages additional employment to 300 people, with a monthly salary outlay of Rs. 75.3 lakhs which will have a direct positive impact. The neighboring villages and towns are having adequate institutions ranging from degree colleges to engineering colleges which may cater to the employee requirement of the plant. The expansion does not require any additional connectivity as the existing infrastructure is adequate reflecting in low impact. The site is about 10.5 km from Ranasthalam mandal, which has adequate infrastructure with respect to housing, education, transport, health and civic amenities, and hence the additional influx of 300 people may have low impact on infrastructure availability. The impact on health was assessed by air quality impact predictions and was observed to be within prescribed NAAQ standards. There will be medium significant, direct negative impact due to community expectations and public safety concern as the unit handles, and produces hazardous chemicals. The proposed CSR activities from the company shall also enhance the public approval for the project and ensure improvement in infrastructure in the surrounding villages. The overall impact due to this expansion shall be positive, both direct and indirect with high significance. The proposed expansion generates 300 employment during operation phase, and the required staff includes shift chemists, supervisors, administrative staff etc.

4.2.7 Prediction of Impact on Vehicular Traffic

As the plant is located adjacent to the national highway there will not be any unauthorized shop or settlements along the road connecting the plant site. The traffic density of the connecting road is low mainly consisting of local transport, commercial and passenger vehicle traffic. Raw materials and finished products are transported by

road using road trucks. The additional traffic generated due to the proposed expansion shall be 12-15 truck trips per day. There will be marginal increase in the traffic density.

The traffic study of the connecting road revealed that the peak traffic volume is 0.088 during 8 to 9 AM and the level of service of the connecting road remains A, after expansion also. Modified level of service for connecting roads considering the additional truck trips for both the unit for proposed expansion is presented in [Table 4.7](#)

Table 4.7 Modified level of services for connecting roads

Road	Existing volume, PCU/hr	Existing volume/ Capacity	Additional volume	Modified Volume	Modified volume/ Capacity	Modified Los & performance
Govindhapuram - National Highway	114	0.06	45	159	0.088	A (Excellent)

5.0 ANALYSIS OF ALTERNATIVES

The proposal is to expand the manufacturing capacity of API products within the existing site, with addition of facilities and utilities at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh in an area of 95.56 acres.

Analysis of alternatives was undertaken to assess sites, process, technology and treatment options. The site is not assessed in this case as it is an expansion project. The objective of this assessment is to identify best available technology not entailing excessive costs, and to reduce pollution loads by optimizing both raw material and resource consumption.

5.1 Alternative Sites

The proposal is for expanding the existing unit, and the land area available for expansion is sufficient and hence there is no requirement of alternative site or additional site area. Hence there was no requirement of alternative site assessment.

5.2 Alternative in Process

The process mass intensity was mainly contributed by water and solvents. Solvents are used as a medium of reaction for all the stages of process. The material balance of each stage of the product was reviewed and it was observed that the solvent usage is ranging from 120 to 16000 kg/day. Solvents like Methylene dichloride, dimethyl sulfoxide, tetrahydrofuran etc. were observed to be used in the manufacturing process of various products. The management has been a pioneer of conducting research and development of active pharma ingredients and is in process of identifying potential solvents from the list of preferred solvents as per green chemistry principles, i.e., solvents like water, methanol, ethanol, propanol, ethyl acetate etc.

The usage of high pressure water jet in place of fill and vacate method of washing is chosen as the best alternative of equipment washing. The product washings will be optimized by agitating the wash product thereby reducing number of washings. The

management proposed to assess process mass intensity of each stage of manufacturing and evaluate the best options of reducing the process mass intensity by reducing usage of water and solvents in addition to improving the yields of reaction.

5.2.1 Alternatives in Technology

Active Pharma Ingredients manufacturing is mainly batch process, with usage of day tanks, reactors, and centrifuge, filters and dryers, wherein each stage of process involves different type equipment which are potential sources of diffuse emissions. Hence the alternatives were reviewed for charging the material into reactors to drying of product. Manual charging of material shall be completely avoided to reduce diffuse emissions and loss into atmosphere of raw materials.

The cogeneration plants shall use high pressure boilers of 67 bar (a) pressure. Instead of condensing the steam after passing through turbine, the pressure of steam is stepped down to medium pressure ranging between 10 to 15 bar pressure and extract the steam of about 9.5 TPH to use process heating requirements and also effluent treatment system. This option shall ensure reduced water consumption for cooling towers, and reduced fuel consumption resulting in lesser emissions release into atmosphere both onsite and offsite.

The constant flux cooling jacket reactors is proposed for regulating the process temperature without altering the jacket temperature for quick cooling of reaction mass to avoid diffuse emissions and loss of media. The technologies identified for adoption are dip pipe provision for transfer of liquid materials from day tanks to reactors to avoid static electricity, Air operated Diaphragm (AOD) pumps for transfer of materials from drums, powder transfer systems for solids and transfer by pipeline. The identified alternative for filter and dryers was Agitated Nutche Filter and Dryer (ANFD) which serves the purpose of both filtration and drying thereby reducing the transfer of material from one equipment reflecting in reduced diffuse emissions. It is proposed to enhance the solvent recovery system by installing fractional distillation columns in place of simple distillation to increase the purity of recovered solvents, which can be reused in process, thereby reducing the consumption of solvents used

and diffuse emissions. The seamless pipes will be used for piping, less number of bends and flanges to avoid loss of material and fugitive emissions. Double mechanical sealed flanges, in solvents transfer pipelines, PTFE pumps for transfer of corrosive material transfer and charging.

The research and development team considered various options of increasing the yields and recovery of byproducts which will have a bearing on the pollution load. Accordingly technologies and processes are identified for recovering various salable by products. This will ensure improved economic viability, reduced pollution loads and reduced capital and operational expenditure of pollution control equipment. It is proposed to continually assess the processes to identify possible schemes for recovery/reuse of wastes.

5.2.2 Alternatives in treatment/mitigation options

The emission sources in the proposed expansion project are utilities, storages, process and effluent treatment system. The alternatives assessed for air pollution control equipment to the boilers are cyclone, multicone cyclone, scrubbers, bag filter and electro static precipitator. Bag filters are selected as the optimum technology for high pressure boilers to ensure particulate emission standards as prescribed by CPCB/SPCB. The alternatives assessed for mitigating emissions process is double stage scrubbing system of PPFRRP material of construction to avoid corrosion of acid fumes, condensers, nitrogen blanketing with breather valves for storages and thermal insulation, nitrogen blanketing for low boiling solvents. Condensers of larger surface area are proposed to mitigate both diffuse and process emissions and the alternatives of medium assessed were RT water, cold water, chilled brine. Cold water and chilled brine were identified as the best medium to mitigate VOC concentration in ambient air.

Marine outfall system is being used for treated effluent disposal and same will be practised after expansion also. The concentration of effluents is lean compared to pesticide and dyes sector, with multiple streams of varying concentrations of COD and TDS. Accordingly, a complex system involving chemical precipitation, physical separation and biological treatment was identified considering the inadequacy of a

single and simple technology to treat the complex wastes from API manufacturing, to ensure that the treated wastewater meets the CPCB marine outfall standards. It is observed that the treatment technology to be a source of solid waste as the organic and inorganic components are separated as stripper condensate and or Multiple Effect Evaporator (MEE) and Agitated Thin Film dryer (ATFD) salts. The management identified this aspect and proposed to identify alternative solid waste treatment/disposal methods, and accordingly proposed to assess the feasibility of disposing the stripper condensate for co-incineration in cement plants as a alternative fuel.

6.0 ENVIRONMENTAL MONITORING

6.1.1 Introduction

The environmental monitoring programme provides such information on which management decision may be taken during construction and operation phases. It provides basis for evaluating the efficiency of mitigation and pollution control measures and suggest further actions that need to be taken to achieve the desired effect.

The monitoring includes:

- (i) Visual observations;
- (ii) Monitoring of environmental parameters at specific locations;
- (iii) Sampling and regular testing of these parameters.

6.1.2 Objectives

The objectives of the environmental monitoring programme are:

- Evaluation of the efficiency of mitigation and pollution control measures;
- Updating of the actions and impacts on baseline data;
- Adoption of additional mitigation measures if the present measures are insufficient;
- Generating the data, which may be incorporated in environmental management plan in future projects.

6.1.3 Methodology

Monitoring methodology covers the following key aspects:

- Components to be monitored;
- Parameters for monitoring of the above components;
- Monitoring frequency;
- Monitoring standards;
- Responsibilities for monitoring;
- Direct responsibility,
- Overall responsibility;
- Monitoring costs.

Environmental monitoring of the parameters involved and the threshold limits specified are discussed below for the proposed expansion of synthetic organic chemicals (Bulk drug manufacturing) unit of M/s. SMS Pharmaceuticals Limited, Unit VII.

6.1.4 Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters recommended are PM₁₀, PM_{2.5}, Oxides of Nitrogen (NO_x) and Sulphur Dioxide (SO₂). These are to be monitored at designated locations starting from the commencement of construction activity. Data should be generated at all identified locations in accordance to the National Ambient Air Quality Standards (Table 6.1) location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 6.1 National Ambient Air Quality Standards

S.No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecological Sensitive Area (Notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO ₂)	Annual*	50	20	Improved west and GaekeUltraviolet fluorescence
		24 Hours**	80	80	
2	Nitrogen Dioxide (NO ₂)	Annual*	40	30	Modified Jacob & Hochheiser (Nn-Arsenite) Chemiluminescence
		24 Hours**	80	80	
3	Particulate Matter (Size Less than 10 µm) or PM ₁₀	Annual*	60	60	Gravimetic TOEM Beta Attenuation
		24 Hours**	100	100	
4	Particulate Matter (Size Less than 2.5µm) or PM _{2.5}	Annual*	40	40	Gravimetic TOEM Beta Attenuation
		24 Hours**	60	60	
5	Ozone (O ₃)	8 hours**	100	100	UV Photometric Chemiluminescence Chemical Method
		1 hour**	180	180	
6	Lead (Pb)	Annual*	0.50	0.50	AAS /ICP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter.
		24 hours**	1.0	1.0	
7	Carbon	8 hours**	02	02	Non Dispersive Infra Red

	Monoxide (CO)	1 hour**	04	04	(NDIR) Spectroscopy
8	Ammonia (NH ₃)	Annual* 24 hours**	100 400	100 400	Chemiluminescence Indophenol blue method
9	Benzene (C ₆ H ₆)	Annual*	05	05	Gas Chromatography based continuous analyzer Absorption and Desorption followed by GC analysis
10	Benzo (o) Pyrene(BaP) - Particulate Phase only,	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As),	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni),	Annual*	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

*Average Arithmetic mean of minimum 104 measurement in a year taken for a week 24 hourly at uniform interval.

**24 hourly/8 hourly values should meet 98 percent of the time in a year

6.1.5 Water Quality Monitoring

The physical and chemical parameters recommended for analysis of water quality relevant are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, chloride, lead, zinc and cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at all identified locations in accordance to the Indian Standard Drinking Water Specification - IS 10500: 1991 (stated in [Table 6.2](#))

Table 6.2 Indian Standard Drinking Water Specifications - IS: 10500:1991

S. No	Substance or Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
ESSENTIAL CHARACTERISTICS						
1	Colour, Hazen units, Max.	5	Above 5, consumer acceptance decreases	25	3025 (Part 4) 1983	Extended to 25 only if toxic substances are not suspected, in absence of alternate sources
2	Odour	Unobjectionable	-	-	3025 (Parts 5): 1984	a) Test cold and when heated b) Test at several dilutions
3	Taste	Agreeable	-	-	3025 (Part 7 & 8) 1984	Test to be conducted only after safety has been established
4	Turbidity NTU, Max.	5	Above 5, consumer acceptance decreases	10	3025 (Part 10) 1984	-
5	pH Value	6.5 to 8.5	Beyond this range, the water will affect the mucous membrane and/or water supply system	No relaxation	3025 (Part 11) 1984	-
6	Total hardness (as CaCO ₃) mg/l, Max	300	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21) 1983	-
7	Iron (as Fe) mg/l, Max	0.3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	1	32 of 3025 : 1964	-
8	Chlorides (as Cl) mg/l, Max	250	Beyond this limit, taste, corrosion and palatability are affected	1000	3025 (Part 32) 1988	-
9	Residual, free	0.2	-	-	3025	To be applicable only

S. No	Substance or Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
	chlorine, mg/l, <i>Min</i>				(Part 26) 1986	when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be <i>Min</i> 0.5 mg/l
DESIRABLE CHARACTERISTICS						
1	Dissolved solids mg/l, <i>Max</i>	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2000	3025 (Part 16) 1984	-
2	Calcium (as Ca) mg/l, <i>Max</i>	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40) 1991	-
3	Magnesium (as Mg), mg/l, <i>Max</i>	30	Encrustation to water supply structure and adverse effects on domestic use	100	16, 33, 34 of IS 3025: 1964	-
4	Copper (as Cu) mg/l, <i>Max</i>	0.05	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this	1.5	36 of 3025: 1964	-
5	Manganese (as Mn) mg/l, <i>Max</i>	0.1	Beyond this limit taste/appearance are affected, has adverse effects on domestic uses and water supply structures	0.3	35 of 3025: 1964	-
6	Sulphate (as 200 SO ₄) mg/l, <i>Max</i>	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are	400	3025 (Part 24) 1986	May be extended up to 400 provided (as Mg) does not exceed 30

S. No	Substance or Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
			present			
7	Nitrate (as NO ₂) mg/l, Max	45	Beyond this, may cause methaemoglobinemia	100	3025 (Part 34) 1988	-
8	Fluoride (as F) mg/l, Max	1	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025: 1964	-
9	Phenolic compounds (As C ₆ H ₅ OH) mg/l, Max	0.001	Beyond this, it may cause objectionable taste and odour	0.002	54 of 3025: 1964	-
10	Mercury (as Hg) mg/l, Max	0.001	Beyond this, the water becomes toxic	No relaxation	(see Note) Mercury ion analyzer	To be tested when pollution is suspected
11	Cadmium (as Cd), mg/l, Max	0.01	Beyond this, the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
12	Selenium (as Se), mg/l, Max	0.01	Beyond this, the water becomes toxic	No relaxation	28 of 3025: 1964	To be tested when pollution is suspected
13	Arsenic (As As) mg/l, max	0.05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37) 1988	To be tested when pollution is suspected
14	Cyanide (As CN), mg/l, Max	0.05	Beyond this limit, the water becomes toxic	No relaxation	3025 (Part 27) 1986	To be tested when pollution is suspected
15	Lead (as Pb), mg/l, Max	0.05	Beyond this limit, the water becomes toxic	No relaxation	(see note)	To be tested when pollution is suspected
16	Zinc (As Zn). Mg/l, Max	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	39 of 3025: 1964)	To be tested when pollution is suspected
17	Anionic detergents (As MBAS) mg/l, Max	0.2	Beyond this limit it can cause a light froth in water	1	Methylene-blue extraction method	To be tested when pollution is suspected
18	Chromium (As Cr ⁶⁺) mg/l, Max	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025: 1964	To be tested when pollution is suspected

S. No	Substance or Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
19	Poly nuclear aromatic hydrocarbons (as PAH) g/l, <i>Max</i>	-	May be carcinogenic above this limit	-	-	-
20	Mineral oil mg/l, <i>Max</i>	0.01	Beyond this limit undesirable taste and odour after chlorination take place	0.03	Gas Chromatographic method	-
21	Pesticides mg/l, <i>Max</i>	Absent	Toxic	0.001	-	-
22	Radioactive materials:				58 of 3025:01964	-
23	a) Alpha emitters Bq/l, <i>Max</i>	-	-	0.1	-	-
24	Beta emitters pci/l, <i>Max</i>	-	-	1	-	-
25	Aluminium (as Al), mg/l, <i>Max</i>	200	Beyond this limit taste becomes unpleasant	600	13 of 3025:1964	-
26	Aluminium (as Al), mg/l, <i>Max</i>	0.03	Cumulative effect is reported to cause dementia	0.2	31 of 3025:1964	-
27	Boron, mg/l, <i>Max</i>	1	-	5	29 of 3025:1964	-

Source: Indian Standard Drinking Water Specification-IS10500:1991

6.1.6 Noise Level Monitoring

The measurements for monitoring noise levels would be carried out at all designated locations in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989 (refer [Table 6.3](#)) Sound pressure levels would be monitored on twenty-four hour basis. Noise should be recorded at a “A” weighted frequency using a “slow time response mode” of the measuring instrument. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan ([Table 5.3](#))

Table 6.3 Noise level standards (CPCB)

Type	Noise level for Day	Noise level for
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence zone	50	40
Day time - 6.00 am - 9.00 pm (15 hours)		

The monitoring plan along with the environmental parameters and the time frame is presented in the [Table 6.4](#).

Table 6.4 Environmental Monitoring Plan (Terms of Reference No. 7 (xii))

S. No	Particulars	Monitoring Frequency	Standards	Duration of Sampling	Important monitoring parameters
Ambient Air Quality Monitoring					
1	Industry Main Gate, Kovvada, Gumpam villages	Monthly	Air (Prevention and Control of Pollution) Rules, CPCB, 1994	24 hrs	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , & VOC
2	Work Place Monitoring: Production blocks 10 locations, Solvent Tankfarm, and ETP area	Monthly		8 hr	SPM, VOC
Stack Emissions Monitoring					
1	Utility Stacks : 3 nos. Coal fired boilers, and 8 no.s DG sets.	Monthly	Air (Prevention and Control of Pollution) CPCB, 1994	--	PM, SO ₂ , Nox , recommended methods of CPCB.
Water Quality Monitoring					
1	Process water	Daily	Water Quality standards by CPCB	Grab	pH, TDS, SS, BOD, COD and Oil & Grease Hardness, , chlorides, using APHA or BIS analytical methods.

2	Effluents Stream wise	Quarterly		Grab	pH, TDS, SS, BOD, COD using APHA or BIS analytical methods.
3	Treated effluent before disposal Marine outfall	Daily		Grab	pH, TDS, TSS, COD, BOD and Oil and Grease using APHA or BIS analytical methods.
Noise Quality Monitoring					
1	Noise Levels at Turbine area, 3 Locations within plant site and 2 locations outside the plant site , Kovvada, Gumpam villages	Quarterly	Noise standards by CPCB	24 hrs	Equivalent Noise levels in dB(A)
Soil Quality Monitoring					
1	Soil - 3 locations within the site; storage area, near production blocks (10no.s) and ETP area.	Once a year			pH, EC, CEC, Lead, Moisture, Texture, Bulk Density etc.

6.1.7 Responsibility of Monitoring And Reporting System

The overall responsibility of monitoring the above parameters shall lie with the management of SMS Pharmaceuticals Limited, Unit VII. The maintenance/environment wing shall be responsible for day to day monitoring of effluent, raw water and treated water quality. The Ambient air quality, Stack emissions, soil, noise and water quality shall be monitored by either third party or by the Environment management division of the unit.

Records shall be maintained for the analysis of raw effluents and treated effluents, ambient air quality data, stack emissions monitoring results, micro- meteorological data and noise levels. These records are not only required for the perusal of the Pollution Control Board authorities but also to derive at the efficiencies of the pollution control equipment as the objective of the project proponent is not only compliance with statutory regulations, but also a serious commitment towards clean environment.

The industry shall maintain the records as per the hazardous waste regulations and EPA regulations and apply for the annual consents for air and water, and renewal of authorization for the storage of hazardous waste as per Hazardous Waste (Handling & Management) Rules, 1989. The records of hazardous waste manifest will be maintained.

Reporting system provides the necessary feedback for project management to ensure quality of the works and that the management plan in implementation. The rationale for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Management Plan get implemented in the project.

6.1.7.1 Work Zone Monitoring for Hazardous Chemicals

(Terms of Reference No. Sp. TOR (4))

Periodic Workzone monitoring is carried out and same will be followed after expansion also to review the indoor toxic chemicals concentration. The periodicity of monitoring is dependent on the concentrations i.e., below or above TLV values.

6.2 Environmental Monitoring Budget

The environmental budget for the various environmental management measures in the EMP is detailed in **Table 6.5**. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs. Moreover, since environmental enhancements have not been finalized at this stage, the table projects the typical costs unit wise.

Table 6.5 Environmental Monitoring Budget

Particulars	Monitoring Frequency	Unit Cost Rs.	Annual Cost Rs.
Ambient Air Quality Monitoring	Monthly	4500	162000
Work Place Monitoring	Monthly	2000	288000
Stack Emissions Monitoring	Monthly	2700	97200
DG Set Stack Emissions Monitoring	Quarterly	2700	86400
Process water	Daily	500	165000
Effluents - Stream wise	Quarterly	600	4800
Treated effluent (ETP water)	Daily	600	198000
Noise Level Monitoring	Quarterly	1000	24000
Soil Quality	Once a year	2000	24000
Total (Rs.)			1049400

7.0 RISK ASSESSMENT AND DAMAGE CONTROL

7.0 Introduction

This chapter presents the risk assessment study results for the plant operations, transport and storage of raw materials, and identifies maximum credible accident scenarios to draw the emergency management plan addressing various credible scenarios identified.

7.1. Objectives and Scope

The production of Synthetic Organic chemicals (bulk drug and intermediates) involves usage of many chemicals which are both hazardous and toxic in nature. The risks associated with the chemical industry are commensurate with their rapid growth and development. Apart from their utility, chemicals have their own inherent properties and hazards. Some of them can be flammable, explosive, toxic or corrosive etc. The whole lifecycle of a chemical should be considered when assessing its dangers and benefits. In order to ensure the health and safety of persons at or near the facilities, Govt. has approved some regulations. The regulation requires Employers to consult with employees in relation to:

- Identification of major hazards and potential major accidents
- Risk assessment
- Adoption of control measures
- Establishment and implementation of a safety management system
- Development of the safety report

The involvement of the employees in identification of hazards and control measures enhances their awareness of these issues and is critical to the achievement of safe operation in practice. In order to comply with regulatory authorities, M/s SMS Pharmaceuticals Limited, Unit VII have entrusted Team Labs and Consultants, Hyderabad to review and prepare Hazard analysis and Risk assessment for their facility along with an approach to on-site emergency preparedness plan as required under the acts and rules.

(Manual on emergency preparedness for chemical hazards, MOEF, New Delhi). In this endeavor, the methodology adopted is based on;

- visualizing various probable undesirable events which lead to major accidents
- detailed and systematic assessment of the risk associated with each of those hazards, including the likelihood and consequences of each potential major accident event; and
- identifying the technical and other control measures that are necessary to reduce that risk to a level that is as low as reasonably practicable

The strategy to tackle such emergencies, in-depth planning and person(s) or positional responsibilities of employees for implementation and coordination timely and effective response measures are described in onsite detail in Emergency Plan.

7.2 Project Details

The project site of 95.56 acres is located at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh. There is no additional land acquisition for the proposed expansion and the available land of 96.56 acres is sufficient for expansion. The site is situated at the intersection of 18°06'02" (N) latitude and 83°35'22" (E) longitude. The site elevation above mean sea level (MSL) is in the range of 38-45 m. The plant site is surrounded by NH-5 to Chintapalli Road in North and East direction, open lands in south and west directions. The nearest village from the plant is Kovvada Agraharam village located at a distance of 1.7 km in southwest direction. The main approach road AH45 (NH-5) is at a distance of 1.9 km in north direction. The nearest Town Vizianagaram is at a distance of 16 km in northwest direction and Nellimarla railway station is at a distance of 17 km in northwest direction and nearest airport is Visakhapatnam located at a distance of 56 km in southwest direction. Kandivalasa gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 3.4 km in east direction, and Champavathi gedda, a seasonal stream is flowing from northwest to southeast direction at a distance of

7.4 km in southwest direction. Bay of Bengal is at a distance of 6.7 km in SE direction. There are three reserve forests in the study area, Kumili RF is at a distance of 2.6 km in northeast direction, Konada RF is at a distance of 7.6 km in southwest direction, Damarasingi RF is at a distance of 8.2 km in northwest direction. There is no National Park, sanctuary, critically polluted area and interstate boundary within the impact area of 10 km surrounding the site. Pydibhimavaram industrial area, which has a number of pharmaceutical manufacturing industries is located at a distance of 4.5 km in northeast direction. The manufacturing capacity is presented in [Table 7.1](#) and by-products after expansion is presented in [Table 7.2](#). Chemical inventory is presented in [Table 7.3](#)

Table 7.1 Proposed Manufacturing Capacity

S.No	Name of Product	Capacity (TPM)	
		Permitted	After Expansion
1	Efavirenz	16	120
2	Lopinavir	3	5
3	Emtricitabine	1.5	20
4	Tenofavir	5	60
5	Atazanavir	0.5	15
6	Valcyclovir	10	30
7	Ritonavir	1	5
8	Zidovudine	7	20
9	Lamivudine	2	75
10	Valsartan	13	13
11	Abacavir	5	10
12	TPN Base	3	3
13	Pantoprazole	2	5
14	Ranitidine	90	90
15	Levetiracetam	10	20
16	Temisartan	0.5	2
17	Olmisartan	0.5	5
18	Candesartan	0.3	2
19	Ibresartan	0.25	2
20	Itraconazole	1.5	3
21	L-Carbocystiene	2	10
22	Sulfamide	3	3
23	Gabapentin	1	40
24	Valganciclovir	1	5
25	Sitagliptin		10

26	Vildagliptin		2
27	Briviracetam		10
28	Amlodipine		5
29	Penciclovir		1
30	Arpiprazole		2
31	Rosiglitazone		0.5
32	Canagliflozin		2
33	Dapagliflozin		2
34	Empagliflozin		20
35	Ranolzine		10
36	Lanoconazole		0.05
37	Paliperidone Palmitate		0.1
38	Mirabegron		0.5
39	Solefinacin		1
40	Lamotrazine		5
41	Sumatriptan		0.5
42	Famotidine		5
43	Almotriptan		0.1
44	Ondansertan		0.5
45	Zolmitriptan		0.5
46	Rizatriptan		0.5
47	Elitriptan		0.25
48	Tadalafil		0.5
49	Sildenafilcitrate		2
50	Lanthanum Carbonate		2
51	Luliconazole		0.01
52	Verdinafil		0.25
53	Raltegravir		5
54	Dolutegravir		25
55	Darunavir		15
56	Linagliptin		0.5
57	Rivaroxaban		3
58	Apixaban		1
59	Sofosbuvir		30
60	Trazadone		15
	Total	179.05	740.76
61	Co-generation Power Plant	---	2 x 2 MW

Table 7.2 List of By-Products - After expansion

S.No	Name of Product	Stage	Name of By-product	Quantity	
				Kg/day	TPM
1	Atazanavir Sulphate	III	Triethylamine HCl	521.2	15.6
2	Dapagliflozin Propanediol	I	N-Methylmorpholine HCl	121.7	3.6
3	Darunavir	II	1-Hydroxy pyrrolidine-2,5-dione	210.2	6.3
4	Dolutegravir Sodium	III	Toluene	175.8	5.3
5	Efavirenz	V	Trichloro methanol	3430.9	102.9
6	Emitricitabine	I	Menthol	438.7	13.2
			Isopropyl Alcohol	168.7	5.1
		II	Triethyl amine HCl	377.2	11.3
7	Leviteracetam	II	Potassium Chloride	876.0	26.3
8	Sofosobuvir	I	Triethyl amine HCl	821.4	24.6
		III	4-Trifluoromethyl phenol	306.2	9.2
9	Tenofovir disoproxil fumarate	I	p-Toulene sulfonic acid	555.1	16.7
			Ethanol	296.9	8.9
10	TPN Base	II	Ammonium chloride	43.7	1.3
11	Valacyclovir HCl	III	Benzoyl formate	377.3	11.3
12	Zidovudine	I	Trityl chloride	695.4	20.86

Table 7.3 List of Raw Materials and Inventory (Terms of Reference No. 3(iv) & 3(v))

S.No	Name of Raw Material	Max Storage Quantity (Kgs)	Physical Appearance	Type of Hazard	Mode of Storage	Mode of Transport
1	(1S,4R)-4-Aminocyclopent-2-enylmethanol tartaric acid salt	2000	Solid	Corrosive	Bags	By Road
2	(2S)-2-amino-3,3-dimethylbutanoic acid	2000	Solid	Corrosive	Bags	By Road
3	(S) -Propane-1,2-diol	80	Liquid	Non-Hazard	Drums	By Road
4	1-(2-amino-5-Chlorophenyl)-2,2,2-trifluoroethanone	8000	Solid	Irritant	Bags	By Road
5	1-(2-Chlorophenyl)-2-methanesulfonyloxy-ethylester Methanesulphonic acid	100	Crystalline	Non-Hazard	Bags	By Road
6	(2S,3S,5S)-2-(2,6-dimethylphenoxy acetyl)amino-3-hydroxy-5-amino-1,6-diphenyl hexane	850	Liquid	Flammable	Drums	By Road
7	(2-Amino-4-thiazolyl)acetic acid	50	Powder	Irritant	Bags	By Road
8	1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride	100	Liquid	Toxic	Drums	By Road
9	1,2,3,9-tetrahydro carbazole-4-one	400	Solid	Toxic	Bags	By Road
10	(4-fluorophenyl)methanamine	300	Liquid	Toxic	Drums	By Road
11	(3R)-3-(tetr-butoxycarbonyl amino)-4-(2,4,5-trifluoro phenyl) butanoic acid	1800	Solid	Non Hazard	Bags	By Road
12	1-((2R,3R,4R,5R)-3-fluoro-4-hydroxy-5-(hydroxymethyl)-3-methyltetrahydro furan-2-yl)pyrimidine-2,4(1H,3H)-dione	3528	Crystalline	Toxic	HDPE Bags	By Road
13	(R)-1,2-propylene carbonate	2342	Liquid	Irritant	Drums	By Road
14	(S)-1-(2-Chloroacetyl)pyrrolidine -2-Carbonitrile	320	Liquid	Corrosive	Drums	By Road
15	1,3 Dichloro acetone	1105	Solid	Toxic	HDPE Bags	By Road
16	1,4 Dibromobutane	246	Liquid	Irritant	Drums	By Road
17	1-[7-But-2-ynyl-3-methyl-1-(4-methyl-quinazolin-2-ylmethyl)-2,6-dioxo-2,3,6,7-tetrahydro-1H-	200	Powder	Irritant	Bags	By Road

	purin-8-yl]-piperidine-3-carboxylic acid ethyl ester					
18	1,3- Dimethyl-2-imidazolidinone	100	Liquid	Carcinogenic	Drums	By Road
19	10% Pd/C	200	powder	Non hazard	Bags	By Road
20	2-Chlororbenzaldehyde	535	Liquid	Corrosive	Drums	By Road
21	1-4(-Iodophenyl) piperdin-2-one	300	Solid	Irritant	Bags	By Road
22	2,3-Dichlorophenylpiperazine (DCPP)	300	Solid	Irritant	Bags	By Road
23	1H-Benzotriazole-1-ol	700	powder	Irritant	Bags	By Road
24	2-(5-bromo-2-methyl benzul)-5-(4-fluorophenyl)thiophene	1000	Solid	Irritant	Bags	By Road
25	2,4-Difluorobenzylamine	2157	Liquid	Corrosive	Drums	By Road
26	2,3-dichloro-5,6dicyano-1,4benzoquinone(DDQ)	25053	Crystalline	Toxic	HDPE Bags	By Road
27	2-Bromo butane	202	Liquid	Highly Flammable	Drums	By Road
28	2,5 Diethane	800	Solid	Non-Hazard	Bags	By Road
29	2-Amino-6-chloropurine	200	Powder	Non Hazard	Bags	By Road
30	2,6 xyliadiene	1399	Liquid	Carcinogenic	Drums	By Road
31	2-[methyl-(2-pyridinyl) amino]ethanol	100	Liquid	Irritant	Drums	By Road
32	2,4-thiazolidinedione	50	Powder	Nonhazard	Bags	By Road
33	1-methyl-4-nitro-3-propyl-1H-pyrazole-5-carboxamide	200	Solid	Cobustable	Bags	By Road
34	1-hydroxy benzotriazole	200	Solid	Irritant	Bags	By Road
35	2-Methyl2-Butanol	100	Liquid	Highly Flammable	Drums	By Road
36	2-Cyano-4'-Bromo Methyl biphenyl (Bromo OTBN)	300	Powder	Irritant	Bags	By Road
37	2S-(1-Tetrahydro-pyrimid-2-onyl)-3-methylbutanoic acid	400	Solid	Irritant	Bags	By Road
38	2-methyl imidazole	50	Powder	Toxic	Bags	By Road
39	2-Methoxy phenol	1208	Liquid	Irritant	Drums	By Road
40	2-Oxiranylmethyl-isoindole-1,3-dione	1283	Powder	Toxic	HDPE Bags	By Road

41	3-(trifluoromethyl)-5,6,7,8-tetrahydro-[1,2,4]triazolo[4,3-a] pyrazine	1000	Solid	Irritant	Bags	By Road
42	2-Hydroxy Benzotrile	50	Solid	Irritant	Bags	By Road
43	Hydrochloric acid	24335	Liquid	Corrosive	Drums	By Road
44	4-Nitrobenzene methane sulfonyl chloride	100	Liquid	Irritant	Drums	By Road
45	4,4-diethoxy-N,N-dimethylbutan-1-amine	100	Liquid	Corrosive	Drums	By Road
46	1H-1,2,4-triazole	200	Solid	Irritant	Bags	By Road
47	3-Chloropropionyl chloride	179	Liquid	Toxic	Drums	By Road
48	4-Bromo-1-chloro-2(4-ethoxybenzyl) benzene	504	Solid	Toxic	HDPE Bags	By Road
49	4-Amino-N-(2R,3S)(3-amino-2-hydroxy-4-phenyl-butyl)-N-isobutyl-benzenesulfonamide	2789	Liquid	Toxic	Drums	By Road
50	4-Methoxy benzyl chloride	26559	Liquid	Flammable	Drums	By Road
51	4-{4-[4-(4-Methoxy-phenyl)-piperazin-1-yl]-phenyl}-2,4-dihydro- [1,2,4] triazol-3-one (Triazole compound)	500	Powder	Irritant	Bags	By Road
52	4-chlorobutyryl chloride	4165	Liquid	Toxic	Drums	By Road
53	4-Nitrophenylethylamine.HCl	950	Crystalline	Non hazard	Bags	By Road
54	4-(chloromethyl)-5-methyl-1,3-dioxol-2-one	348	Liquid	irritant	Drums	By Road
55	3-Di methyl amino methyl-9-methyl-1,2,3,9-tetrahydro carbazole-4-one	163	Crystalline	Toxic	HDPE Bags	By Road
56	4-(4-aminophenyl)-morpholin-3-one	1200	Solid	Non Hazard	Bags	By Road
57	4-nitro benzyl bromide	100	Crystalline	Corrosive	Bags	By Road
58	4-chlorobutanal dimethyl acetal	100	Liquid	Flammable	Drums	By Road
59	4-fluorobenzaldehyde	100	Liquid	Flammable	Drums	By Road
60	4-Amino-1-methyl-3-propyl-1H-pyrazole 5-carboxamide	200	Solid	Irritant	Bags	By Road
61	4-Hydrazine-N-Methyl Benzene Methane Sulfonoxide.HCl	200	Powder	Corrosive	Bags	By Road
62	4-Chloro-1-1-Hydroxy Butane Sulfonic Acid Sodium Salt	159	Liquid	Irritant	Drums	By Road
63	4-Methyl-6-(1-methylbenzimidazole-2-yl)-2-	300	Powder	Corrosive	Bags	By Road

	propylbenzimidazole					
64	4'-(Bromomethyl) biphenyl-2-carboxylic acid methyl ester	311	Liquid	Irritant	Drums	By Road
65	3-Chloropropionitrile	302	Liquid	Toxic	Drums	By Road
66	4-Amino-L-Phenyl Oxazolidinone	100	Powder	Corrosive	Bags	By Road
67	Formaldehyde	242	Liquid	Toxic	Drums	By Road
68	4-Amino-N-(2R,3S)(3-amino-2-hydroxy-4-phenyl-butyl)-N-isobutyl-benzenesulfonamide	2789	Liquid	Flammable	Drums	By Road
69	4-Bromo-1-chloro-2(4-ethoxybenzyl)benzene	504	Liquid	Toxic	Drums	By Road
70	4-chlorobutyl chloride	4165	Liquid	Toxic	Drums	By Road
71	4-chlorobutanal dimethyl acetal	100	Liquid	Flammable	Drums	By Road
72	4-nitro benzyl bromide	100	Crystalline	Toxic	HDPE Bags	By Road
73	4-Nitrobenzene methane sulfonyl chloride	50	Solid	Corrosive	Bags	By Road
74	4-Nitrophenylethylamine.HCl	950	Crystalline	Non hazard	Bags	By Road
75	5-(1-Hydroxy-1-methyl-ethyl)-2-propyl-3-[2'-(2-trityl-2H-tetrazol-5-yl)-biphenyl-4-ylmethyl]-3H-imidazole-4-carboxylic acid ethyl ester	1681	Liquid	Corrosive	Drums	By Road
76	5-(4-amino-5-flouro-2-oxo-2H-pyrimidin-1-yl)-[1,3]oxathiolane-2-carboxylic acid-2-isopropyl-5-methyl cyclo hexyl ester	8000	Powder	Irritant	Bags	By Road
77	5'-O-trityl-2, 3'-anhydro thymidine	8500	Solid	Flammable	Bags	By Road
78	5-bromoindole	100	Powder	Non hazard	Bags	By Road
79	5-Difluoro methoxy 2-Mercapto benzimidazole	600	Powder	Irritant	Bags	By Road
80	5-methyl-1, 3, 4-oxadiazole- 2-carbonyl Chloride	400	Solid	Corrosive	Bags	By Road
81	9-[[2-Hydroxy-1-(hydroxymethyl)ethoxy]methyl] guanine / ADX	1500	Solid	Corrosive	Bags	By Road
82	Activated carbon	7000	Solid	Flammable	Bags	By Road
83	Acetic acid	30000	Liquid	Flammable	Storage Tanks	By Road
84	Acetone	100000	Liquid	Flammable	Storage Tanks	By Road

85	Acetonitrile	100000	Liquid	Flammable	Storage Tanks	By Road
86	Adenine	3099	Liquid	Irritant	Drums	By Road
87	Acyclovir	4771	Powder	Toxic	HDPE Bags	By Road
88	Aluminium chloride	200	Powder	Corrosive	Bags	By Road
89	Amantadine Hydrochloride	435	Liquid	Corrosive	Drums	By Road
90	Ammonia gas	500	Solid	Irritant	Bags	By Road
91	Ammonia	200	Gas	Flammable	Cylinders	By Road
92	Ammonium Carbonate	300	Powder	Irritant	Bags	By Road
93	Ammonium chloride	2000	Solid	Corrosive	Bags	By Road
94	Ammonium formate	300	Solid	Corrosive	Bags	By Road
95	Ammonium Sulphate	200	Crystalline	non-Hazard	Bags	By Road
96	Benzoic acid	50	Crystalline	Irritant	Bags	By Road
97	Candesartan	600	Solid	Irritant	Bags	By Road
98	Borane THF Complex	100	Liquid	Flammable	Drums	By Road
99	Benzyl chloro formate	3878	Liquid	Carcinogenic	Drums	By Road
100	Butyryl Chloride	100	Liquid	Toxic	Drums	By Road
101	Carbondisulphide	100	Liquid	Flammable	Drums	By Road
102	Caustic lye	24677	Liquid	Corrosive	Drums	By Road
103	Celite	100	Liquid	Flammable	Drums	By Road
104	Chloro Cilexetil	200	Powder	Corrosive	Bags	By Road
105	Chloro sulfonic acid	109	Liquid	Toxic	Drums	By Road
106	Chloro acetyl chloride	1319	Liquid	Combustible	Drums	By Road
107	Chloroform	50000	Liquid	Carcinogenic	Storage Tanks	By Road
108	cis-[2-(2,4-Dichlorophenyl)-2-(1H-1,2,4-triazol-1-ylmethyl)-1,3-dioxolan-4-yl] methyl methane sulfonate (Mesylate compound)	500	Powder	Irritant	Bags	By Road
109	Chlorothiophenecarboxylic acid	500	Solid	Irritant	Bags	By Road
110	Chloromethyl-2-propyl carbonate	6890	Liquid	Flammable	Drums	By Road
111	Chlorosulphonic acid	100	Liquid	Toxic	Drums	By Road

112	Citric acid monohydrate	2000	Crystalline	Irritant	Bags	By Road
113	Citric Acid	168	Liquid	Combustible	Drums	By Road
114	Copper Iodide	20	Powder	Corrosive	Bags	By Road
115	CP HCL (35-38%)	900	Liquid	Corrosive	Drums	By Road
116	Common salt	1000	Solid	Corrosive	Bags	By Road
117	Cyclohexane	50000	Liquid	Flammable	Storage Tanks	By Road
118	Cyclopropyl amine	403	Liquid	Corrosive	Drums	By Road
119	Cyclopropyl acetylene	10366	Liquid	Flammable	Drums	By Road
120	Cyclopentanone	100	Liquid	Flammable	Drums	By Road
121	Cystosine	6500	Powder	Non hazard	Bags	By Road
122	Cysteamine HCl	5000	Crystalline	Irritant	Bags	By Road
123	Di isopropyl ethylamine	155	Liquid	Flammable	Drums	By Road
124	Dibromo dimethyl hydantoin (DDH)	2800	Powder	Irritant	Bags	By Road
125	Di Ethyl Sulphate	100	Liquid	Flammable	Drums	By Road
126	Dichloroethane (MDC)	50000	Liquid	Carcinogenic	Storage Tanks	By Road
127	Diclohexyl	300	Solid	Irritant	Bags	By Road
128	Dicyclohexyl carbodiimide	5464	Powder	Toxic	HDPE Bags	By Road
129	Diethyl Ether	725	Liquid	Flammable	Drums	By Road
130	Diethyl-3-(benzoyloxy)-1-(2,2-dimethoxyethyl-4-oxo-1,4-dihydropyridine-2,5-carboxylate	6533	Liquid	Corrosive	Drums	By Road
131	Diethyl p-toluene sulphonyloxy methyl phosphonate	7000	Powder	Irritant	Bags	By Road
132	Diethoxy dimethyl butanamine	80	Liquid	Carbondioxide	Drums	By Road
133	Diisopropyl ether (DiIPE)	12810	Liquid	Flammable	Drums	By Road
134	Dimethyl acetamide (DMA)	5985	Liquid	Flammable	Drums	By Road
135	Dimethyl amine HCl	14717	Liquid	Corrosive	Drums	By Road
136	Dimethyl amino pyridine	100	Solid	Toxic	HDPE Bags	By Road
137	Dimethyl formamide	30000	Liquid	Flammable	Storage Tanks	By Road

138	Dimethyl sulfate	265	Liquid	Flammable	Drums	By Road
139	Dimethyl sulphate	14563	Liquid	Toxic	Drums	By Road
140	Dimethylsulfoxide(DMSO)	112994	Liquid	Irritant	Drums	By Road
141	Disucinimidyl carbonate	1800	Powder	Irritant	Bags	By Road
142	Diphenyl Phosphoryl Azide	100	Liquid	Toxic	Drums	By Road
143	Dioxane	18200	Liquid	Flammable	Drums	By Road
144	DL Alaninie	20	Powder	Irritant	Bags	By Road
145	DPHP	50	Powder	Irritant	Bags	By Road
146	D-tryptofin	100	Solid	Non hazard	Bags	By Road
147	Epichlorohydrin	900	Liquid	Flammable	Drums	By Road
148	Ethanol	80000	Liquid	Flammable	Storage Tanks	By Road
149	Ethyl acetate	180000	Liquid	Flammable	Storage Tanks	By Road
150	Ethyl4(2-(phthalamido)-ethoxy)-cetoacetate	1200	Powder	Flammable	Bags	By Road
151	Ethyl Chloro [(4-methoxy phenyl)hydrazono] acetate	166	Liquid	Toxic	Drums	By Road
152	Ethylmagnesium bromide	100	Liquid	Flammable	Drums	By Road
153	Ethylene dichloride HCL	100	Liquid	Toxic	Drums	By Road
154	Ethyl Oxalyl Chloride	100	Liquid	Flammable	Drums	By Road
155	Formamide	100	Liquid	Non-Flammable	Drums	By Road
156	Formic acid	184	Liquid	Flammable	Drums	By Road
157	Furfuryl alcohol	17491	Liquid	Toxic	Drums	By Road
158	Fumaric acid	2620	Liquid	Corrosive	Drums	By Road
159	Gluconolacotone	300	Crystalline	Non hazard	Bags	By Road
160	Gloxalic acid	300	Solid	Corrosive	Bags	By Road
161	Guanyl Thiourea	1000	Solid	Irritant	Bags	By Road
162	Hexane	13440	Liquid	Flammable	Drums	By Road
163	HOBT.2H2O	300	Solid	Flammable	Bags	By Road
164	Hydrobromic Acid	420	Liquid	Corrosive	Drums	By Road
165	Hydrogen	200	Gas	Flammable	Cylinders	By Road

166	Hydroxylamine HCl	20	Solid	Corrosive	Bags	By Road
167	Hyflow	1000	Solid	Non - Flammable	Bags	By Road
168	Hyflow supercel	175	Solid	Carcinogenic	HDPE Bags	By Road
169	Hypo	5630	Liquid	Corrosive	Drums	By Road
170	Imminogunidly-2,3-Dichlorobenzyl Cyanide Phosphate	2500	Crystalline	Corrosive	Bags	By Road
171	Imidazole-1yl-acetonitrile	100	Liquid	Irritant	Drums	By Road
172	IPA Hydrochloric acid	18062	Liquid	Flammable	Drums	By Road
173	Isopropyl Alcohol	80000	Liquid	Flammable	Storage Tanks	By Road
174	Isopropyl acetate (IPAc)	42000	Liquid	Flammable	Drums	By Road
175	Isopropyl ether (IPE)	9044	Liquid	Corrosive	Drums	By Road
176	L(+)-Menthol	600	Solid	Irritant	Bags	By Road
177	L-Alanine isopropyl ester hydrochloride	2300	Solid	Corrosive	Bags	By Road
178	Lanthanum Oxide	400	Powder	Non hazard	Bags	By Road
179	L-Cysteine hydrochloride monohydrate	2800	Solid	Irritant	Bags	By Road
180	Lithium hydroxide Monohydrate	50	Solid	Corrosive	Bags	By Road
181	Lithium tertiary butoxide	100	Powder	Flammable	Bags	By Road
182	L-Valine	3800	Solid	Non-Hazard	Bags	By Road
183	Magnesium Sulphate	500	Powder	Non hazard	Bags	By Road
184	Maleic acid	400	Solid	Combustible	Bags	By Road
185	Methane Sulfonic Acid	130	Liquid	Non - Flammable	Drums	By Road
186	Methylene disulfide	1313	Liquid	Flammable	Drums	By Road
187	Methanol	280000	Liquid	Flammable	Storage Tanks	By Road
188	Methyl 3-aminobut-2-enoate	400	Crystalline	Irritant	Bags	By Road
189	Methyl iso thio cyanate	16875	Solid	Toxic	HDPE Bags	By Road
190	Methyl tert-butyl ether (MTBE)	37345	Liquid	Flammable	Drums	By Road
191	Morpholine	100	Liquid	Flammable	Drums	By Road
192	Methylcarbon Chloridate	1512	Liquid	Corrosive	Drums	By Road
193	Monochloroacetic acid	1477	Crystalline	Toxic	HDPE Bags	By Road

194	Molecular sieves	200	Crystalline	Non-Hazard	Bags	By Road
195	Mono methyl amine	316	Liquid	Flammable	Drums	By Road
196	N-(2-Amino-4,6-dichloro pyrimidin-5-yl)formamide	1500	Powder	Flammable	Bags	By Road
197	N-(benzyloxy carbonyl)-D-proline	200	Powder	Irritant	Bags	By Road
198	N-(4-Fluorobenzyl)-2-(2-aminopropan-2-yl)-1,6-dihydro-5-hydroxy-1-methyl-6-oxopyrimidine-4-carboxamide monohydrate	600	Solid	Corrosive	Bags	By Road
199	N,N'-Carbonyl- diimidazole (CDI)	800	Solid	Corrosive	Bags	By Road
200	N,N-Dimethylformamide (DMF)	4279	Liquid	Flammable	Drums	By Road
201	N-[3-(dimethyl amino)propyl]-N'-ethyl carbodimide	1200	Solid	Corrosive	Bags	By Road
202	n-Butyl lithium	869	Liquid	Flammable	Drums	By Road
203	N-Benzyloxy Carbonyl L-Valine pure	4262	Crystalline	Carcinogenic	HDPE Bags	By Road
204	N-chlorosuccinamide	100	Solid	Corrosive	Bags	By Road
205	N-ethylpiperazine	100	Liquid	Flammable	Drums	By Road
206	n-Heptane	30000	Liquid	Flammable	Storage Tanks	By Road
207	n-Hexane	60000	Liquid	Flammable	Storage Tanks	By Road
208	Nitric acid	146	Liquid	Corrosive	Drums	By Road
209	N-Methylmorpholine	757	Liquid	Flammable	Drums	By Road
210	Nitromethane	14101	Liquid	Flammable	Drums	By Road
211	N-Methyl-2-Pyrrolidone	45000	Liquid	Carcinogenic	Storage Tanks	By Road
212	n-methyl piperazine	100	Liquid	Corrosive	Drums	By Road
213	n-Pyrrolidenylolpydrine	1050	Liquid	Flammable	Drums	By Road
214	N-Sulphamyl-3-Chloro Propionamidine HCl	800	Powder	Corrosive	Bags	By Road
215	n-Propylamine	140	Liquid	Flammable	Drums	By Road
216	Oxalyl chloride	100	Liquid	Toxic	Drums	By Road
217	o-Tolyl benzonitrile	2000	Crystalline	Irritant	Bags	By Road

218	O-Xylene	6250	Liquid	Flammable	Drums	By Road
219	Palladium acetate	20	Powder	Toxic	HDPE Bags	By Road
220	Pentanoyl chloride	158	Liquid	Flammable	Drums	By Road
221	Para formaldehyde	5000	Crystalline	Flammable	Bags	By Road
222	Pet. Ether	7000	Liquid	Flammable	Drums	By Road
223	Phosphorous Pentachloride	200	Solid	Flammable	Bags	By Road
224	Phenyl(vinyl)sulfone	50	Crystalline	Corrosive	Bags	By Road
225	Phosphoric acid	471	Liquid	Irritant	Drums	By Road
226	Phenyl Phosphate dichloride	2975	Liquid	Corrosive	Drums	By Road
227	Phosphorous OxyTrichloride	100	Liquid	Corrosive	Drums	By Road
228	Piperidine-2-one	50	Powder	Non-Hazard	Bags	By Road
229	2- Chloromethyl-3,4 Dimethoxy Pyridine HCl	699	Solid	Carcinogenic	HDPE Bags	By Road
230	Piperazine	900	Solid	Corrosive	Bags	By Road
231	Piperanal	50	Crystalline	Non-Hazard	Bags	By Road
232	Potassium carbonate	5000	Crystalline	Irritant	Bags	By Road
233	Potassium Hydroxide	8000	Solid	Corrosive	Bags	By Road
234	P-Toluene sulphonic acid	8750	Liquid	Flammable	Drums	By Road
235	Potassium Iodide	300	Solid	Irritant	Bags	By Road
236	Pyrrolidine	1892	Liquid	Flammable	Drums	By Road
237	Pyridine	595	Liquid	Flammable	Drums	By Road
238	R-3-amino-butanol	1276	Liquid	Flammable	Drums	By Road
239	R-(-)-Mandelic acid	700	Solid	Irritant	Bags	By Road
240	Raney Nickel	100	Solid	Flammable	Bags	By Road
241	Silyl D-gluconolactone	1300	Crystalline	Non hazard	Bags	By Road
242	Silica gel	1200	Beads	Non-Flammable	Bags	By Road
243	S-(2)-Amino butyric acid HCl	4500	Crystalline	Irritant	Bags	By Road
244	Sodium azide	1913	Crystalline	Toxic	HDPE Bags	By Road
245	Soda Ash	700	Crystalline	Irritant	Bags	By Road
246	Sodium hypochloride	218	Liquid	Non - Flammable	Drums	By Road
247	Sodium Bicarbonate	8200	Crystalline	Irritant	Bags	By Road
248	Sodium bisulfate	2500	Solid	Corrosive	Bags	By Road

249	Sodium borohydride	4000	Powder	Flammable	Bags	By Road
250	Sodium Borohydrite	700	Powder	Flammable	Bags	By Road
251	Sodium Carbonate	3500	Crystalline	Irritant	Bags	By Road
252	Sodium chloride	7500	Solid	Corrosive	Bags	By Road
253	Sodium Dihydrogen Phosphate	50	Solid	Non hazard	Bags	By Road
254	Sodium cyanide	100	Solid	Toxic	HDPE Bags	By Road
255	Sodium hydroxide	88756	Liquid	Corrosive	Drums	By Road
256	Sodium Hypochlorite	100	Liquid	Non - Flammable	Drums	By Road
257	Sodium Methoxide	200	Solid	Non - Flammable	Bags	By Road
258	Sodium meta bisulfate	1000	Powder	Corrosive	Bags	By Road
259	Sodium nitrite	100	Solid	Oxidizer	Bags	By Road
260	Sodium sulphate	1000	Granules	Non-Hazard	Bags	By Road
261	Sodium Sulphite	20	Granules	Non-Hazard	Bags	By Road
262	Stannous chloride dihydride	100	Crystalline	Corrosive	Bags	By Road
263	Succinic Acid	50	Crystalline	Corrosive	Bags	By Road
264	Sulfuric acid	5151	Liquid	Corrosive	Drums	By Road
265	tert-butyl 2-[4-(pyridin-2-yl) benzyl] Hydrazine Carboxylate	2300	Solid	Flammable	Bags	By Road
266	t-butyl{(1S)-1-[(2R)-Oxiran-2-yl]-2-phenylethyl}Carbamate	2061	Solid	Toxic	HDPE Bags	By Road
267	Tert-butyl chloride	700	Liquid	Flammable	Drums	By Road
268	Tetrahydrofuran(THF)	224137	Liquid	Flammable	Drums	By Road
269	Tetrabutylammonium Iodid (TBAI)	100	Crystalline	Toxic	Bags	By Road
270	Tetra-n-butylammonium bromide(TBAB)	300	Solid	Harmful	Bags	By Road
271	Thionyl chloride	12230	Liquid	Toxic	Drums	By Road
272	Thiourea	750	Solid	Irritant	Bags	By Road
273	Toluene	180000	Liquid	Flammable	Storage Tanks	By Road
274	Triethylamine	23433	Liquid	Flammable	Drums	By Road
275	Triethyl silane	149	Liquid	Flammable	Drums	By Road
276	Tributyl tin chloride	379	Liquid	Toxic	Drums	By Road

277	triethyl-3-bromopropane-1,1,1-tricarboxylate (Bromotriester)	400	Crystalline	Flammable	Bags	By Road
278	Triethylorthoformate(TEOF)	2905	Liquid	Flammable	Drums	By Road
279	Trifluoromethyl phenol	2300	Crystalline	Flammable	Bags	By Road
280	Trimethylsilyl chloride	813	Liquid	Flammable	Drums	By Road
281	Triphenylmethane	700	Solid	Non Hazardous	Bags	By Road
282	Triphosgene	39321	Solid	Acute toxicity	HDPE Bags	By Road
283	Tri-p-tolylphosphine	100	Crystalline	Irritant	Bags	By Road
284	Valeryl Chloride	1149	Liquid	Toxic	Drums	By Road

7.3 Process Description

The manufacturing process for all the products is presented in separate Annexure.

7.4 Plant Facilities

The manufacturing facility shall be provided with

- | | |
|-----------------------------|-------------------------------|
| 1) Production blocks | 6) Tank farm area |
| 2) Utilities | 7) Cylinder Storage |
| 3) Quality Control, R&D lab | 8) Administrative Office |
| 4) Effluent Treatment plant | 9) Solvent recovery area |
| 5) Warehouses | 10) Coal and Ash Storage Area |

The production facilities shall be designed for proper handling of materials and machines. Safety of operators, batch repeatability and process parameter monitoring shall be the major points of focus in the design of facility. The current Good Manufacturing Practices (GMP) guidelines shall be incorporated as applicable to synthetic organic chemicals manufacturing facilities.

7.4.1 Production Blocks:

The Production blocks will consist of SS and glass lined reactors, storage tanks, shell & tube heat exchangers, evaporators, vacuum pumps, packed columns, Agitated Nutche Filter and Dryers, crystallizers, layer separators etc. The area shall be provided with proper concealed drainage facility and all process facilities shall be performed under protective environment.

7.4.2 Utilities:

The proposed expansion requires additional steam for both process and effluent treatment system. It is proposed to establish coal fired boilers of 1 x 20 TPH, 1 x 12 TPH, and 2 x 10 TPH capacity and 1 x 10 lac k.cal/hr and 1 x 2 lac. K.cal/hr coal fired thermic fluid heaters for process requirement in addition to the existing 1 x 6 TPH, and 1 x 3 TPH coal fired boilers. It is proposed to keep proposed 1 x 12 TPH coal fired boiler and the existing 1 x 6 TPH and 1 x 3 TPH coal fired boilers as standby after expansion. The DG sets required for

emergency power during load shut down is estimated at 12000 kVA and accordingly 7 x 1500 kVA DG sets are proposed in place of exiting 1 x 125kVA. The list of utilities is presented in the following **Table 7.4**.

Table 7.4 List of Utilities

S. No	Description	Unit	Capacity		
			Existing	Proposed	Total after expansion
1	Coal Fired Boilers	TPH	1 x 6	1 x 20	1 x 20
			1 x 3	1 x 12	1 x 12*
				2 x 10	2 x 10
					1 x 6*
					1 x 3*
2	Themic Fluid Heater	K. Cal/hr		1 x 2 Lac	1 x 2 Lac
				1 x 10 Lac	1 x 10 Lac
3	DG Set**	KVA	1 x 125	7 x 1500	7 x 1500
					1 x 125

* Standby

**DG sets will be used during load shut down by AP TRANSCO.

7.4.3 Quality Control, R&D Lab

The QC department shall comprise of an in-process lab with instruments like HPLC, GC etc. It will be maintained by highly qualified and trained people. The activities include:

- In-process quality check during manufacturing
- Validation of facilities
- Complaint handling

Also a process development laboratory shall be provided for in-house process development, initial evaluation of process technology in case of technology transfer, back-up for production department to address any issues arising during commercial production

7.4.4 ETP and Solid waste storage

The effluents are segregated into two streams; high TDS/ COD and Low TDS/COD streams based on source of generation. These effluents are treated in effluent treatment plant and the treated effluent twill be disposed to sea by using marine outfall system.

7.4.5 Ware Houses:

The plant had sufficient storage facility for safe handling of raw materials. All solid raw materials are stored in marked areas with proper identification. Liquid raw materials and

solvents like which are available in drums will be stored according to material compatibilities and flammability. Adequate firefighting facilities shall be provided as per NFPA norms.

7.4.6 Tank Farm Area:

A separate tank farm area shall be provided for storing liquid raw materials, especially solvents with high inventory and also for toxic, corrosive chemicals. Dykes shall be provided to ensure safety in case of tank failure. Acid proof lining for the dykes shall be provided for acid storage tanks. Condensers for low volatile solvent storage tanks vents.

7.4.7 Cylinders storage Area:

Gas cylinders storage should conform to SMPV-Unfired rules-1981. Hydrogen cylinders should be stored in approved Gas Storage pad. Chained and capped when not in use. Operational cylinder should be firmly secured. Pressure regulator, metal piping, non-return valve, and safe residue bleed off arrangement should be incorporated in installation design. Strict hot work control and display of danger signs should be ensured.

7.4.8 Administrative Office:

An Administrative office shall be provided at the entrance of the factory to ensure the entry of authorized personnel only into the premises.

7.4.9 House Keeping:

A regular housekeeping schedule with adequate preventive maintenance shall be ensured so that the plant is consistently maintained as per GMP standards.

7.4.10 Coal and Ash Storage:

Coal will be stored under covered shed with water sprinkler system in emergency. Ash silos will be provided for storage and handling of ash generated from combustion of coal.

Water sprinkling system shall be installed on stocks of coal in required scales to prevent spontaneous combustion and consequent fire hazards. The stack geometry shall be adopted to maintain minimum exposure of stock pile areas towards predominant wind direction

7.4.11 Facility layout and design:

The layout of all the various areas required for the facility, as mentioned above is considered. In laying out the above areas, isolation of the various process areas from the utilities and non-process areas is considered in view of both containment and cGMP. A tentative plant layout is shown in [Fig 7.1](#).

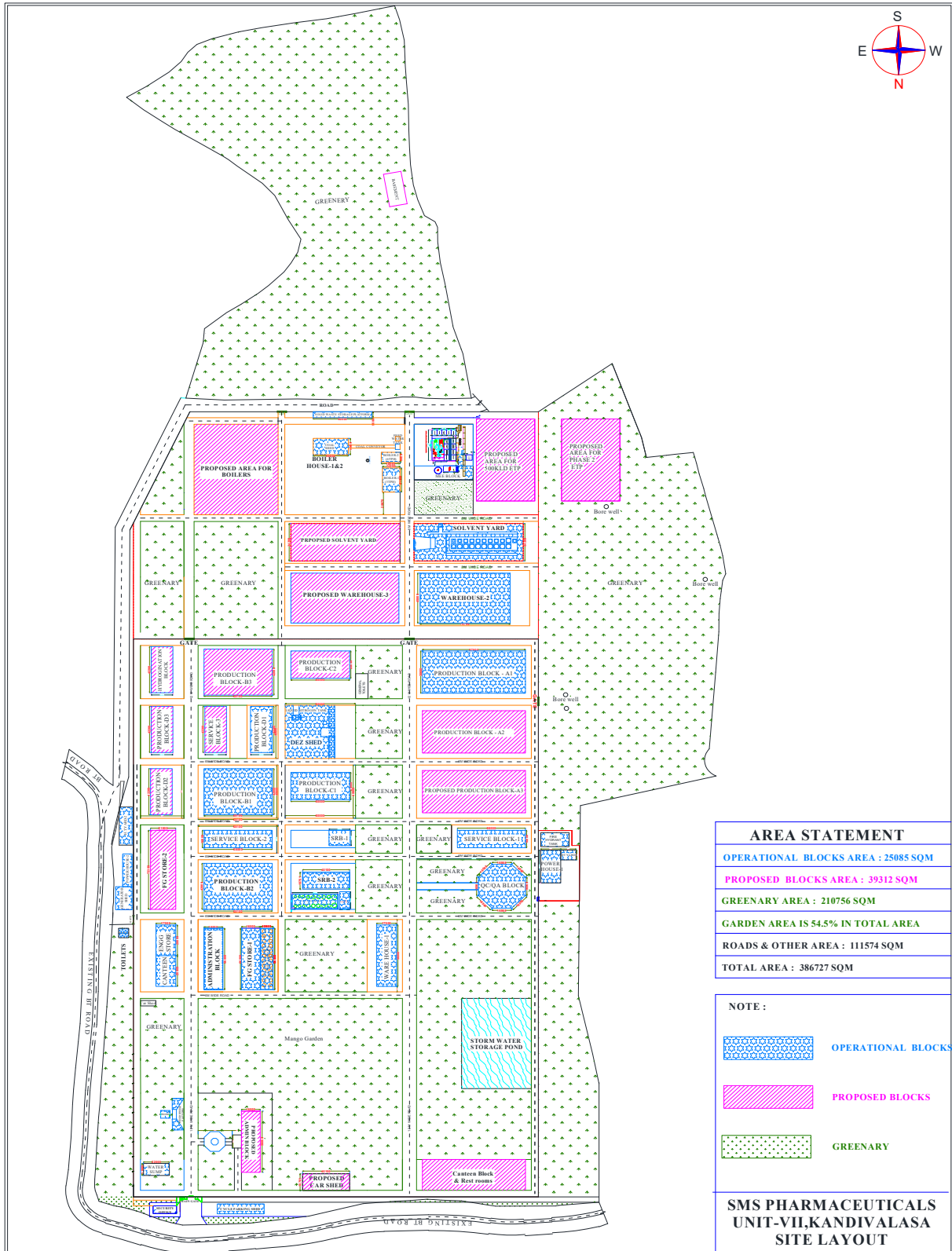


Fig 7.1 Plant Layout of SMS Pharmaceuticals Limited, Unit VII

Table 7.5 Risk Control Measures

Significant Risks	Control Measures
Solvent Tank Farm and Chemical Tank Farm	
Fire/ Explosion	<ul style="list-style-type: none"> • Solvent Tank Farm licensed by PESO. • Restrict inventory to licensed quantities in Solvent Tank Farm. • Fenced Solvent Tank Farm. • Fenced Solvent Tank Farm capable of being locked when not in use. • Access Control and control of visitors • Control of ignition sources. • All electrical equipment and fittings to be flameproof as per area classification. • Provision of foam cover to cover the largest dyke area • Water spray cooling arrangements for all tanks • Fire hydrants and fire monitors • Solvent Storage Tanks to have N₂ blanketing • Earth rite system for earthing of tankers carrying solvents. • Spark arresters on vehicles • Wetting of road and tyres before unloading • NO dry grass inside the fenced area • No parking inside/ near the tank farm. • No obstruction on the road for free movement of fire tender. • No solvent pumping in night shift – Daytime operations only.
Loss of Containment and Spillage	<ul style="list-style-type: none"> • Dykes for all tanks (Dyke capacity to be min. 110% of tank capacity and dyke distance from tank to be min half the tank height). • Tanker unloading area (road) to be dyked. • Availability of the Spill control kit.
Injury at the time of loading/ unloading	<ul style="list-style-type: none"> • Provision of PPE to stores personnel. • Operations by trained stores personnel only.
Bulk Materials Store (liquid chemicals) Drum Yard and Special Chemicals Store	
Fire/ Explosion	<ul style="list-style-type: none"> • Fenced area, Access Control and control of visitors • Building capable of being locked when not in use. • Control of ignition sources. • Control of inventory to minimum possible • Segregation of materials. • Smoke/ Heat detection system (non-electricity based) • No water-based firefighting setup around the store. • Adequate CAUTION displays • Fire hydrants and fire monitors • Provision of foam • No electrical installation inside the Store • Adequate natural light and ventilation. • Daily night inspection by Shift Manager.

Significant Risks	Control Measures
	<ul style="list-style-type: none"> No dry grass inside the fenced area Emergency exit.
Loss of Containment Spillage	<ul style="list-style-type: none"> Arrangements of drums in rows of two (two levels max) and a gap of at least 2 feet between rows and from the walls all around. Storage in open area on hard impervious floor surrounded by a dyke/ sill. (For Bulk Materials Store and New Solvent Drum Shed) Availability of the Spill control kit
Ergonomics - Poor posture leading to illness/ injury. Injury at the time of loading/ unloading	<ul style="list-style-type: none"> Provision of PPE to stores personnel. Loading/ unloading only by trained stores personnel.
Raw Materials Warehouse, Finished Goods Warehouse, Packing Materials Warehouse, and Engineering Store	
Fire	<ul style="list-style-type: none"> Access Control and control of visitors Fenced area Building capable of being locked when not in use. Control of ignition sources. Control of inventory to optimal levels Segregation of flammable materials. Segregation of materials. Battery charging not to be done inside the warehouse except for penicillin warehouse, that too during daytime only. Installation of Smoke/ Heat detectors Adequate hydrant points outside/around the building Daily night inspection by Shift Manager. Emergency exit. Availability of DCP, Foam and CO₂ fire extinguishers, Spill Control kit.
Spillage	<ul style="list-style-type: none"> Availability of the Spill control kit
Falling Objects	<ul style="list-style-type: none"> Mandatory head and foot protection when inside the warehouse.
Ergonomics - Poor posture leading to illness/ injury. Injury at the time of loading/ unloading	<ul style="list-style-type: none"> Provision of other PPE to stores personnel. Loading/ unloading only by trained stores personnel.

7.5 Hazard Analysis and Risk Assessment *(Terms of Reference No. 3(ix))*

7.5.1 Introduction.

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the plant. On the other hand, risk analysis deals with the

identification and quantification of risks, the plant equipment and personnel are exposed to, due to accidents resulting from the hazards present in the plant.

Hazard and risk analysis involves very extensive studies and requires a very detailed design and engineering information. The various hazard analysis techniques that may be applied are hazard and operability studies, fault-tree analysis, event-tree analysis and failure modes and effects analysis.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks; the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population's etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

In the sections below, the identification of various hazards, probable risks, maximum credible accident analysis, consequence analysis are addressed which gives a broad identification of risks involved in the plant.

7.5.2 Hazard Identification *(Terms of Reference No. 3(ix))*

The Hazard identification process must identify hazards that could cause a potential major accident for the full range of operational modes, including normal operations, start-up, and shutdown, and also potential upset, emergency or abnormal conditions. Employers should also reassess their Hazard identification process whenever a significant change in operations has occurred or a new substance has been introduced. They should also consider incidents, which have occurred elsewhere at similar facilities including within the same industry and in other industries.

Hazard identification and risk assessment involves a critical sequence of information gathering and the application of a decision-making process. These assist in discovering

what could possibly cause a major accident (hazard identification), how likely it is that a major accident would occur and the potential consequences (risk assessment) and what options there are for preventing and mitigating a major accident (control measures). These activities should also assist in improving operations and productivity and reduce the occurrence of incidents and near misses.

The chemical and process industries have been using a variety of hazard identification techniques for many years, ranging from simple screening checklists to highly structured Hazard and Operability (HAZOP) analysis. Each technique has its own strengths and weaknesses for identifying hazards. It is impossible to compare hazard identification techniques and come to any conclusion as to which is the best. Each technique has been developed for a specific range of circumstances taking many factors into account including the resources required to undertake the analysis, expertise available and stage of the process. While HAZOP is primarily a tool for hazard identification, the HAZOP process can also include assessment of the causes of accidents, their likelihood and the consequences that may arise, so as to decide if the risk is acceptable, unacceptable or requires further study. Moreover, a formal guidance for applying this technique is available. Collaboration between management and staff is fundamental to achieving effective and efficient hazard identification and risk assessment processes.

After identifying hazards through a qualitative process, quantification of potential consequences of identified hazards using simulation modelling is undertaken. Estimation of probability of an unexpected event and its consequences form the basis of quantification of risk in terms of damage to property, environment or personnel. Therefore, the type, quantity, location and conditions of release of a toxic or flammable substance have to be identified in order to estimate its damaging effects, the area involved, and the possible precautionary measures required to be taken.

Considering operating modes of the facility, and based on available resources the following hazard identification process chosen are:

- a) Fire Explosion and Toxicity Index (FETI) Approach;
- b) HAZOP studies;
- c) Maximum Credible Accident and Consequence Analysis (MCACA);
- d) Classification of Major Hazard Substances;
- e) Manufacture Storage and Import of Hazardous Chemical Rules, 1989 (GOI Rules, 1989) and its amendments;
- f) Identification of Major Hazardous Units.

The physical properties of solvents used in the process are presented in [Table 7.7](#) which forms the basis for identification of hazards during storage and interpretation of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 (GOI Rules, 1989)

The interpretation of “The Manufacture Storage and Import of Hazardous chemicals” issued by the Ministry of Environment and Forests, GOI, which guides the preparation of various reports necessary for safe handling and storage of chemicals shows that the present project requires preparation of safety reports before commencing operation and risk assessment is not mandatory. The applicability of various rules is presented in [Table 7.6](#).

Table 7.6 Applicability of GOI Rules to Storage/Pipeline

S.No	Name of Chemical	Inventory KL	Threshold Quantity (T) For Application of Rules		Applicable Rules
			5,7-9, 13-15	10 - 12	
1	Ethyl acetate	150	1500	10000	4 (1) (a), (2), 5,15
2	Methanol	280	1500	10000	4 (1) (a), (2), 5,15
3	Dichloromethane	150	1500	10000	4 (1) (a), (2), 5,15
4	Dimethyl formamide	30	1500	10000	4 (1) (a), (2), 5,15
5	Toluene	180	1500	10000	4 (1) (a), (2), 5,15
6	Acetonitrile	100	1500	10000	4 (1) (a), (2), 5,15
7	Isopropyl alcohol	80	1500	10000	4 (1) (a), (2), 5,15
8	Tetrahydrofuran	140	1500	10000	4 (1) (a), (2), 5,15
9	Hexane	60	1500	10000	4 (1) (a), (2), 5,15
10	Acetone	100	1500	10000	4 (1) (a), (2), 5,15
11	Cyclohexane	50	1500	10000	4 (1) (a), (2), 5,15
12	Ethanol	80	1500	10000	4 (1) (a), (2), 5,15

13	Chloroform	50	1500	10000	4 (1) (a), (2), 5,15
14	Acetic acid	30	1500	10000	4 (1) (a), (2), 5,15
15	n-Heptane	30	1500	10000	4 (1) (a), (2), 5,15
16	Isopropyl acetate	30	1500	10000	4 (1) (a), (2), 5,15
17	Methyl tert-butyl ether	30	1500	10000	4 (1) (a), (2), 5,15
18	N-Methylene Pyridine	45	1500	10000	4 (1) (a), (2), 5,15
19	Dichloroethane	50	1500	10000	4 (1) (a), (2), 5,15

Table 7.7 Physical Properties of Raw Materials and Solvents

S.No	Name of Raw material	TLV (ppm)	Toxicity Level			Flammable Limit					Chemical Class (As per MSIHC Rules)
			LD50	LD50	LC 50	LEL (%)	UEL (%)	FP (°C)	BP (°C)	Class (As per Petroleum Classification)	
			Oral (mg/kg)	Dermal (mg/kg)	(mg/l)						
1	Ethyl acetate	400	5620	18000	2500	2.1	11.5	-4	77	B	Flammable
2	Methanol	200	5628	15800	64000	5.5	36.5	11	64.5	A	Flammable
3	Dichloromethane	50	670	2800	2270	6	11.4	13	40	B	Carcinogenic
4	Toluene	200	636	12124	313	1.2	8	4	110.6	B	Flammable
5	Acetonitrile	40	3800	988	1000	3	17	2	81.6	B	Flammable
6	Isopropyl alcohol	400	5045	12800	100000	2	12.7	12	82.4	B	Flammable
7	Tetrahydrofuran	200	1650	2000	2160	1.5	12.4	-21.5	66	B	Flammable
8	Hexane	50	28710	2000	>20	1	8.1	-22	69	B	Flammable
9	Acetone	1000	5800	20000	5540	2.6	13	<-20	56.2	B	Flammable
10	Cyclohexane	300	12705	2000	13900	1.2	8.2	-18	81	B	Flammable
11	Ethanol	1000	1720	1025	20000	2.1	11.5	-4	77	B	Flammable
12	Chloroform	50	908	20000	47702	----	----	---	61	---	Toxic
13	Acetic acid	10	3310	1060	88	4	19.9	39	118	C	Flammable/Corrosive
14	n-Heptane	400	15000	9750	4900	1	7	-4	98.4	B	Flammable
15	Isopropyl acetate	250	6946	6750	20	1.8	8	4	85	C	Flammable
16	Methyl tert-butyl ether	50	4000	10000	23576	1.6	15.1	-33	55.2	C	Flammable
17	Dimethyl formamide	10	2800	1500	15	2.2	16	58	153	C	Flammable
18	Dioxane	100	5200	7378	46000	1.7	25.2	11	101.5	B	Flammable
19	Dimethyl sulfoxide	50	14500	5000	40250	1.8	63	95	189	B	Non-Hazard
20	n-Propyl Alcohol	250	6946	6750	20	1.8	8	4	85	C	Flammable
21	Diisopropyl ether	250	8470	14480	162000	1	21	-28	67	C	Flammable
22	Triethylamine	5	730	580	7.1	1.2	9.3	-11	90	B	Flammable
23	Dichloroethane	10	670	2800	1000	6	11.4	13	84	A	Flammable & Toxic
24	Isopropyl ether	500	8470	14480	162000	1	21	-28	67	C	Flammable
25	Pet. Ether	300	2000	2000	3400	1	7.4	<-21	70	B	Flammable
26	O-xylene	100	3567	12126	4595	1	7.6	30	144.4	B	Flammable
27	Dimethyl acetamide	10	5680	2240	2475	1.7	11.5	70	165	D	Carcinogenic
29	N-Methyl-2-Pyrrolidone	540	3914	7000	8000	1.3	9.2	91	202	B	Flammable

7.5.3 Fire & Explosion Index (F & EI):

7.5.3.1 Methodology

Dow Chemical Company issued a guideline for hazard determination and protection. By this method a chemical process unit is rated numerically for hazards. The numerical value used is the Fire and Explosion Index (F&EI) which is most widely used for hazard evaluation in chemical process industries.

The guide applies to process unit only and not to auxiliary units such as power generating stations, plant water systems, control rooms, fired heaters, structural requirements, corrosive nature of material handled and personal safety equipment. These are regarded as basic features that do not vary according to the magnitude of the fire and explosion hazard involved. The guide also does not cover the processing and handling of explosives such as dynamite, TNT etc.

Computation of F&EI

The F&EI is calculated as a product of Material factor, General process hazard factor, and special process hazard factor. The Material factor is a measure of the intrinsic rate of potential energy release from fire or explosion of most hazardous material or mixture of materials present in significant quantity, whether it is raw material, intermediate, product, solvent etc, by combustion or chemical reaction. "In significant quantity" here means such quantity that the hazard represented by the material actually exists. The National Fire Protection Agency of USA (NFPA) have specified standard values for material factor which should be used for F&EI calculations and are available in Dow's Hazard Classification Guide. In case it is not readily available, it can be calculated using the heat of combustion, flammability indices etc.

General process hazards are factors that play a primary role in determining the magnitude of loss of incident. It takes into account the nature of the reaction, ventilation of the unit, accessibility of the unit, drainage facilities etc., Special process hazards are

factors that contribute primarily to the probability of a loss of incident. They consist of specific process conditions that have shown themselves to be major causes of fire and explosion incidents. It takes into account toxicity of the material, operating pressure, operation near flammable range, quantity of material, joints and packing, use of hot oil exchange system etc., The F&EI index is calculated as a product of Material factor, General process hazard factor, and Special process hazard factor.

Hazard Ranking

The hazard ranking based on F&EI value is presented in [Table 7.8](#).

Table 7.8 Degree of Hazard for F&EI

F&EI Index Range	Degree of Hazard
1 - 60	Light
61 - 96	Moderate
97 - 127	Intermediate
128 - 158	Heavy
159 & above	Severe

The estimated values of F&EI and hazard ranking are given in the [Table 7.9](#). The radius of exposure is determined by 0.26 meter x respective F&EI. The estimated values of F&EI reflect light hazard in view of the low volume of chemicals.

The fire and explosion index evaluation can be very useful in developing plant layouts or adding equipment and buildings to existing plants. Evaluation of the F&EI calculations and layout considerations will result a safe, operable, maintainable and cost-effective arrangement of equipment and buildings.

Table 7.9 Fire & Explosion Index for Tank farm

S. No.	Name of Solvent	Fire & Explosion Index (F1*F2*MF)	Radius of Exposure (m) F&EIx0.26	Degree of Hazard
1	Acetone	81.21	21.11	Moderate
2	Acetic Acid	74.73	19.43	Moderate
3	Acetonitrile	95.57	24.85	Moderate
4	Chloroform	92.54	24.06	Moderate
5	Cyclohexane	85.5	22.23	Moderate
6	Dichloromethane	98.04	25.49	Intermediate
7	Dichloroethane	110.9	28.83	Moderate

8	Dimethyl Formamide	66.54	17.30	Moderate
9	Ethanol	73.6	19.14	Moderate
10	Ethyl acetate	79.44	20.65	Moderate
11	Hexane	80.67	20.97	Moderate
12	Heptane	80.67	20.97	Moderate
13	Isopropyl alcohol	81.89	21.29	Moderate
14	Isopropyl Acetate	85.86	22.32	Moderate
15	Methanol	78.11	20.31	Moderate
16	Methyl tertbutyl Ether	86.35	22.45	Moderate
17	N-Methylene Pyridine	84.71	22.02	Moderate
18	Toluene	112.8	29.33	Intermediate
19	Tetra hydro furan	73.37	19.08	Moderate

F& E index value calculated considering the maximum storage capacity of chemical and values are found to be Intermediate for dichloromethane, Triethyl amine and Toluene, Light for Chloroform and moderate for all other solvents storage reflecting the threshold limits as prescribed in MSHC rules.

7.5.4 Hazard and Operability Study (HAZOP)

Hazard and Operability Study (HAZOP) is a highly structured and detailed technique, developed primarily for application to chemical process systems. A HAZOP can generate a comprehensive understanding of the possible 'deviations from design intent' that may occur. However, HAZOP is less suitable for identification of hazards not related to process operations, such as mechanical integrity failures, procedural errors, or external events. HAZOP also tends to identify hazards specific to the section being assessed, while hazards related to the interactions between different sections may not be identified. However, this technique helps to identify hazards in a process plant and the operability problems. It is performed once the engineering line diagrams of the plant are made available. It is carried out during or immediately after the design stage. The purpose of the study is to identify all possible deviations from the way the design/operation is expected to work and all the hazards associated with these deviations. A multi-disciplinary team was constituted with chemical, mechanical and instrumentation engineers, R&D chemist and production manager. It is important to keep the team small

enough to be efficient, while retaining a sufficient spread of skills and disciplines for all aspects of the study to be covered comprehensively. The group discussion is facilitated by a Chairman and the results of the discussion are recorded by a Secretary. Every investigation must be led by Chairman who is familiar with the HAZOP study technique, which is primarily concerned with applying, controlling the discussions and stimulating team thinking.

The preparative work for HAZOP studies consisted of four stages i.e., obtaining the data, converting into usable form, planning the sequence of the study and arranging the necessary meetings. The documents referred to for the study include process description, process flow diagrams, P&I diagrams plant layout, operating manuals including startup & shutdown, safety instructions etc., The parameters such as temperature, pressure, flow, level were investigated for deviation and hazard situations are identified.

Some basic definitions of terms frequently used in HAZOP studies are deviation, causes, consequences and guide words etc., Deviations are departures from the design intent which are discovered by systematically applying the guide words. Causes are the reasons why deviations might occur. Consequences are the reasons why deviations should they occur. Guide words are simple words used to understand a particular plant section in operating condition in order to guide and simulate the creative thinking process and so discover deviations. NO, less, more, as well as, part of, reverse, other than are guide words used.

Potential problems as represented by the consequences of the deviation should be evaluated as they arise and a decision reached on whether they merit further consideration or action. Except for major risk areas where a fully quantitative assessment is required this decision is made semi-quantitatively on the consequence (usually scaled as trivial, important or very probable).

7.5.5 Hazard Factors

A study of past accident information provides an understanding of failure modes and mechanisms of process and control equipment and human systems and their likely effects on the overall plant reliability and safety. Some of the major contributing factors for accidents in chemical industries are presented in **Table 7.10**:

Table 7.10 Major Contributing Factors for Accidents in Chemical Industries

S. No	Contributing Factor	Percent Loss
1	Equipment design faults	41
2	Process design faults	10
3	Operator errors	31
4	Maintenance deficiencies	12
5	Material hazards	6

7.5.6 Common Causes of Accidents

Engineering and Instrumental

Based on the analysis of past accident information, common causes of major chemical plant accidents are identified as:

- Poor house keeping
- Improper use of tools, equipment, facilities
- Unsafe or defective equipment facilities
- Lack of proper procedures
- Improving unsafe procedures
- Failure to follow prescribed procedures
- Jobs not understood
- Lack of awareness of hazards involved
- Lack of proper tools, equipment, facilities
- Lack of guides and safety devices
- Lack of protective equipment and clothing

Failures of Human Systems

An assessment of past chemical accidents reveals human factor to be the cause for over 60% of the accidents while the rest are due to other plant component failures. This percentage will increase if major accidents alone are considered for analysis. Major causes of human failures reported are due to:

- Stress induced by poor equipment design, unfavorable environmental conditions, fatigue, etc.
- Lack of training in safety and loss prevention.
- Indecision in critical situations.
- Inexperienced staff being employed in hazardous situations.

Often, human errors are not analyzed while accident reporting and accident reports only provide information about equipment or component failures. Hence, a great deal of uncertainty surrounds analysis of failure of human systems and consequent damages. The number of persons/materials are potentially exposed to a specific hazard zone is a function of the population density and distribution near the accident location. The failure rate data and ignition sources of major fires are presented in the following [Tables 7.11 and 7.12](#).

Table 7.11 Failure Rate Data

S.No	Item	International Data
1.	Process Controllers	$2.4 \times 10^{-5} \text{ hr}^{-5}$
2.	Process control valve	$2.0 \times 10^{-6} \text{ hr}^{-1}$
3.	Alarm	$2.3 \times 10^{-5} \text{ hr}^{-1}$
4.	Leakage at biggest storage tank	$5.0 \times 10^{-5} \text{ yr}^{-1}$
5.	Leakage of pipe line	$1 \times 10^{-7} \text{ m}^{-1} \text{ yr}^{-1}$
6.	Human Failure	$1 \times 10^{-4} \text{ (demand)}^{-1}$

Table 7.12 Ignition Sources of Major Fires

S.No	Ignition Source	Percent
1.	Electrical (wiring of motors)	23%
2.	Smoking	18%
3.	Friction	10%
4.	Over heated material	8%
5.	Burner flames	7%
6.	Combustion sparks	5%
7.	Spontaneous ignition	4%
8.	Cutting & welding	4%
9.	Exposure (fires jumping into new areas)	3%
10.	Mechanical sparks	2%
11.	Molten substances	1%
12.	Chemical actions	1%
13.	Static sparks	1%
14.	Lightening	1%
15.	Miscellaneous	1%

7.6 Maximum Credible Accident and Consequence Analysis (MCACA)

The potential hazards due to flammable and toxic nature of the raw materials, process streams and products can be quantified. However, it is necessary to carry out a hazard analysis study to visualize the consequences of an unexpected release from chemical plant, which consists of a number of process units and tank farm facilities. The present study provides quantified picture of the potential hazards and their consequences.

7.6.1 Methodology

MCACA aims at identifying the unwanted hazardous events, which can cause maximum damage to plant and personnel. At the first instance, all probable accident scenarios are developed. Scenarios are generated based on properties of chemicals, physical conditions under which reactions occur or raw materials stored, as well as material strength of vessels and conduits, in-built valves and safety arrangements, etc. Creating a scenario does not mean that it will occur, only that there is a reasonable probability that it could. A scenario is neither a specific situation nor a specific event, but a description of a typical situation that covers a set of possible events or situations.

The following steps are involved in identifying the maximum credible accident scenarios.

- a. A detailed study of the process and plant information including process flow diagrams and piping & instrumentation diagrams.
- b. Hazard classification of chemicals, operations and equipment.
- c. Identification of representative failure cases of vessels and the resulting release scenarios
- d. Establishment of credibility of visualized scenarios based on past accident data.

7.6.2 Identification of Vulnerable Areas

The unit operations in the process and storage areas involve mass and energy transfer operations to effect the necessary physical changes. Nature of chemicals and the operating conditions create special hazardous situations. In the present case the chemicals handled are flammable and toxic in nature. With these factors in mind a thorough

examination of the process information is carried out and a list of inventories of the hazardous chemicals is prepared to identify the hazardous situations. Based on the raw material consumptions determined from the pilot scale studies, experience in handling commercial scale processes and logistics in procurement of raw materials, the inventories to be maintained for each of the raw material and its mode of storage is determined. High inventory liquid raw materials like solvents are usually stored in tank farms, while solids and other low inventory liquids are stored in ware house based on compatibility, reactivity, toxicity etc. with appropriate safety and fire fighting facilities to handle any kind of emergencies. The solvent tank farm and the capacity of each tank is presented in

Table 7.13.

Table 7.13 Details of Solvent Tank Farm

S.No	Name of Solvent	Tank Capacity (KL)	
		Existing	Proposed
1	Ethyl acetate	1 x 50	2x50
		1 x 30	
2	Methanol	5 x 50	--
		1 x 30	
3	Dichloromethane	1 x 50	2x50
4	Toluene	1 x 50	2x50
		1 x 30	
5	Acetonitrile		2x50
6	Isopropyl alcohol	1 x 50	--
		1 x 30	
7	Tetrahydrofuran	1 x 50	2x30
		1 x 30	
8	Hexane	1 x 30	1 x 30
9	Acetone	1 x 50	1 x 50
10	Cyclohexane	1 x 50	--
11	Ethanol	1 x 30	1 x 50
12	Chloroform		1 x 50
13	Acetic acid		1 x 30
14	n-Heptane		1 x 30
15	Isopropyl acetate		1 x 30
16	Methyl tert-butyl ether		1 x 30
17	N-Methylene Pyridine	1 x 25	
		1 x 20	
18	Dimethyl formamide		1 x 30
19	Dichloroethane	---	1 x 50

7.6.3 Representative Accident Scenarios

A study of past accidents, which took place in similar process units and the present plant, provides reasons and course of accidents and there by focusing on most critical areas. A thorough examination of engineering details indicated many possible scenarios like gasket leak, pinholes in pipes and vessels apart from rupture of pipelines and vessels and catastrophic failure of vessels resulting in a pool. Heat radiation damage distances for Pool fire was considered.

Failure Frequency:

The release scenarios considered above can be broadly divided in to two categories

- (i) Catastrophic failures which are of low frequency and
- (ii) Ruptures and leaks which are of relatively high frequency

Vapor or liquid release from failure of gasket, seal and rupture in pipe lines and vessels fall in second category whereas catastrophic failure of vessels and full bore rupture of pipe lines etc., fall in to first category. Typical failure frequencies are given in [Table 7.14](#).

Table 7.14 General Failure Frequencies

Item	Mode of failure	Failure frequencies
Pressure Vessel	Serious leak	1.0×10^{-5} /Year
	Catastrophic	3.0×10^{-6} /Year
Pipe lines		
=50 mm dia	Full bore rupture	8.8×10^{-7} / m.year
	Significant leak	8.8×10^{-6} /m.year
>50 mm =150 mm dia	Full bore rupture	2.6×10^{-7} / m.year
	Significant leak	5.3×10^{-6} /m.year
>150 mm dia	Full bore rupture	8.8×10^{-8} /m.year
	Significant leak	2.6×10^{-6} /m.year
hose	Rapture/Failure	4.0×10^{-5} /hr
Unloading arm	Rapture/Failure	3.0×10^{-8} /hr
Check valve	Failure on demand	1.0×10^{-4} /on demand
motor operated valve	Failure on demand	1.0×10^{-3} / on demand
Flange	Leak	3.0×10^{-4} / Year
Pump seal	Leak	5.0×10^{-3} / Year
Gasket failure	Failure	5.0×10^{-5} / Year

Process safety valve(PSV)	Lifts heavily	4.0*10 ⁻³ / Year
	Blocked	1.0*10 ⁻³ / Year
	Lifts lightly	6.0*10 ⁻² / Year

7.7 Consequence Analysis

The accidental release of hazardous chemicals leads to subsequent events, which actually cause the damage. The damages are of three types.

- 1) Damage due to heat radiation.
- 2) Damage due to Over pressure effects subsequent to explosion
- 3) Damage due to toxic effects

The type of damage and extent of damage depends on nature of chemical, the conditions of release, atmospheric conditions and the subsequent events. The sequence of probable events following the release of a hazardous chemical is schematically shown in [Figure 7.2](#). The best way of understanding and quantifying the physical effects of any accidental release of chemicals from their normal containment is by means of mathematical modeling. This is achieved by describing the physical situations by mathematical equations for idealized conditions and by making corrections for deviation of the practical situations from ideal conditions. In the present study ALOHA software from USEPA is used. These models for various steps are described in the following sub-sections.

7.7.1 Release Models and Source strength

This depends on the nature of failure of the unit and the content of the unit and operating temperature and pressure of the unit. The release may be instantaneous due to total failure of storage unit or continuous due to leakage or rupture of some component of the storage facility. The material discharged may be gas or liquid or the discharge could be manifested through two phase flow.

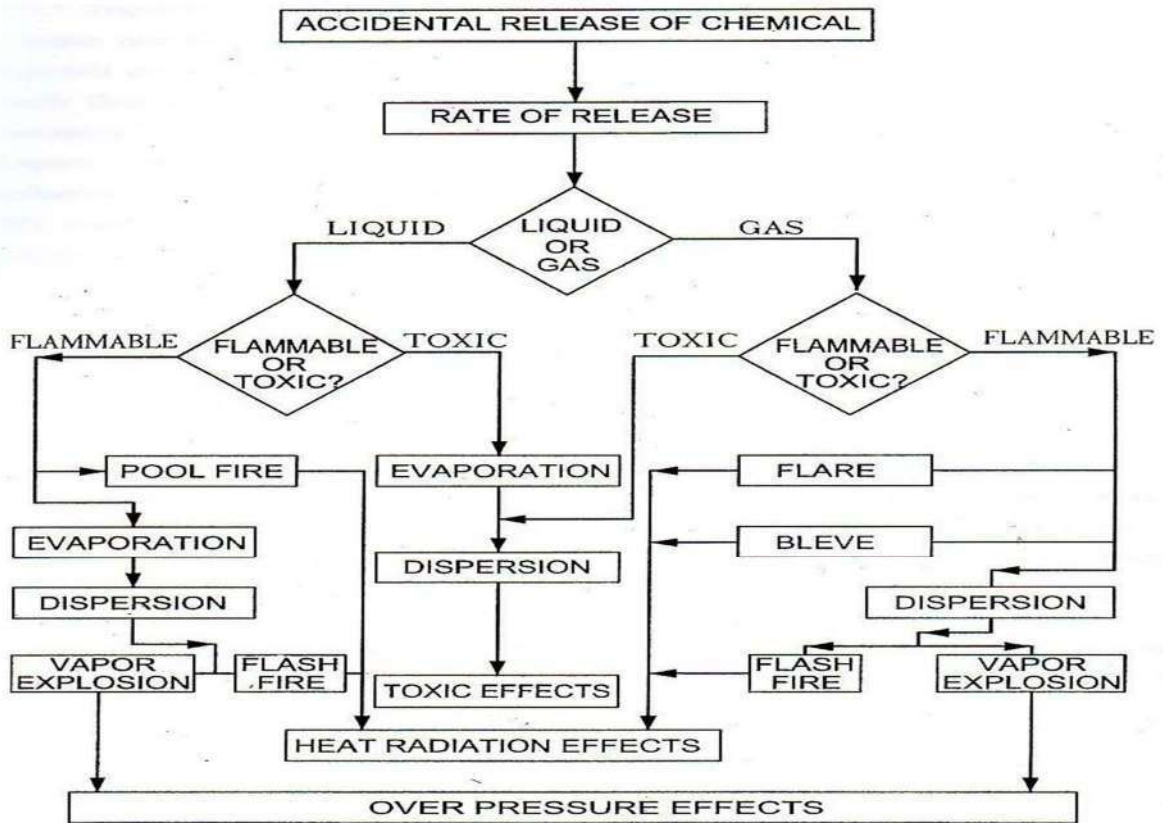


Fig 7.2 Steps in Consequence Calculations

The following criteria tables present heat radiation intensities (Table 7.15), radiation exposure and lethality (Table 7.16), and damage due to peak over pressure is presented in Table 7.17.

Table 7.15 Damage Due to Incident Radiation Intensities

S. No	Incident Radiation (KW/m ²)	Type of Damage Intensity	
		Damage to Equipment	Damage to the People
1	37.5	Damage to process Equipment	100% lethality in 1 min. 1% lethality in 10 sec.
2	25.0	Minimum energy required to ignite wood at indefinitely long exposure without a flame	50 % lethality in 1min. Significant injury in 10 sec.
3	19.0	Maximum thermal radiation intensity allowed in thermally unprotected adjoining equipment.	---
4	12.5	Minimum energy to ignite with a flame, melts plastic tubing	1% lethality in 1 min.

5	4.0	--	Causes pain if duration is longer than 20 sec, however blistering is unlikely (First degree burns)
6	1.6	--	Causes no discomfort on Longer exposure

Source: Techniques for Assessing Industrial Hazards by World Bank

Table 7.16 Radiation exposure and lethality

Radiation Intensity (KW/m ²)	Exposure Time (seconds)	1% Lethality	Degree Burns
1.6	--	0	No Discomfort even after longer exposure
4.5	20	0	1st
4.5	50	0	1 st
8.0	20	0	1 st
8.0	50	<1	3 rd
8.0	60	<1	3 rd
12.0	20	<1	2 nd
12.0	50	8	3 rd
12.5	--	1	--
25.0	--	50	--
37.5	--	100	--

Table 7.17 Damage Due to Peak Over Pressure

Human Injury		Structural Damage	
Peak Over Pressure(bar)	Type of Damage	Peak over Pressure(bar)	Type of Damage
5 - 8	100% lethality	0.3	Heavy (90% Damage)
3.5 - 5	50% lethality	0.1	Repairable (10% Damage)
2 - 3	Threshold lethality	0.03	Damage of Glass
1.33 - 2	Severe Lung damage	0.01	Crack of Windows
1 - 1 ^{1/3}	50% Eardrumrupture	-	-

Source : Marshall, V.C.(1977)' How lethal are explosives and toxic escapes.

7.7.2 Results of Consequence Analysis

The damages due to the accidental release of chemicals are of three types.

- Damage due to heat radiation
- Damage due to Over pressure effects subsequent to explosion
- Damage due to Toxic effects

7.7.2.1 Analysis of Hazardous Scenarios

The hazardous chemicals involved are stored within the threshold limits of storage and hence few representative chemicals mainly solvents were studied.

7.7.2.1.1 Heat radiation effects (Terms of Reference No. Sp. TOR (13))

When a non-boiling liquid spills, it spreads into a pool. The size of the pool depends on the availability of the bund and obstacles. The heat load on objects outside a burning pool of liquid is calculated with the heat radiation model. The average heat radiation intensity, the diameter-to-height ratio dependent on the burning liquid, geometric view, distance from the fire, relative humidity of air, horizontal or vertical orientation of the object radiated with respect to fire are factored. All storage tanks in tank-farm area are provided with dykes. For each of the hazardous chemicals involved various scenarios such as pipe line leaks of 5mm or pipeline ruptures or catastrophic vessel ruptures of the inventories as outlined have been considered and damage distances for Lower Flammability Limits (LFL) and heat radiation effects for the three levels of intensity are calculated and presented in [Table 7.18](#). Heat radiation damage distances for most of the scenarios are not occurring in the case of release from 25 mm holes at a height of 0.1 m from the bottom of the tank for one hour, in the storage tanks. In case of pipeline leaks, 5 mm leaks are considered for 15 mm and 50 mm pipe sizes. The release rates from 5 mm leaks are observed to be low, and these leaks have low incident hazard. The concentration of the flammable material in the vapor cloud was found to be below the lower flammability limits. Heat radiation damage distance (Pool Fire) is presented in [Fig 7.3 to Fig 7.6](#).

Table 7.18 Heat Radiation Damage Distances - Tank Farm (Pool Fire)

S.No	Name of Raw material	Tank (KL)	No.s	Diameter (m)	Height (m)	Release Rate (Kg/min)	Heat radiation damage distances in m for KW/m ²		
							37.5	12.5	4.0
1	Acetone	50	2	3.60	5.00	22.6	<10	<10	<10
2	Acetic Acid	30	1	3.00	4.30	26	<10	<10	<10
3	Acetonitrile	50	2	3.60	5.00	22.5	<10	<10	12
4	Cyclohexane	50	1	3.60	5.00	22.3	<10	<10	11

5	Dichloromethane	50	3	3.60	5.00	218	<10	10	12
6	Dichloro Ethane	50	1	3.60	5.00	27.5	<10	10	11
7	Dimethyl Formamide	30	1	3.00	4.30	24.8	<10	<10	<10
8	Ethanol	50	1	3.60	5.00	22.8	<10	<10	<10
9	Ethanol	30	1	3.00	4.30	22.2	<10	<10	<10
10	Ethyl acetate	50	3	3.60	5.00	24	<10	<10	<10
11	Ethyl acetate	30	1	3.00	4.30	24	<10	<10	<10
12	Hexane	30	2	3.00	4.30	20.6	<10	<10	11
13	Heptane	30	1	3.00	4.30	20.8	<10	<10	11
14	Isopropyl alcohol	50	1	3.60	5.00	22.4	<10	<10	<10
15	Isopropyl alcohol	30	1	3.00	4.30	21.4	<10	<10	<10
16	Isopropyl Acetate	30	1	3.00	4.30	23.8	<10	<10	<10
17	Methanol	50	5	3.60	5.00	22.8	<10	<10	<10
18	Methanol	30	1	3.1	4.0	22.5	<10	<10	<10
19	Methyl tertbutyl Ether	30	1	3.00	4.30	26.3	<10	<10	<10
20	N-Methylene Pyridine	25	1	2.80	4.00	24.7	<10	<10	<10
21	N-Methylene Pyridine	20	1	2.6	3.7	23.4	<10	<10	<10
22	Toluene	50	3	3.60	5.00	23.6	<10	10	12
23	Toluene	30	1	3.00	4.30	21.2	<10	<10	11
24	Tetra hydro furan	50	1	3.60	5.00	24	<10	<10	<10
25	Tetra hydro furan	30	3	3.00	4.30	21.4	<10	<10	<10

S.No	Name of Raw material	Tank Capacity (KL)	Ht. (m)	Dia (m)	Release Rate(Kg/sec)	IDLH (ppm)	Distance (m)
1	Chloroform	50	6.10	2.68	0.47	500	45

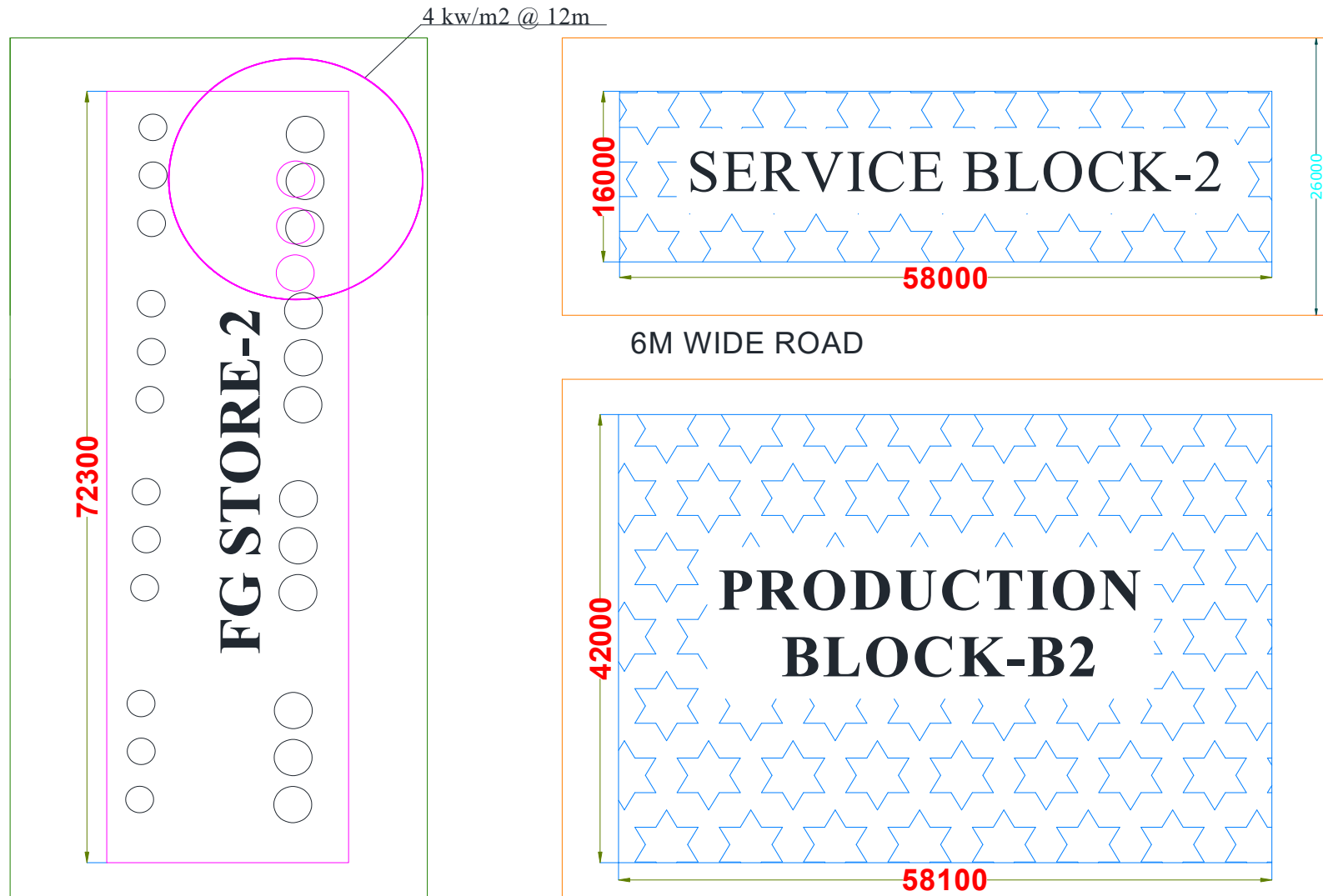


Fig 7.3 Heat Radiation Damage - 50Kl Acetonitrile Tank

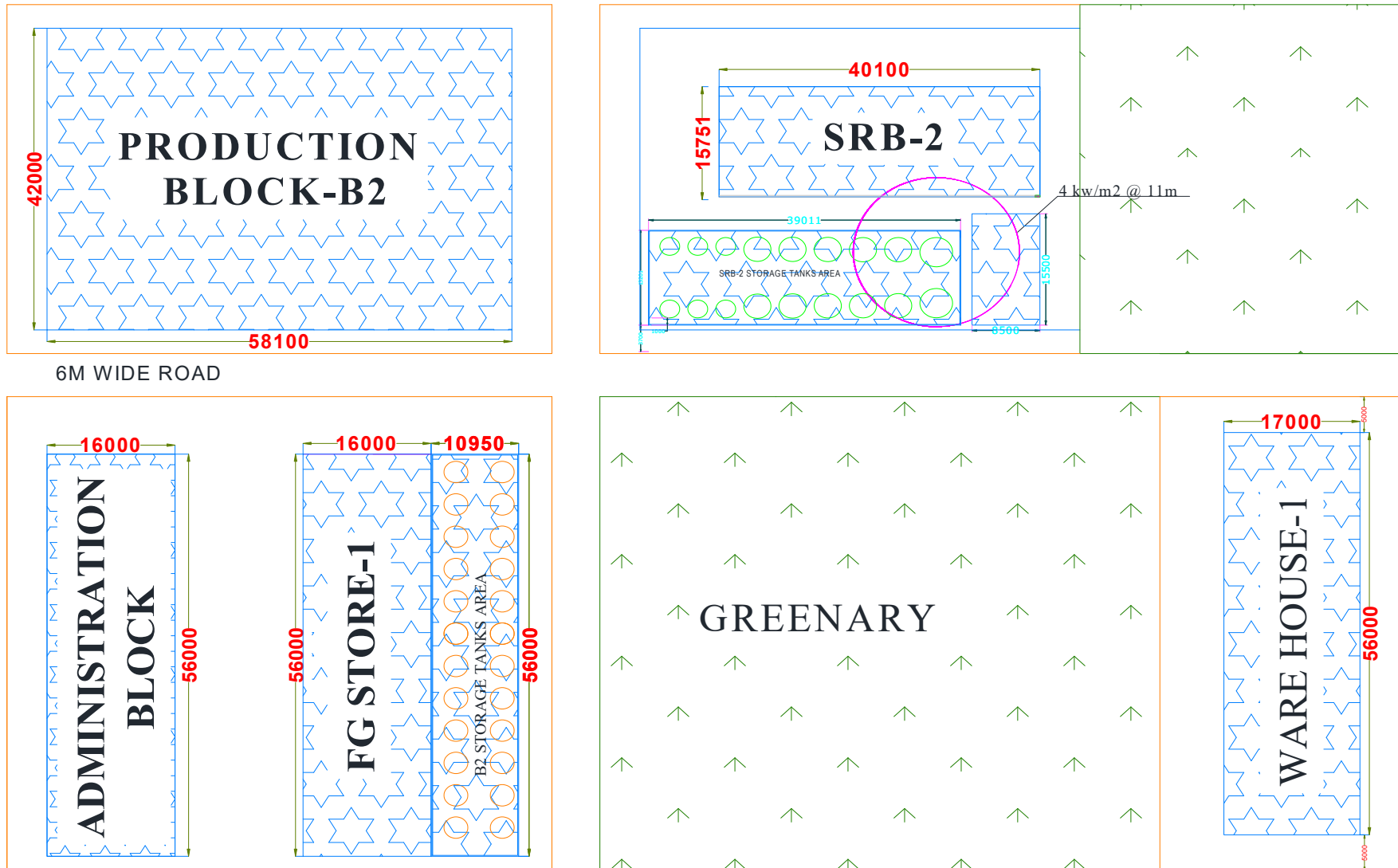


Fig 7.4 Heat Radiation Damage - 50Kl Cyclohexane Tank

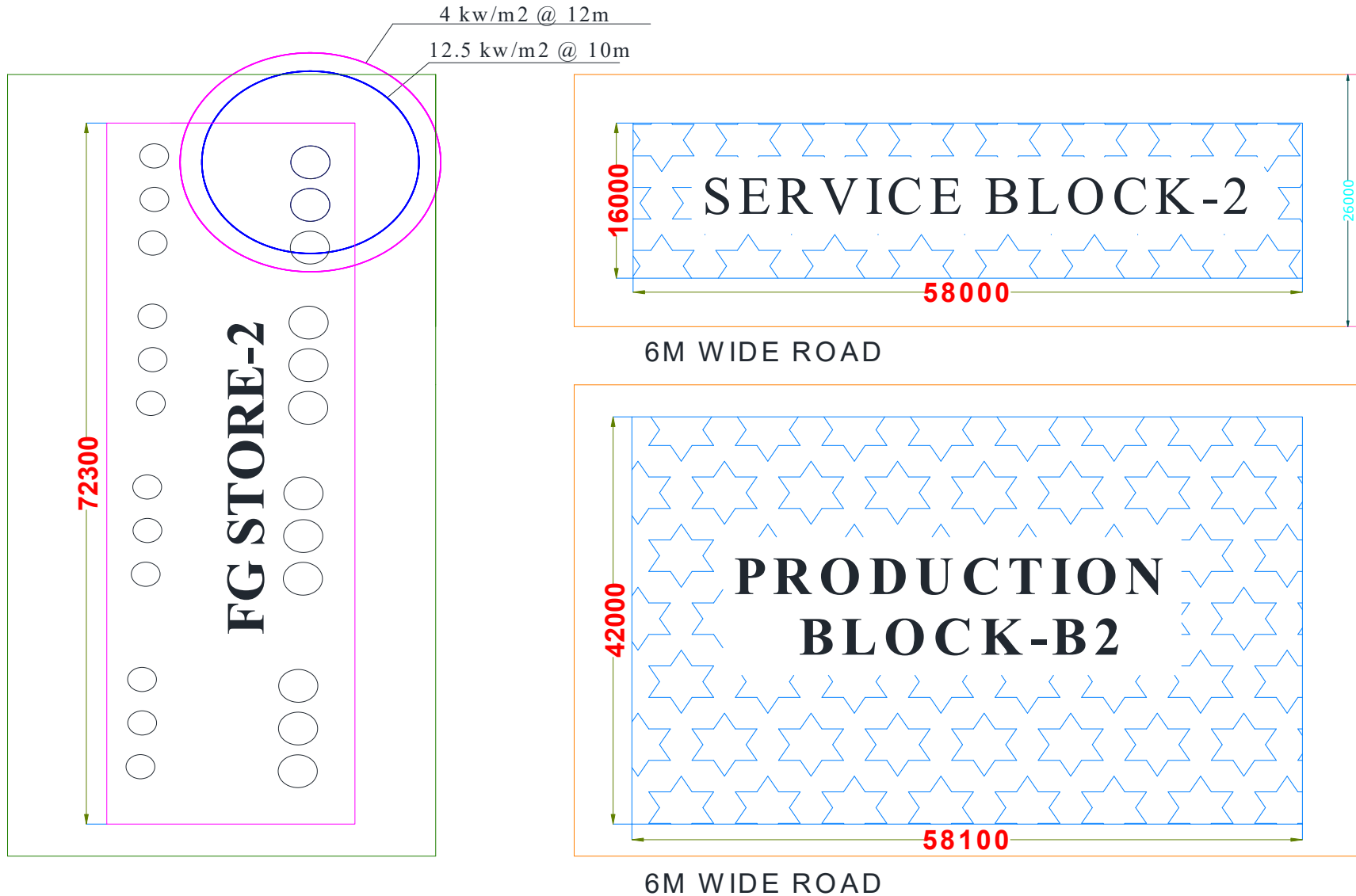


Fig 7.5 Heat Radiation Damage - 50Kl Dichloromethane Tank

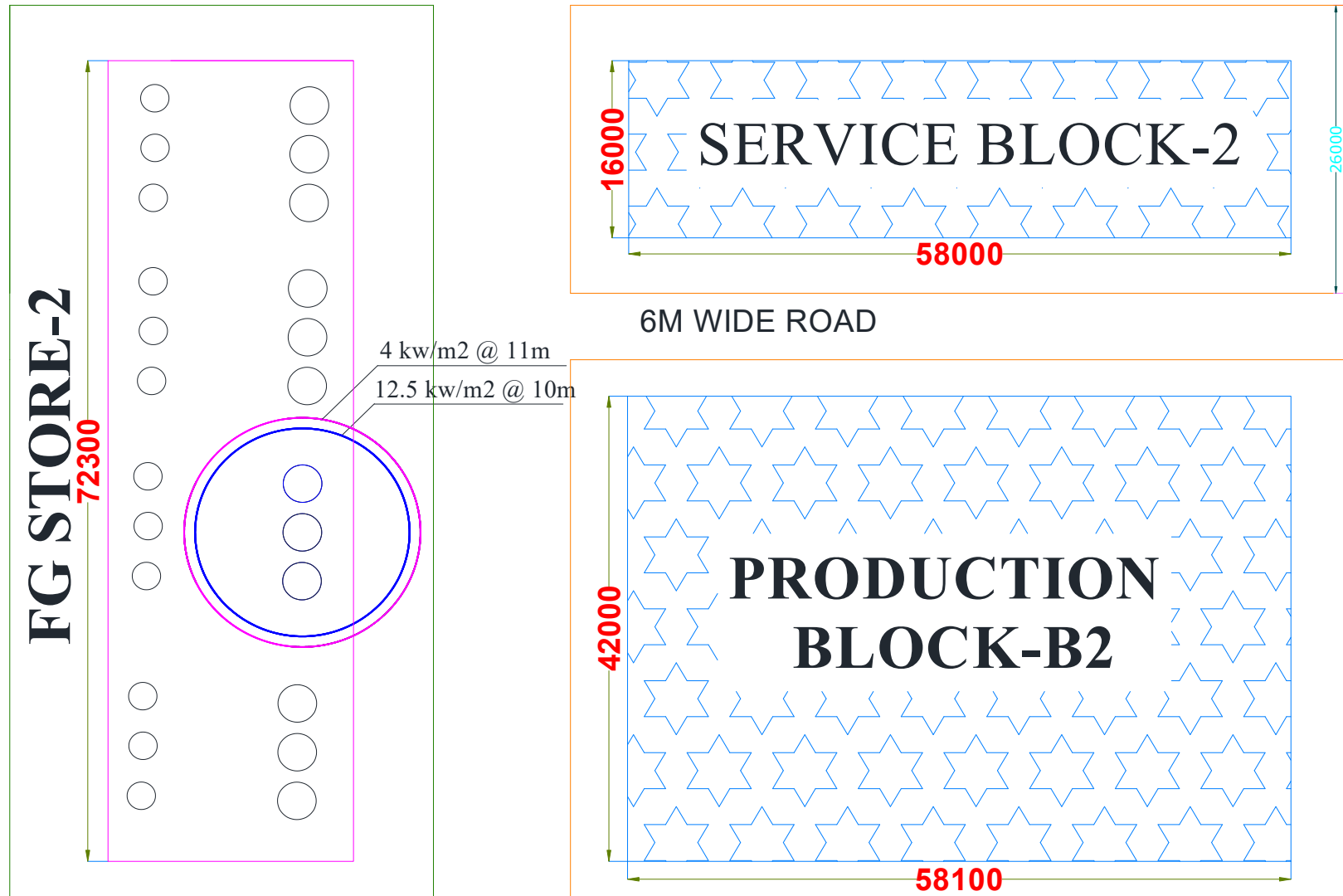


Fig 7.6 Heat Radiation Damage -50kl Dichloroethane Tank

Table 7.19 Heat Radiation Damage Distance - Hydrogen Cylinders

S. No.	Scenario Description	Release Rate Kg/sec	Storage Tank Details			Heat radiation damage distances in m for KW/m ²		
			Height (m)	Diameter (m)	Storage Pressure	37.5	12.5	4.0
1	Hydrogen Gas Cylinder (50Kg)	5.42	0.87	0.27	350 Bar	<10	12	20

7.7.2.1.2 Overpressure effects:

When an unignited gas cloud mixes with air and reaches the flammable range and if the cloud ignites wither a flash fire or flash fire explosion can occur. Since the burning time is shorter, instead of heat radiation from a flash fire, peak overpressure as a function of distance from the centre of the cloud is derived. In case of pipeline leaks, damage distances due to overpressure effects are not observed. The values are found to be similar as there are no pressurized storage tanks in the tank farm, and the over pressure distances are contingent on the tank capacity.

7.7.3 Observations:

From the previous incident records published in literature and hydrocarbon release data bases, it has been observed that pinhole leaks contribute highest percentage whereas the second cause is small sized leaks of 25 mm diameter in tank farm. Accordingly, the consequence analysis was carried out for 25 mm sized leaks in the tank farm.

7.7.4 Recommendations:

The following are the recommendations to minimize the hazards and improve the safety of the proposed plants. Plants of this nature, which handle a variety of chemicals, face problems of fire and vapor cloud explosions. It has been observed that the damage distances are more or less confined to the plant area only. Taking precautionary safety measures as outlined below can further minimize these effects.

- In view of hazardous nature of operations, it is recommended to adopt best practices with respect to design, operation and maintenance.
- It is recommended that all flammable areas and process area be maintained free of ignition sources. Ensure that sources of ignition, such as pilot lights, electrical ignition devices etc., at strategic locations like solvent storage areas are avoided.
- All electrical fittings involved in and around the pipeline and operation system should conform to flame/explosion proof regulations.
- Strict hot work control and display of danger signs should be ensured.
- It is recommended to provide one fire hydrant point in the tank-farm area to take care of any emergency. Installation of fire water hydrant net work is suggested.
- It is suggested to provide fire extinguishers in process plant at solvent storage area and the vents of solvent tanks to be provided with PESO approved flame arrestors.
- Fire protection equipment should be well maintained so that it is available when required. They should be located for quick accessibility. Provide carbon dioxide fire extinguishers and DCP extinguishers for Electrical fires.
- It is suggested to have a periodical review of safety awareness and safety training requirements of plant employees with respect to hazards present in the plant.
- In general, all pipelines carrying flammable liquids/vapor are periodically checked for their integrity. Spillages have to be avoided and disposal should be done quickly.

7.7.5 Toxic Management Plan (*Terms of Reference No. Sp. TOR (14)*)

The list of chemicals identified to have toxic or carcinogenic nature is presented in [Table 7.20](#).

Table 7.20 List of Toxic/Carcinogenic Chemicals and Mode of Storage/Transport

S.No	Name of Raw Material	Max Storage Quantity (Kgs)	Physical Appearance	Type of Hazard	Mode of Storage
1	1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide HCl	100	Liquid	Toxic	Drums
2	1,2,3,9-tetrahydro carbazole-4-one	400	Solid	Toxic	Bags

3	(4-fluorophenyl)methanamine	300	Liquid	Toxic	Drums
4	1-((2R,3R,4R,5R)-3-fluoro-4-hydroxy-5-(hydroxymethyl)-3-methyltetrahydro furan-2-yl)pyrimidine-2,4(1H,3H)-dione	3528	Crystalline	Toxic	HDPE Bags
5	1,3 Dichloro acetone	1105	Solid	Toxic	HDPE Bags
6	1,3- Dimethyl-2-imidazolidinone	100	Liquid	Carcinogenetic	Drums
7	2,3-dichloro-5,6dicyano-1,4benzoquinone(DDQ)	25053	Crystalline	Toxic	HDPE Bags
8	2-methyl imidazole	50	Powder	Toxic	Bags
9	2-Oxiranylmethyl-isoindole-1,3-dione	1283	Powder	Toxic	HDPE Bags
10	3-Chloropropionyl chloride	179	Liquid	Toxic	Drums
11	4-Bromo-1-chloro-2(4-ethoxybenzyl) benzene	504	Solid	Toxic	HDPE Bags
12	4-Amino-N-(2R,3S)(3-amino-2-hydroxy-4-phenyl-butyl)-N-isobutyl-benzenesulfonamide	2789	Liquid	Toxic	Drums
13	4-chlorobutyryl chloride	4165	Liquid	Toxic	Drums
14	3-Di methyl amino methyl-9-methyl-1,2,3,9-tetrahydro carbazole-4-one	163	Crystalline	Toxic	HDPE Bags
15	3-Chloropropionitrile	302	Liquid	Toxic	Drums
16	Formaldehyde	242	Liquid	Toxic	Drums
17	4-Bromo-1-chloro-2(4-ethoxybenzyl)benzene	504	Liquid	Toxic	Drums
18	4-chlorobutyryl chloride	4165	Liquid	Toxic	Drums
19	4-nitro benzyl bromide	100	Crystalline	Toxic	HDPE Bags
20	Acyclovir	4771	Powder	Toxic	HDPE Bags
21	Butyryl Chloride	100	Liquid	Toxic	Drums
22	Chloro sulfonic acid	109	Liquid	Toxic	Drums
23	Chlorosulphonic acid	100	Liquid	Toxic	Drums
24	Dicyclohexyl carbodiimide	5464	Powder	Toxic	HDPE Bags
25	Dimethyl amino pyridine	100	Solid	Toxic	HDPE Bags
26	Dimethyl sulphate	14563	Liquid	Toxic	Drums
27	Diphenyl Phosphoryl Azide	100	Liquid	Toxic	Drums
28	Ethyl Chloro [(4-methoxy phenyl)hydrazono] acetate	166	Liquid	Toxic	Drums
29	Ethylene dichloride HCL	100	Liquid	Toxic	Drums
30	Furfuryl alcohol	17491	Liquid	Toxic	Drums
31	Methyl iso thio cyanate	16875	Solid	Toxic	HDPE Bags
32	Monochloroacetic acid	1477	Crystalline	Toxic	HDPE Bags
33	Oxalyl chloride	100	Liquid	Toxic	Drums

34	Palladium acetate	20	Powder	Toxic	HDPE Bags
35	Sodium azide	1913	Crystalline	Toxic	HDPE Bags
36	Sodium cyanide	100	Solid	Toxic	HDPE Bags
37	t-butyl{(1S)-1-[(2R)-Oxiran-2-yl]-2-phenylethyl} Carbamate	2061	Solid	Toxic	HDPE Bags
38	Tetrabutylammonium Iodide	100	Crystalline	Toxic	Bags
39	Thionyl chloride	12230	Liquid	Toxic	Drums
40	Tributyl tin chloride	379	Liquid	Toxic	Drums
41	Valeryl Chloride	1149	Liquid	Toxic	Drums

Handling: Storage & handling in compliance with MSDS. The transfer of solvents shall be mainly by closed pipeline systems, while solvents are transferred from drums by using air operated diaphragm pumps in closed hoods. Solid raw materials are charged by using hoppers to avoid dust emissions and hazard of static electricity. SOP's are used for better operational control.

Engineering Control Measures: Filtration and drying is conducted in closed conditions. Forced dry ventilation system will be given to hoods. Vent condensers in series to reactors, distillation columns, driers and centrifuge to mitigate atmospheric emissions of toxics. Solvents with low boiling point will be stored in insulated storage tanks.

Vents of secondary condensers connected to vacuum pumps followed by tertiary condenser. Common headers connecting all the process vents and the same are connected to scrubbers. Low boiling solvents tanks are connected with reflux condensers to minimise the loss. The transfer pumps shall be provided with mechanical seals.

Personnel Protective Equipment: Personal protective equipment shall be provided to all employees including contract employees. All the employees shall be provided with gumshoe, helmet, masks, goggles. The other equipment like ear muffs, gloves, respirators, aprons etc., will be provided to employees depending on the work area allocated to them. The PPE selection shall strictly follow the prescribed guidelines of MSDS.

Health Monitoring of Employees: The pre-employment screening and periodic medical examination shall follow the guidelines of factories act. The pre-employment screening shall obtain medical history, occupational history followed by physical examination and baseline monitoring for specific exposures.

Frequency of Health Monitoring

Occupation	Type of evaluation		Frequency
Process area	Physical Observation	Height Weight	Once a year for regular employees.
	Eyes	Color vision	
	Detailed Test	Hearing Ability; Physical Status, Lung function test, General Condition; Previous Accidents, Skin Infections; Any Physical Handicap	Half yearly for contract employees
	Clinical Observation	Heart; Hydrocele; Central Nervous System; Liver functioning; Diabetes; Any operations undergone; Symptoms of communicable and other contagious disease and Medical fitness	
Noise prone areas	Audiometry		Annually

7.7.6 Transportation (Terms of Reference No. 7(iii))

All the raw materials and finished products are transported by road. There will be 12-15 truck trips per day to the factory. Safety signages are placed at various locations in the battery limit. The drivers of the vehicles will be provided with TREM cards and will be explained the measure to be adopted during various emergencies.

Transportation of raw materials may result in accidents due to high speed collision, low speed collision, overturning and non-accident-initiated release. The initiating and contributing causes are presented in **Table 7.21**

Table 7.21 Truck Incidents - Initiating and Contributing Causes

Human Errors	Equipment Failures	System or Procedural Failures	External Events
Driver Impairment	Non-dedicated trailer	Driver incentives	Vandalism/ Sabotage
Speeding	RR crossing guard	Driver training	Rain
Driver Overtired	Failure	Carrier selection	Fog

Contamination Overfilling	Leaking Valve Leaking Fitting	Container Specification Route selection	Wing Flood/washout
Other Vehicle's Driver	Brake Failure	Emergency response training	Fire at rest areas/parking areas
Taking Tight	Insulation/Thermal Protection Failure	Speed Enforcement	Earthquake
Unsecured Load	Relief device failure Tire failure Soft shoulder Overpressure Material defect Steering failure Sloshing High center of gravity Corrosion; Bad Weld; Excessive Grade Poor Intersection design Suspension system	Driver rest periods Maintenance Inspection Time of day Restrictions	Existing accident

The scenarios presented for storages are calculated for transport related incidents/accidents and presented in [Table 7.22](#).

Table 7.22 Transportation Specific Concerns

Concern	Road
Spill on Water	Over or near a body of water
Unconfined Pools	In an undisturbed flat area
BELVE-Induced catastrophic vessel failure	Possible if sufficient quantity in car with small leak to feed fire or if double tank trailer or burning fuel leak
Toxic products of combustion or reaction	Dependent on material and whether ignition occurs

7.7.7 Control Measures for Accidental Spillage of Chemicals

Name of the Chemical Stored	Storage Details		Hazard Rating Systems			Type of Hazards Involved	Persons Effected	Control Measures
	Quantity (KL)	Pressure/Temp	TLV (PPM)	STEL (PPM)	FP (°C)			
Acetone	30	NTP	1000	500	-20	Highly flammable liquid and vapor. Causes serious eye irritation. May cause drowsiness or dizziness.	Operators Maintenance Technicians	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Safety board's displayed on the tank. Effective ventilation must be provided. For accidental contact if you feel unwell, seek medical advice immediately. Handling of Acetone with Safety gloves and protective clothing
Dimethyl Formamide	30	NTP	10		58	Flammable liquid and vapor Harmful in contact with skin Causes serious eye irritation Harmful if inhaled	Operators Maintenance Technicians	Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. Avoid inhalation of vapor or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the buildup of electrostatic charge. Wear respiratory protection. Avoid breathing vapors', mist or gas. Ensure adequate ventilation.
Methanol	20	NTP	1000	1000	14	Highly flammable liquid and vapor.	Operators Maintenance	Keep away from heat/sparks/open flames/hot

							Technicians	surfaces. Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas.
Dichloromethane	20	NTP	50		13	Limited evidence of a carcinogenic effect.	Operators Maintenance Technicians	Do not breathe gas/fumes/vapour/spray. Avoid contact with skin and eyes. Wear suitable protective clothing and gloves. Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage
Toluene	20	NTP	200		4	Highly flammable liquid and vapor. May be fatal if swallowed and enters airways. Causes skin irritation May cause drowsiness or dizziness. May cause damage to organs through prolonged or repeated exposure	Operators Maintenance Technicians	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. Use personal protective equipment as required. IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Do NOT induce vomiting. Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation

7.8 Disaster Management Plan *(Terms of Reference No. 7(xiii))*

7.8.1 Introduction

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

Disasters can be divided into two main groups. In the first, are disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, avalanches, landslides, and forest fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are armed conflict, industrial accidents, radiation accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents and can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster in the abstract since this depends to a large extent on the physical, economic and social environment in which it occurs. However, all disasters bring in their wake similar consequences that call for immediate action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured, medical and social care, removal of the debris, the provision of temporary shelter for the homeless, food, clothing and medical supplies, and the rapid re-establishment of essential services.

An emergency may be said to begin when operator at the plant or in charge of storage of hazardous chemicals cannot cope up with a potentially hazardous incident, which may turn into an emergency. The emergencies could be a major fire or explosion or release of toxic gas or a combination of them.

The proposed expansion will store fuels, which are flammable in nature, and the storage will be as per the Controller of Explosives and OISD norms. The hierarchy of the employees is yet to be determined and the project is still in the initial stages of designing. Hence a tentative disaster management plan is prepared to be suitably modified before commissioning of the plant.

7.8.2 Objectives of Emergency Management Plan (ON-SITE) *(Terms of Reference No. 7(xiii))*

A quick and effective response at that time can have tremendous significance on whether the situation is controlled with little loss or it turns into a major emergency. Therefore, the purpose of this Onsite Emergency Response and Preparedness Plan is to provide basic guidance to the personnel for effectively combating in case of disaster.

An Objective of Emergency Planning is to minimize thinking time, maximize the resource utilization and combined efforts towards emergency operations to mitigate the emergency situation and/or.

DURING AN EMERGENCY:

- To increase thinking accuracy and to reduce thinking time.
- To localize the emergency and if possibly eliminate it,
- To minimize the effects of accident on people and property.
- To take correct remedial measures in the quickest time possible to contain the incident and control it with minimum damage.
- To prevent spreading of damage in the other sections.
- To mobilize the internal resources and utilize them in the most effective way.
- To arrange rescue and treatment of casualties.
- To safe guard employees by evacuating them to safe assembly points.

DURING NORMAL TIME

- To keep the required emergency equipment in stock at right places and ensure the working condition.

- To keep the concerned personnel fully trained in the use of emergency equipments.
- To train employees at all levels in Emergency Preparedness and Response.
- To design, conduct and evaluate mock drills.
- To provide a basis for updating and reviewing emergency procedures.
- Preserving records, evidence of situation for subsequent emergency etc

IMPORTANT ELEMENTS OF OSEP

- Identification of Possible Emergencies
- Emergency Organization
- Emergency Organization chart
- Emergency Communication
- Roles and Responsibilities of Emergency Organization
- Noticing of Emergency
- Emergency handling guidelines
- Control of Fire emergencies
- Emergency handling facilities
- Emergency Control center
- Assembly points
- Evacuation of personnel
- Training & Mock Drill
- Important Information

EMERGENCY ORGANIZATION

General Manager (Plant Operations) is designated as Chief Controller. In case of non-availability of General Manager (Plant Operations), Senior Manager (Production) shall hold the responsibility of Alternate Chief Controller.

Concerned HODs are act as site controller for the particular building / facility. In case of non-availability of Site Controller, Area Managers will hold the responsibility of Alternate Site Controller.

Incident area Managers are designated as Incident Controller. In case of non-availability of incident controller, Shift In -charge will hold the responsibility of alternate incident controller.

Other than day shift hours and when chief controller and Site controllers are not available then Incident controller takes control of overall situation and acts as Incident and Site controller.

The nominated emergency response team members and other departments shift in-charges shall carry out the functions of Emergency team.

In the event of an Emergency situation, Emergency team members and other key personnel shall support the activities of Incident controller after taking the instructions from the site controller.

All following key department heads are designated as emergency coordinators.

Maintenance b) Ware house c) Safety d) HR & Admin

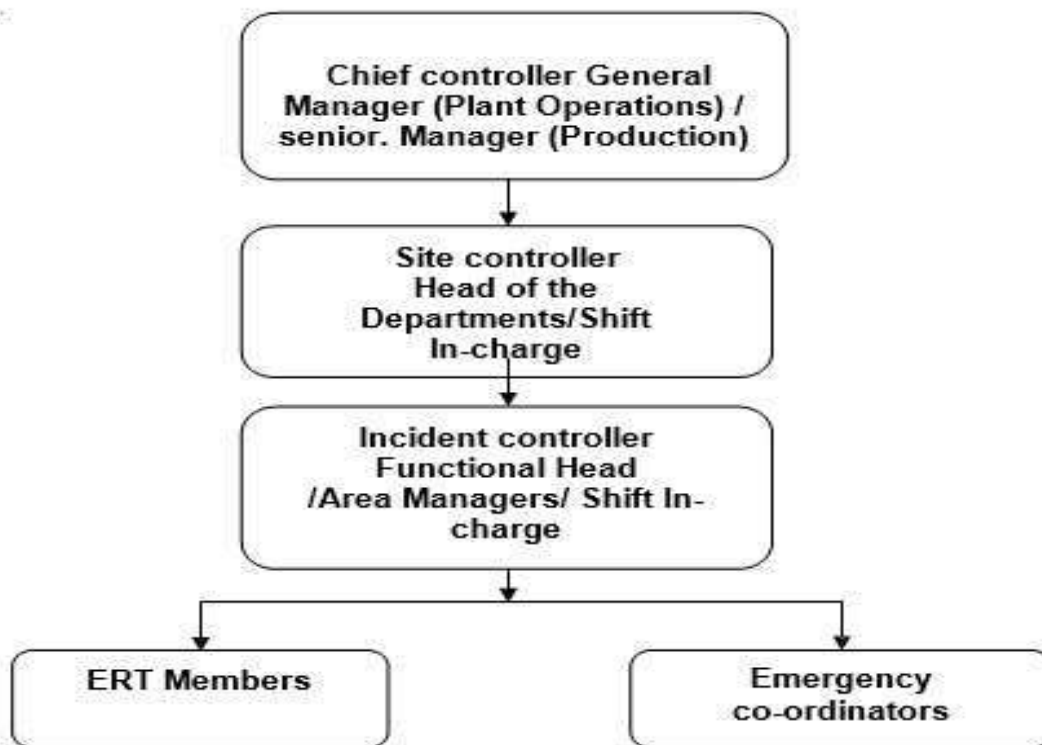


Fig 7.7 Emergency Organization Chart

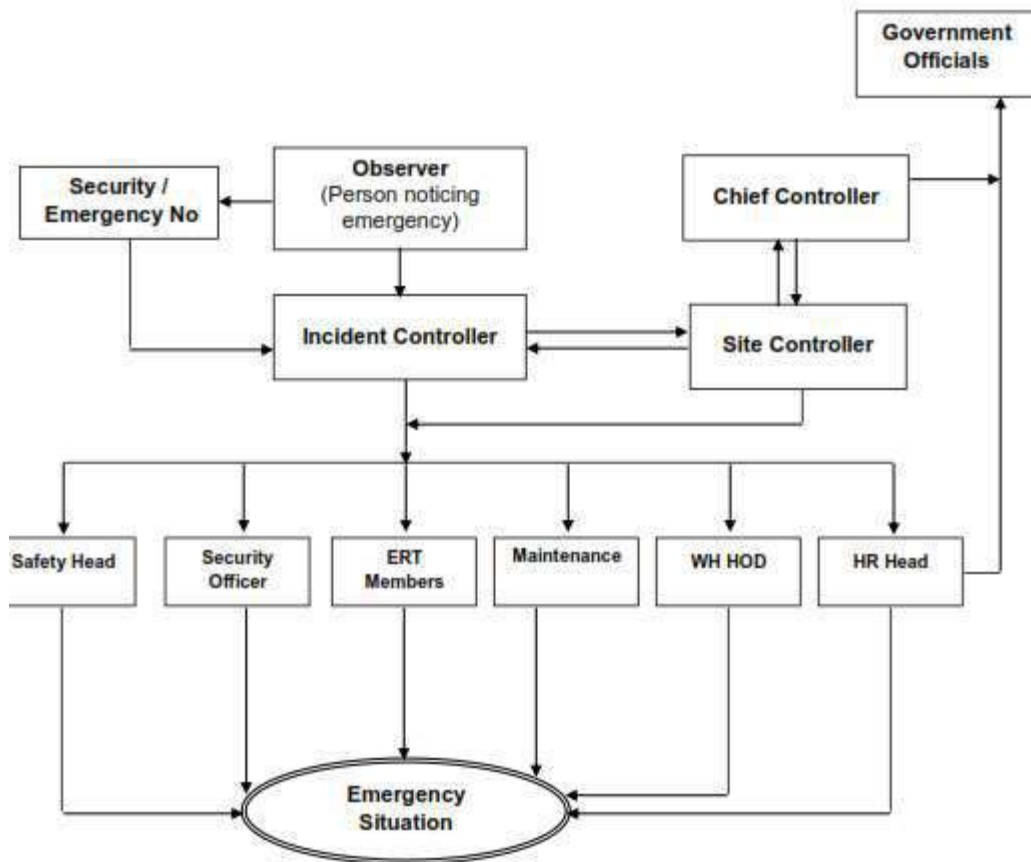


Fig 7.8 Emergency Communication Chart

EMERGENCY COMMUNICATION

If any person observes the abnormality, which may lead to emergency should communicate over a phone or verbally to immediate superior / shift in charge / Block/area In-charge (Incident controller)/ Security. His communication should be precise, covering location and the nature of abnormality.

The Incident and Site controllers should inform to the Chief controller after assessing the situation.

All the employees shall be communicated about the emergency by blowing the Emergency Siren as per code given below. The Security officer or his deputy is responsible to operate the siren as per code after receiving communication from site

controller or chief controller. To declare the emergency, alarm shall be blown continuously with Intermittent hooting for two minutes.

Emergency Siren Code: Interrupted wailing sound of 10 seconds duration with a gap of 5 seconds for three minutes



All clear Signal: After the situation brought under the control, Chief controller/Site Controller will call off the emergency. This is long continuous note for 2 minutes



Two minutes continuous blast shall denote all clear and restoration of normalcy

FUNCTIONS OF EMERGENCY ORGANISATION

- As soon as he is informed of emergency, he shall ensure that all emergency coordinators have received communication regarding emergency.
- Maintain contact with accident site, Occupational Health center, Assembly point and evacuation.
- Ensure that, the casualties receive adequate medical attention.
-
- Consult the other key personnel and decide shut down of the plant.
-
- Upon receiving message from incident controller, he instruct for evacuation of employees of other departments to assembly points.
- Arrange for additional help from the neighboring industries and local authorities.
-
- Exercise direct operational control over the works outside the affected area, with the help of emergency coordinators.
- Once the situation is brought under control, call off onsite emergency and instruct security for blowing all clear signals.
- Orders the liaison officer to liaise closely with Government authorities and also order to seek mutual aid and arrange for additional help for the neighboring industries.
- Initiate investigation by constituting a committee and appraise top management

and statutory authorities.

SITE CONTROLLER:

- On receipt of the information about emergency, he shall protect himself and rush to the spot.
- After collecting the first hand information, all concerned should be informed.
- Decide whether on site emergency is to be initiated depending upon the gravity of the situation in consultation with Chief Controller.
- He shall arrange required Safety Equipment and start controlling the incident with the help of emergency response team members etc
- He shall exercise all efforts to prevent spread of emergency.
- In case of major fire, direct rescue and firefighting operation within affected area with the
- Help of plant personnel/security.
- Secure the safety of the personnel. Minimize damage to plant, property and environment.
- Seeks further necessary help from other functional heads & Emergency Response Team
- Members for bringing the situation under control.
- Check the wind direction from the windsocks located on the top of production blocks and decide the escape route if required.
- Evacuate non-essential person (contract employees and other unconnected) to assembly point if deemed necessary.
- Arrange to search for casualties

INCIDENT CONTROLLER:

- As soon as incident controller receives the message of incident he shall protect himself and rush to the spot.
- Assess the situation and declare the emergency by instructing emergency squad for hooting siren.

- Start controlling incident with emergency squad available in incident area.
- Organize for plant shut down and utility shut down if deemed necessary and evacuate employees of the department.
- Inform to site controller regarding the type of emergency, seriousness etc. including details of injured if any.
- In the absence of site controller, during emergencies performs the functions of Site controller.
- Assign the job to emergency squad a) rescue b) First aid c) leakage control d) Firefighting e) evacuation as per the need of situation.
- Share the responsibilities of incident control with safety in charge up on his arrival.
- Depute emergency squad for search of missing people as per information received from site controller

EMERGENCY RESPONSE TEAM MEMBERS:

- They will carry at least one fire extinguisher or rescue equipments like Respirators, SCBA
- from their department and report to the incident controller and work as per their direction.
- They will be utilized for firefighting, rescue, first aid and evacuation and leakage control.
- Evacuation of all visitors and contract people to assembly point as per the direction of incident controller.

SAFETY IN CHARGE:

- Rush to the site on receipt of information and assist the Incident Controller/Site Controller for managing the onsite emergency.
- Arranging necessary equipments like PPE's, SCBA, Fire extinguishers, hoses, nozzles, Mobile Foam Monitors and foam etc.
- Coordinate with fire brigade and help them.
- Arrange first aid to the injured and medical assistance.

- Responsible for familiarizing the emergency siren and all clear siren to all employees.
- Co-ordinate with the Medical Officer in identifying antidotes for chemicals from the MSDS.

EMERGENCY COORDINATOR- MAINTENANCE:

- Depute technicians and reports to the Incident/Site Controller.
- Cut off power supply to the affected area in consultation with the Incident/Site controller.
- Ensure that Emergency power and water supply is on and ensure their continuity.
- Arrange for changeover of pumps and system and extend all necessary help to bring the situation under control.

EMERGENCY COORDINATOR- WH

- Depute ERT members to incident spot.
- Arrange neutralizing chemicals if incase required

EMERGENCY COORDINATOR - SECURITY / TRANSPORT

- On receiving the information regarding emergency through siren hooting he shall rush to the incident area and reports to site controller, with the attendance record of employees, list of contract workmen and visitors.
- Arranging the transport to victim and information to the relatives of the injured.
- Appoint supervisor from the factory to assist injured, who are under medical treatment.
- Ensure all the security guards are reporting to in gate except main gate security guard.
- Control the traffic on internal roads.
- Guide the employees to proceed to the safe assembly points.
- Keep the main gate closed to prevent unauthorized persons entry and also stop the visitors.
- Allow only essential services like fire engine / ambulance / mutual aid vehicles

/ Government agencies.

- Lead the external agencies to reach the incident site.

EMERGENCY COORDINATOR - HR:

- On receiving the information regarding emergency or hearing siren hooting, he shall ensure that all the emergency services are functioning properly and he shall assist the Chief Controller.
- Communicate to Fire service, Pollution control board, Inspector of factories and boilers, Department of explosives, ESI, Labor commissioner, Police or other departments in consultation with the site controller as required.
- Co-ordinate with the neighboring industries and arrange mutual aid.
- Co-ordinate with Medical officer and arrange best available treatment to the injured.
- Receive instruction from Chief Controller and order the security to declare emergency and all clear by blowing the siren.
- Arranging photo graph/video for helping the investigating authority
- At assembly point, take the head count and pass on to site controller

OTHER DEPARTMENTS HEADS / FUNCTIONAL HEADS

- Continue operation of the plant. If likely to be affected by the emergency take safe shut down of the plant as per instructions of site controller / Incident controller.
- Send contract workmen / visitors to assembly point when required.
- Lead department employees to assembly point when required.
- Upon hearing all clear siren, lead the employees of the department for resuming operation, if there was a shut down.

SHIFT ELECTRICIAN

- The shift electrician must always be available so that he can be contacted to switch off power supply to the affected section under the guidance and

instruction of Projects & Engineering head or his nominee.

- He would be ready to start the emergency equipment if required and if generator is not in operation. In the event of fire accident, electrical operator would switch off power supply in the specific block enabling firefighting operations after appraising Incident Controller.

BOILER OPERATOR:

- If required, takes an emergency shutdown of boiler after appraising the under the guidance and instruction of Site Controller or his nominee.

INSTRUCTIONS TO EMPLOYEES:

- After hearing the emergency siren, except emergency team members, non-essential employees should proceed to the safe assembly point after receiving instructions.
- Do not get panic and don't spread rumors.
- Act accordingly to prevailing situation
- In case of fire or toxic chemical releases follow up wind direction by checking wind socks direction
- Except ERT members remaining all employees do not approach the scene of accident as a spectator.

NON ESSENTIAL WORKERS & OTHERS

Person from outside or other workers, contract casual workers who are not connected with emergency operations must withdraw from the plant where emergency occurred, to either assembly point or other safe location and await instructions.

Security In charge arranges sending away of non-essential employees to either assembly point or to outside gate. He also arranges preventing outsiders and other unconnected persons entering. On advising Site Controller, seeks help of Police in control of Law and Order. Road Tankers, Lorries drivers, cleaners withdraw the vehicles beyond the factory to safe location towards main road and await at that place

for any emergency instructions like evacuation etc.

PRIORITY OF PROTECTION

The Priority of protection envisaged is as follows:

1. Life safety, Neighborhood and Environment
2. Preservation of property
3. Restoration of the normalcy

7.8.2.1 NOTICING OF EMERGENCIES:

FIRE:

- Any person noticing the fire shall attempt to put off the fire using the fire extinguishers available. Simultaneously, he will start shouting "FIRE" "FIRE" till assistance arrives. His colleagues or whoever hears him shall intimate to immediate supervisor personally or by over intercom or call to Emergency number (102, 300) inform about the incident.
- Immediate supervisor / concerned in charge / Functional head (incident controller) reaches the incident spot and assess the situation, he shall seek help of emergency squad of his department. He will pass the message to Site controller.
- As soon as the incident controller reaches the scene, if necessary he will instruct the shift in charge / emergency coordinators for plant shut down and cut off the power supply to the affected area immediately. The incident controller will assume the charge of firefighting operations. He shall inform site controller about the situation. Assessing the incident he shall call for evacuation of his department and announce the emergency through siren hooting.
- On hearing hooter the emergency squad shall report to Site Controller.
- ERT Members soon after reaching the fire shall start firefighting to the extent possible and keeping the passages and doors clear. After the situation is brought under control, the site controller will call off the emergency by all clear signals.

TOXIC CHEMICAL RELEASE

- In case of toxic chemical release the man who notices shall inform to his immediate supervisor or Functional head immediately. Simultaneously, he will start shouting “CHEMICAL LEAK”, “CHEMICAL LEAK”, “CHEMICAL LEAK” till assistance arrives. Concerned in-charge will initiate for leakage control and rescue through emergency squad of his department. The procedure for handling chemical leakage for different chemical is given in the emergency handling guide.
- He will also inform incident controller by telephone immediately. If the leak is heavy and uncontrollable the siren will be hooted as per incident controller’s instructions and onsite emergency is declared. The emergency squad soon after reaching the incident area, they start working on leakage control and rescue operations as directed by incident controller.
- After the situation is brought under control, the site controller will call off the emergency by all clear signals.

SPILLAGE OF CHEMICALS

- Any person notice the spillage shall shout “SPILLAGE, SPILLAGE” till assistance arrives.
- His colleagues or who ever hear him shall intimate to immediate supervisor / Functional head personally or by calling him through intercom.
- Immediate in charge reaches the incident spot and assess the situation and initiate measures to control the spillage and try to stop the spreading of chemicals by containment and by using absorbent. If the spillage is from flange joint, due to corrosion of bolts replace the corroded bolts with new one. Ensure that dyke drains valve are closed or not? If not closed, close the drain valves immediately to contain the leaked chemical within dyke. He shall seek help of emergency squad of his/other department and also inform incident controller by telephone immediately.
- On arrival, incident controller shall find out the source and cause of the

spillage and shall plan rescue operations with the assistance of emergency squad. Incident controller and emergency squad (ERT Members) shall try to stop the spillage of chemicals and shall try to neutralize the chemicals as per MSDS.

- If necessary the incident controller will instruct the shift in-charge / emergency coordinators for plant shut down and cut off the power supply to the affected area immediately. He shall inform the site controller about the situation.
- Assessing the situation, the incident controller shall call for evacuation and will declare emergency by hooting siren if the incident could lead to onsite emergency. Other heads of all departments will direct the visitors and workers to assembly point on receiving warning siren.
- Neutralize the chemical in the dyke and sent to ETP or Collect in another empty tank. After the situation is brought under control, the site controller will call off the emergency by all clear signals.

EXPLOSION:

- After hearing the explosion sound, Concerned in charge / immediate supervisor shall rush to the scene, assesses the situation and informs the incident controller by phone. He shall seek the help of emergency squad of his department also. On arrival, incident controller shall assess the situation and initiate the measures to control the after effects of explosion.
- Emergency squad (ERT Members) shall look for injured personnel inside the factory and move them to OHC. Incident controller and emergency squad shall try to control the after effects of explosion and shall try to minimize the impact of explosion of surrounding area.
- If necessary the incident controller will instruct the shift in-charge / emergency coordinators for plant shut down and cut off the power supply to the affected area immediately. Incident controller shall inform the site controller about the situation.
- After assessing the situation, the incident controller shall call for evacuation and will declare emergency by hooting siren if the incident could lead to onsite

emergency. Officers and Heads of all departments will direct the visitors and contract workers to assembly point on receiving warning siren.

- After the situation brought under control, the site controller will call off the emergency by all clear signals.

7.8.2.2 EMERGENCY HANDLING GUIDELINES: Action to be taken in case of general fire:

- Switch off power.
- Use Co2 fire extinguisher or water available in your section.
- This will avoid damage of electric shock during the firefighting operation.
- Remove other flammable, combustible material in the surrounding area.

Action to be taken in case of flammable liquid fire:

- Use mechanical foam, chemical foam, DCP and Co2 fire extinguishers and contain the fire.
- Do not use water directly on flammable liquid fire. You may cool the tank externally
- Stop flammable liquids pumping operations and close the valves of the vessels
- Use fire hydrant at minimum pressure of 7 kg/cm² with foam making branch pipe and bulk foam to fight large flammable liquid fires.
- Inform fire station if required.

Fire involving gases like hydrogen, L.P.G and Acetylene:

- Use Co2 or DCP fire extinguishers.
- If it is possible without endangering life, try to close the cylinder valve so that the gas flow is stopped.

In case of failure of regulator and main valve of cylinder, do not try to close any valve. In such case there is every possibility of cylinder explosion, to avoid this, follow below instructions:

- a) Connect firefighting hose with nozzle to the hydrant valve
- b) Take shelter behind concrete pillar and strong brick wall
- c) Start hydrant water and spray water on cylinder which has caught fire
- d) Do not move from shelter. Due to continuous pouring of water the temperature of gas cylinder will not suddenly increase. If the cylinder temperature increases, the gas inside will expand rapidly and cylinder will explode.

- e) Once the cylinder explosion is avoided allow the gas to burn which will not be very vigorous.
- f) This will avoid cylinder explosion and injuries to the employee carrying out firefighting operation.

In case of electrical fire:

- Switch off the electrical supply of the equipment or panel involved in fire.
- In case fire is likely to spread the electrical cables and cables are likely to catch fire, switch off the main.
- Remove flammable liquid drums materials which are likely to catch fire from the area of the incidence.
- Use DCP and CO₂ extinguisher only.
- Do not use water on electrical fires. The person will get electrical shock
- Caution: It is recommended to use CO₂ extinguisher on electrical fires, using of DCP extinguisher will cause damage to equipment and create problem of cleaning of entire electrical installation.

Centrifuge fire and explosion:

- The smoke may come out of centrifuge lid joints
- Get alert and run away from the area. The centrifuge lid will blow open
- Once the lid blow open, the fire ball will occur
- Escape yourself from that area of centrifuge fire
- Cut off the power supply to the centrifuge which is on fire.
- If the feed is not cut off, try to cut off the feed valve without endangering yourself.
- Start firefighting with available fire extinguishers.
- Arrange foam, hose and foam making branch pipe and continue fire fighting.
- Charge foam in to centrifuge and extinguish the fire.
- Use of water to be avoided which will spread the solvent in to other area.
- Nitrogen blanketing may also help to some extent.

Production Block Fires:

- Major production block fires are extinguished mainly by isolation and removal of fuel. Small fires can be combated with dry chemical extinguisher. Foam should be used only where it can blanket the burning fuel. Water in the foam

of spray, foam, and high -pressure fog nozzle is most effective on large areas affected by fires or which are likely to damage supporting structures.

Ground fires around tanks:

- Apply water to all flames exposed to metals immediately. Then attempt to put out the ground fire by isolating the source of fuel.
- Try to close off the isolation valve in the fuel line under the protection of water spray systems.
- If possible displace the oil level with sufficient water taken into the tank. Do not overflow the tank during the process.
- Ground fires involving flammable liquids may be extinguished with dry chemical powder, water spray or foam. It may also be possible to flush the liquid to safer location and put out the fire easily or reduce the flame contact.
- Fires involving flammable chemicals having flash points above 38°C may be extinguished with water spray. Radiant heat from the flame heats the surface flame and reduces the flame size. Further spraying cools the fuel oil.

P.D.Lab and QC laboratory Fires:

- Laboratory fires are to be tackled differently because glass wares and special types of apparatus / equipments are involved.
- Use CO₂ extinguishers on small fires.
- Fire involving lab apparatus / equipment should be put out using CO₂ extinguishers.
- In case of large spills of flammable material, whether ignited or not, evacuate all personnel from the building, cut off, air supply and electric power to the building.
- Cut off any outside source of fuel.
- Use water fog or water spray only on fire, which threaten the building structure.

7.8.2.3 CONTROL OF FIRE EMERGENCIES: Control of Fire occurs due to catalyst:

- At once declare onsite emergency
- If the technician is burnt shift him to the safety shower and drench him with water.
- Transport him to OHC immediately through ambulance while giving oxygen administration.
- Shift the injured to hospital, never try to remove the burnt clothing. Simultaneously one batch of squad should start firefighting by portable fire extinguisher and hydrant system with foam compound. Remove all nearby flammable chemicals.

How to Control a Pump Fire

Whenever a pump fire is noticed proceed as under:

- Stop the pump.
- Close the suction and discharge valves on both sides of the pump to stop flow if this is possible to be done safely. This will cut off the fuel supply to leaking gland point.
- Use carbon dioxide, dry powder or foam extinguisher depending on the size of fire.
- If the fire is found to increase, immediately call for help.
- Start cooling the nearby flammable storage tanks.

Control of Boilers backfires:

- Stop coal feed.
- Start ID fans if tripped.
- Stop the FD fan.
- To control backfire wear fire retardant coat and helmet fitter with face shield and fire retardant hand gloves.

Control of Diesel generator fires:

- Trip the generator.
- Immediately put off the fire by using DCP or CO₂ fire extinguisher.

- If diesel fires use foam.

Control of Warehouse fires:

- If small fire occurs put off with DCP or CO2 extinguisher.
- Never use foam extinguisher or water on water reactive chemicals.
- If possible remove chemicals nearby fire without endangering to your life by wearing breathing apparatus.
- If the fire is big, declare onsite emergency and inform local fire station also.
- Hydrant water can be used for fighting warehouse fires but under the guidance of safety and fire experts only.
- Cool the tanker / drum externals with water spray

Control of fireballs, VCE and BLEVE:

- The control of fire-ball, VCE and BLEVE essentially consists of preventing the formation of the flammable vapour / gas clouds, if a flammable vapor / gas cloud is formed following steps be taken:
- Dilute the flammable vapour / gas cloud with steam or god and maintain this dilution till you are sure that the cloud has fully diluted and dispersed away and there is no more flammable vapour / gas leak forming cloud.
- Switch off all power supply and sources of ignition from MCC.
- Cool with water any hot objects in the way of the flammable vapour / gas cloud.
- Fire engine and other vehicles should not be brought in the zone of the passing flammable vapour / gas cloud.

EMERGENCY HANDLING FACILITIES

Fire Hydrant System Details

Description	Capacity
Storage Tank Capacity	1200 KL
Jockey/Pressurization pump	12 HP and 10.8 M3/Hr- 02 Nos
Motor Driven Pump	120 HP and 273 m3/hr.
Diesel Engine pump	120 HP and 273 m3/hr
Single Hydrant Points	46 Nos
15 meters length Fire Hoses	48 Nos

Hose reel	10 Nos
No. of Branch pipes	48 Nos
Mobile Foam Monitors	02 Nos
Fixed Foam Monitor	04 Nos
Fixed Water Monitor	03 Nos
Mayuri curtains	02 Nos
Fog Nozzle	01 No
Divider Branch	02 Nos
Triple purpose nozzle	01 No
Foam compound	1000 Lts

FIRE EXTINGUISHERS:

Type of Fire Extinguisher	Capacity
Cartridge type Dry Chemical powder Fire Extinguisher	5 Kg Capacity - 45 Nos 6 Kg Capacity - 35 Nos 9 Kg Capacity - 14 Nos 10 Kg Capacity - 54 Nos 50 Kg Capacity - 05 Nos 75 Kg Capacity - 24 Nos
Mechanical Foam type Fire Extinguisher	100 Ltr Capacity - 02 Nos 50 Ltr Capacity - 40 Nos 9 Ltr Capacity - 06 Nos
CO2 Type Fire Extinguisher	2 Kg Capacity - 20 Nos 9 Kg Capacity - 22 Nos 4.5 Kg Capacity - 99 Nos

FIRE BRIGADE FACILITY:

Ranastharam Fire station is the nearest fire station and it can reach the plant within 15 minutes. Alternate fire station is at Vizianagaram which is 22 Km faraway, it will reach within 25 minutes.

LIST OF ITEMS IN OCCUPATIONAL HEALTH CENTER:

S.No	ITEM	QUANTITY
1	Bed	1 No
2	Dual fold stretcher	1 No
3	Staircase stretcher	1 No
4	Thermometer(mercury)	1 No
5	B.P.apparatus (Manual)	1 No
6	Stethoscope	1 No
7	Neboliser	1 No

8	Anti snake venom injection	1 No
9	Scissors mayors	1 No
10	Antidote kit	1 No
11	Wheel Chair	1 No
12	First aid Box	1 No

LOCATIONS OF SPILL KITS

S.No	Location of Spill Kits
1	A1 Block Intermediate area
2	A1 Block Ground Floor area
3	B1 Block Intermediate area
4	B1 Block Ground Floor area
5	B2 Block Intermediate area
6	B2 Block Ground Floor area
7	C1 Block Intermediate area
8	C1 Block Ground Floor area
9	D1 Block Intermediate area
10	SRB-1 Ground floor
11	SRB-2 Ground floor
12	SRB-2 3 rd Floor area

LIST OF KEY PERSONNEL

S.No	Location	Designation	Department	Phone Number	*star Dial Number
1	N.H.D.Prasad	General Manager	Plant Operations	8374455533	*7001
2	B.Karuna kumar	AGM	HR & Admn	8374432107	*7006
3	K.Malleswararao	AGM	QC	8374532102	*7022
4	Harjeet Singh	AGM	QA	8374439980	*7059
5	A.Gopalakrishna	Sr.Manager	Production	8374532100	*7005
6	P. Siva Prasad	Sr.Manager	Production	8374469781	*7062
7	Y.Radha Krishna	Sr.Manager	Maintenance	8374455531	*7035
8	V.Ramesh	Sr.Manager	QC	9100032625	*7076
9	I.Mohanrao	Asst. Manager	QA	8374532105	*7004
10	G. Vijayabaskara Rao	Dy. Manager	Warehouse	8374432109	*7016
11	B.Venu prasad	Manager	ETP	8374532101	*7007
12	G.Venkateswararao	Dy. Manager	Engg. stores	8374455536	*7003
13	N.V.Ganpathi	Dy. Manager	Production	9441042515	*7070
14	V.Ranga Rao	Asst. Manager	Safety	8374532107	*7061

EMERGENCY CONTROL CENTER:

An emergency control center is established in Safety Office and it is equipped with adequate means of telecommunication to areas inside and outside the works together with relevant equipment to those manning the center and to enable them to organize emergency efficiently.

ASSEMBLY POINTS:

Assembly Point -1: North east corner of A2 block

building. Assembly Point -2: Westside of warehouse-1

Assembly Point -3: North east corner of Administration building.

5.14 EVACUATION OF PERSONNEL:

- On hearing the emergency siren incident area, contract workmen, casuals and visitors shall proceed to assembly point as directed by shift in-charge/ Functional head (incident controller). All visitors and contract workmen from other departments are directed to assembly point by department heads.
- Depending on severity of emergency employees of other departments shall proceed to assembly point as directed by their department heads or shift in charges as necessarily arises. Liaison In-charge will take the head count at assembly point and report the same to site controller.

MUTUAL AID:

While necessary facilities are available and are updated from time to time, some times, it may be necessary to seek external assistance, it may be from the neighboring factories or from the State Government as the case may be

External Agencies contact details involved during Emergency :			
S. No.	Name of the Industry/Office	Landline phone Nos.	Mobile phone.
01	Mylan Laboratories Ltd	08922- 304100/1/2/5	

02	HBL Power systems Ltd	08922-258159	
03	CPF Aquaculture	08922-258491	
04	Deputy Commissioner (collector)VZM	08922-276720/276177	
05	DSP office	08922-277405	
06	Superintendent of police, Pusapatirega		9440795908
07	Superintendent of police, Vizianagaram	08922- 276163/226937/274225	
08	Rural police station, C.I (Bhogapuram)	08922-240318	
09	Fire Station		9963731326
10	Divisional Fire Officer	08922-226101	
11	Govt. Hospital at Pusapatirega		9440223357
12	Tirumala Hospitals, Vizianagaram	08922-223920	
13	Dr. Ramesh of Tirumala Hospital		9493154155
14	Directorate of Factories	08922-272865	
15	Environmental Officer, VSKP	0891-2719481	
16	APPCB	08922-227370	
17	Industries Department	08922-255478	
18	Dy. Commissioner of Labour		9492555021
19	RDO(VZM)	08922-276888/275560	
20	MRO	08922-258840	

TRAINING, MOCK DRILL & REVISION OF

OSEP TRAINING:

Employees will be trained regarding their specific role in case of emergency. The emergency response topic was incorporated as a part of safety training program. The emergency organizing personnel will be trained on their role in handling an emergency. The emergency siren code, all clear siren code will be blown in mock drills so as to make employee acquainted to emergency siren code.

The emergency organizing personnel will be trained and issued a copy of onsite emergency plan. The onsite emergency mock drill will be video recorded/ Photographed.

MOCK DRILL

Mock drills will be conducted to familiarize the persons concerned in the emergency organization on their duties as well as for others to observe actions during such emergency. Based on the nature of hazards and its risk level mock drill required activities will be identified and prepared the Mock drill plan in advance. Mock drill will be conducted once in six months as per the mock drill plan.

MOCK DRILL PROCEDURE

HOD will decide the date and time with the concurrence of safety in charge. A hypothetical incident will be identified by above persons will be communicated to all concerned in the organization for action on onsite emergency and emergency is declared by HOD. Before conducting the mock drill, table top exercises are conducted with concerned employees to familiarize about the emergency and roles of individual.

MOCK DRILL OBSERVATION:

Mock drill observation team will be constituted and they will note down the action of various coordinators in chronological order. The time of each coordinator and their duties will be detailed in a note. Immediately after mock drill, the advisory team and emergency coordinators will meet and review mock drill records in chronological

order and take note of corrective action. The record of this meeting note is circulated for compliance of concerned. Depending on type of emergency checklist on emergency preparedness / mock drill will be prepared and given to mock drill observers.

ROLE OF MOCK DRILL OBSERVERS:

- Meteorological conditions.
- Time of emergency declaration and time when the personnel responded / reported.
- Ambulance reported time and when additional vehicles reported.
- Collect information on description of the event, estimated quantity of the gas release, fire, contamination and effected levels at various locations, injuries and equipment damage.

REVISION:

The plan will be revised as and when major changes / product changes and also in case of major accident occurrence. Plan will be periodically reviewed and updated as per recommendation of mock drill observations to bridge the gap.

8.0 PROJECT BENEFITS

8.1 Introduction

M/s. SMS Pharmaceuticals Limited, Unit VII obtained Environment Clearance Vide letter no. F. No. J-11011/361/2006-IA II (I) dated: 16.04.2007 and No. 11-45/2007-IA III dated: 08.10.2007 for marine disposal of treated wastewater through dedicated pipeline to sea. It is now proposed to expand the API manufacturing capacity from 179.05 TPM to 740.76 TPM with inclusion of a captive power plant of 2 x 2 MW capacity in existing site area of 95.56 acres. The capital cost for expansion is Rs. 600 crores contributing to the local economy due to consumption of building construction materials from the surrounding areas and usage of construction labour from surrounding villages. The project after implementation will ensure savings in foreign exchange by reducing import of active pharma ingredients from China and shall also improve availability of affordable medicines for domestic usage. The project shall also facilitate foreign exchange accruals due to exports of active pharma ingredients. The project proposal involves environmental social responsibility (ESR) expenditure to the tune of Rs. 15 crores during the project implementation phase, in addition to investing 2% of their profits in socioeconomic development programs in the surrounding villages with an objective of contributing to the overall development of surrounding villages in the impact area and to support such schemes in the following areas; Health, Sanitation, Drinking water and Eco Development.

8.2 Employment Potential

The proposed expansion will provide employment to 300 people. It will be spending approximately Rs. 75.3 Lakhs of rupees every month on salaries providing bread and succor to 300 families additionally. The proposed project will also generate indirect employment to the locals during construction phase in the order of 150 people for a period of 18-24 months. The employers will contribute to the provident fund, ESI and provide facilities as per the relevant labour act.

8.3 Corporate Environment Responsibility

The management proposes to spend 0.5% of the capital cost of expansion towards Corporate Environment Responsibility (CER) in the surrounding villages. The programs for implementation shall be finalized in consultation with the local stakeholders, public representatives and revenue authorities. The tentative list of CER programs are presented in chapter 10. The list shall be finalized after incorporating the demands that arise during public consultation process. The objective is to obtain a social license from the stake holders who are likely to be affected due to the expansion and the proposed manufacturing activities.

Tax Income

The proposed capital expenditure of Rs. 600 crores includes GST on various equipment and services. The provision of employment also directly contributes to additional income tax and also indirectly contributes to additional GST due to various transactions. The operation of the expansion project also results in additional GST and also additional income tax on profits and also from employee salaries.

9.0 ENVIRONMENT COST BENEFIT ANALYSIS

The TOR letter IA-J-11011/12/2018-IA II (I) dated 05.02.2018, does not mention Environment Cost Benefit Analysis and hence the same was not conducted.

SMS PHARMACEUTICALS LIMITED, UNIT - VII

**SY.NO. 160,161,163 TO 168 AND 170 (KANDIVALASA VILLAGE),
SY. NO.72 (KOVVADA AGRAHARAM VILLAGE),
PUSAPATIREGA MANDAL, VIZIANAGARAM DISTRICT,
ANDHRA PRADESH**

2. ENVIRONMENT MANAGEMENT PLAN

**Project No. 0119-21-01
January 2019**

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**SUBMITTED TO
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI**

10.0 ENVIRONMENT MANAGEMENT PLAN

10.0 Introduction

Environmental protection is an issue that no organization can neglect and hope to survive. The by-products of civilization are being dumped upon the environment to a degree that the environment finds difficult to assimilate. The key to the success of the integrated approach to pollution prevention and control is the management and operation of the organization. Effective committed management delivers a successful industry. As total commitment to the environment, not just for compliance with legal or regulatory compliance will be the essence of environment management of an industry. Many companies have recognized the benefits of implementing an effective environmental management system.

Environmental management plan can be effectively implemented to mitigate the pollution levels by observing the following;

1. Pollution will be prevented or reduced at the source,
2. Pollution that cannot be prevented will be recycled in an environmentally safe manner,
3. Pollution that cannot be prevented or recycled will be treated in environmentally safe manner, and
4. Disposal and other releases into the environment will be used “only as a last resort” and will be conducted in an environmentally safe manner.

The management plan is drawn in consultation with the project proponents with reference to various potential aspects and impacts monitored, identified and predicted in the previous chapters. Review of the process is the essential component of Environmental Management M/s. SMS Pharmaceuticals Limited, Unit VII has been conducting experiments to optimize the consumption of raw materials and to increase the purity of the product.

10.1 Environment Management Plan

10.1.1 Construction Phase *(Terms of Reference No. 10)*

The potential of pollution during construction phase due to transport of construction materials will be less compared to operational stage. However industry will ensure that pollution potential in the construction phase is at a minimum. Wherever applicable, detailed procedures will be developed for control of pollution during project execution phase for expansion. Separate rooms will be provided for labors and casual workers. The following measures are to be adopted to minimize pollution load during construction phase

Sanitation

Considering the standards of hygiene, the workers involved in construction will be provided temporary toilets, and drinking water. The toilets will be attached to septic tank so as to minimize the percolation and to control the subsequent impact on the environment. These facilities will be properly designed and maintained to ensure minimum environmental impact.

Noise

The site is located in a place where habitation is minimum and at distance of 1.7 km. Thus there will be insignificant impact due to noise on the inhabitants. The construction workers on site will be provided with personal protective equipment like earmuffs whenever for those who work near noise generating equipment/sources.

Wastes from Construction Equipment

Construction activity involves a number of operations that utilize equipment like DG sets, dozers, cranes etc. These equipment are a source of emissions and solid wastes. Proactive maintenance to mitigate emissions, while hazardous solid wastes of waste oils and used batteries are sent to authorized recyclers. Spillage is avoided and spill control measures are adopted to minimize contamination of soil and ground water resources. The empty containers of paints, thinners etc shall be sold to authorized buyers.

10.1.2 Operation Phase

During operation stage the major pollution from proposed expansion is from liquid effluents from process, utilities and domestic facilities, and air pollution from utilities and or combustion of fuels/wastes. The effluent treatment system will convert most of the liquid effluents to solids by way of evaporation of salts and ETP sludge. The environment management plan is drawn in consultation with the project authorities, R&D experts of SMS Pharmaceuticals Limited, Unit VII and other technical consultants involved in preparing the project plan. The management, mitigation and enhancement measures identified for significant impact sources are presented as follows;

10.2 Sources of Pollution from Manufacturing Process:

The major contributions of pollution from proposed expansion are effluent generation from process, utilities and domestic sources and gaseous emission from process and utilities. The water pollution is due to the effluent generated from process, washings, scrubbing, utility blow downs and domestic sources. The air pollution is caused due to process operation and combustion of both fuels and solid/gaseous wastes. The treatment of effluents and recovery operations of solvents generate salts and residues respectively, in addition to residues from process operations, which are considered hazardous wastes. The quantities and quality of effluents, emissions and solid wastes are identified and quantified in the environmental impact assessment study. The environment management measures proposed are described as follows;

10.2.1 Water Pollution (*Terms of Reference No. 3(vi) & 7(iv)*)

The effluents generated in the process, separation techniques and during purification contain organic and inorganic soluble raw materials, solvents, and products. Hence the effluents contain both organic and inorganic salts in various quantities leading to high COD and TDS concentrations respectively. The effluents process, washings and scrubber are segregated as high TDS/COD stream based on above 15000 mg/l concentration of TDS, while utility blow downs, domestic wastewater, DM rejects and process streams that have

less than 15000 mg/l of TDS are segregated as low TDS stream. The segregated effluent is subjected to treatment and the treated effluent will be disposed to sea by using marine outfall system. The total effluent generated and mode of treatment is presented in **Table 10.1**. The total effluent characteristics before and after treatment is presented in **Table 10.2**.

Table 10.1 Total Effluents Generated and Mode of Treatment

S.No	Description	Quantity (KLD)		Mode of Treatment/Disposal
		Permitted	After Expansion	
I High TDS Effluents				
1	Process	71.91	430.7	Effluent is stripped in a steam stripper to remove organics and then concentrated in multiple effect evaporators (MEE) followed by drying in agitated thin film dryer (ATFD). Stripper condensate will be sent to cement plants for Co-Incineration. Salt from ATFD is sent to TSDF. Distillate from MEE and ATFD is sent for further treatment in biological treatment plant.
2	Washings	20	60	
3	Scrubber	---	40	
Total - I		91.91	530.7	
II Low TDS Effluents				
1	Process	3.6	--	Sent to biological treatment plant and disposed to sea from guard ponds on site, through Marine Outfall system after bioassay, only when it meets the disposal standards.
2	Boiler Blow downs	16	45	
3	Cooling tower blow downs	12.5	210	
4	Domestic wastewater	16	31.5	
5	RO/DM Rejects	53.5	80	
Total - II		101.6	366.5	
Grand Total (I+II)		193.51	897.2	

Table 10.2 Effluents Quantity and Quality - Before and After Treatment

S.No	Stream Description	Quantity After Expansion KLD	Inlet Concentration	Outlet Concentration
1	Stream I High TDS and High COD	530.7	pH: 5.5-6.5 COD: 10000 - 85000 mg/l TDS: 20000 - 90000 mg/l	COD: <250 mg/l BOD: <100 mg/l TSS<100 mg/
2	Stream II Low TDS and High COD	366.5	pH: 5.5-6.5 COD: 2000 - 5000 mg/l TDS: 3000 - 8000 mg/l BOD: 250 mg/l	
Total		897.2		

10.2.1.1 Process Description and Technical Specification of Effluent Treatment System

(Terms of Reference No. Sp. TOR 5 & Add. TOR 2)

The effluents are segregated into two streams; high TDS/ COD and Low TDS/COD stream. The effluent treatment system shall be developed in modules at the same location for ease of operation.

I. High TDS/ COD Effluents

The treatment system for treating High TDS/ COD effluents consists of equalization, neutralization, settling tank, stripper, multiple effect evaporator (MEE) followed by agitated thin film dryer (ATFD). The organic distillate from the stripper is sent to cement plants for co-incineration and aqueous bottom from stripper is sent to MEE followed by ATFD for evaporation. The condensate from the MEE and ATFD are sent to Effluent treatment plant based on biological treatment. Salts from ATFD are disposed to TSDF.

II. Low TDS/ COD Effluents

These effluents along with the condensate from MEE and ATFD are treated in primary treatment consisting of equalization, neutralization, and primary sedimentation followed by secondary biological treatment consisting of aeration tank and clarifier. The treated effluents after biological treatment will be stored in Guard ponds and sent to marine disposal after meeting the standards in bioassay test. Photographs presented were obtained from project proponent. Schematic diagram of effluent treatment system is presented in [Fig 10.1](#). Details of treatment facilities are presented in [Table 10.3](#).

Table 2.7 Details of Treatment Facilities

S.No	Facility Description	Capacity (KLD)			Operating Volume after Expansion (KLD)
		Existing	Proposed	Total after Expansion	
1	Stripper	120	2 x 200	2 x 200 1 x 120	432.7
2	Multiple Effect Evaporator	100	2 x 200 1 x 100	2 x 200 2 x 100	464.6
3	Agitated Thin Film Dryer (ATFD)	12	2 x 20	2 x 20 1 x 12	42.3
5	Biological Treatment Plant	60	2 x 400	2 x 400 1 x 60	813

Note: Proposed facility will be established in modules

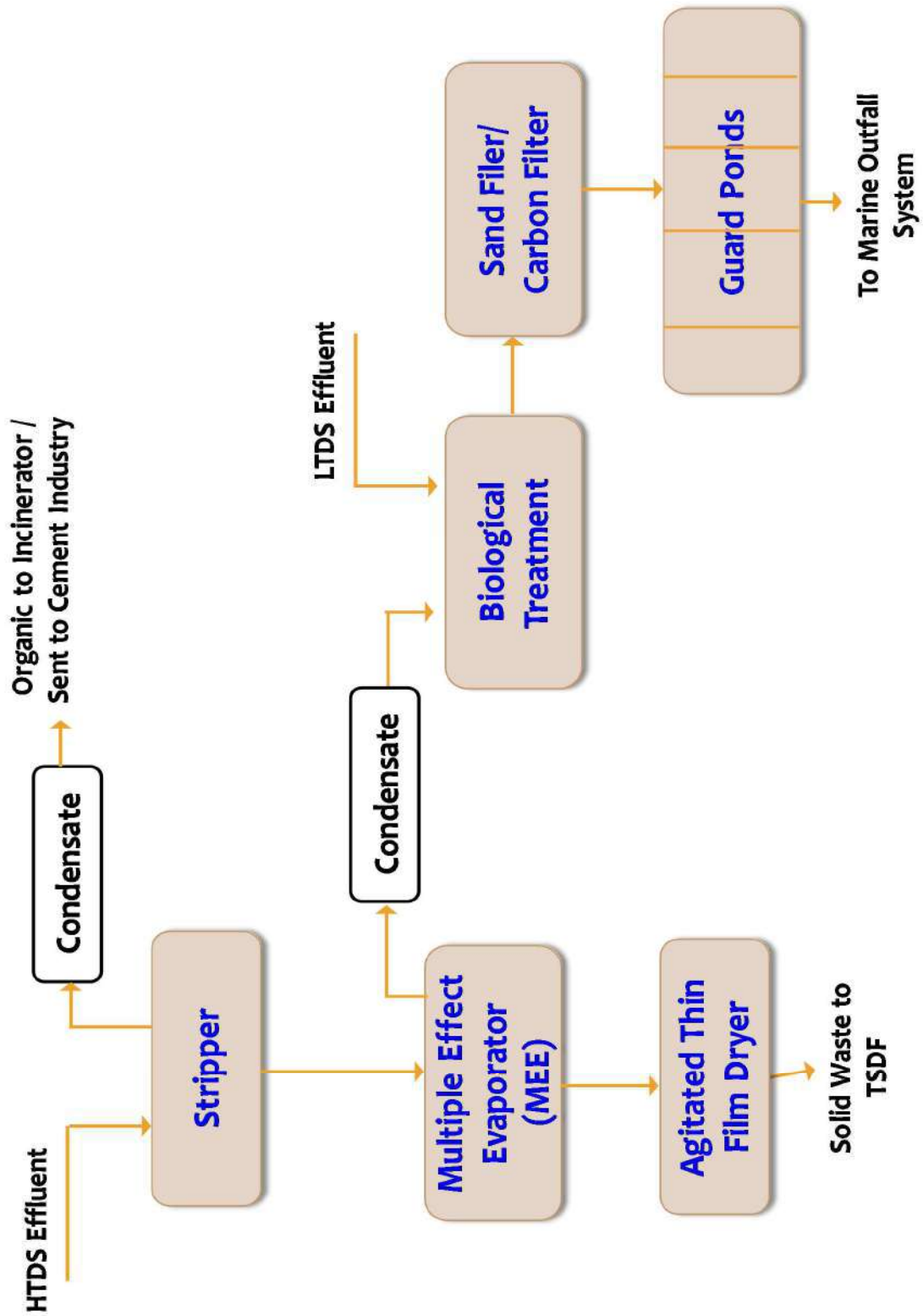


Fig 10.1 Schematic Diagram of Effluent Treatment System



Existing Treatment System - Photographs

10.2.2 Air Pollution (Terms of Reference No. 3(vi))

The manufacturing process consists of reaction, separation and purification. The reaction is conducted in closed reactors, while separation activity is conducted in centrifuge, filtration equipment etc. The purification would be conducted in reactors or filtration equipment. The transfer of materials will be through closed pipelines. Various sources of emissions are identified from process operations. The usage of boiler for steam generation and DG sets for emergency power also results in point source emissions.

10.2.2.1 Emissions from Utilities (Terms of Reference No. 7(v))

The sources of air pollution are boilers and DG sets. Bag filters are proposed as air pollution control equipment for 1 x 20 TPH, 1 x 12 TPH (standby) and 2 x 10 TPH coal fired boilers. DG sets shall be provided with required stack height based on CPCB formula. The emission rates of SO₂, NO_x and PM from each stack are presented in **Table 10.4**. Technical specification of bag filters is presented in **Tables 10.5**

Table 10.4 Emission Details of Pollutants from Stack

S. No	Stack Connected to	Stack Ht (m)	Dia of stack at top(m)	Temp. of exhaust gases (°C)	Exit Velocity (m/sec)	Pollutant Emission Rate (g/sec)		
						PM	SO ₂	NO _x
Existing								
1	1 x 6 TPH Coal fired Boiler *	30	1.3	140	6.2	0.5	0.42	0.15
2	1 x 3 TPH Coal Fired Boiler *	30	0.83	128	8.5	0.15	0.4	0.21
3*	1 x 125 kVA DG set	2.2	0.15	320	5	0.001	0.01	0.02
Proposed								
1	1 x 20 TPH Coal Fired Boiler	40	1.8	180	15	1.8	3.2	4.6
2	1 x 12 TPH Coal fired Boiler *	40	1.3	140	6.2	0.8	1.5	2.4
3	2 x 10 TPH Coal Fired Boilers	30	1.5	180	10	0.5	1.2	1.9
4	1 x 10 Lakh Kcal Thermic Fluid Heaters	30	1.2	170	7.5	0.08	0.12	0.19
5	1 x 2 Lakh Kcal Thermic Fluid Heaters	15.2	0.4	180	6	0.04	0.08	0.12
6**	7 x 1500 kVA DG sets	12	0.2	180	10	0.02	0.03	0.5

* standby

**DG sets will be used during load shut down by AP TRANSCO.



Photographs of Existing Boilers Stack connected to Bag Filters

Table 10.5 Technical Specifications of Bag Filters

S.No	Application	Unit	Value		
1	Boiler Capacity	TPH	20	12	10
	Fuel		Coal	Coal	Coal
2	Gas Volume	m ³ /hr@170 degC	28500	22824	20000
	Gas Temperature	Deg C	180	180	180
	Outlet emission	mg/Nm ³	<50	<50	<50
	Flange to flange pr. drop	mmWC	160	140	140
	Moisture Content	%	8.5	8.5	8.5
	No. of Bags		340	280	268
	Filter area per bag	m ²	1.82	1.79	1.72
	Total filter area	m ²	664	500	460
	Air to cloth ratio	m ³ /min/m ²	1.14	1.14	1.15
3	Bags				
	Diameter	ID, mm	160	150	160
	Length	mm	3860	3650	3650
	Material		Nomex	Nomex	Nomex
	Max. operating temp.	degC	190	190	190
4	Bag Cleaning				
	Compressed air required	Nm ³ /Hr	6-8 kg/cm ²	5-7 kg/cm ²	5-7 kg/cm ²
	No. pulse cum solenoid valve		13	10	10
	Size of pulse valve	NB	40	40	40
5	Material of Construction				

	Casing		MS	MS	MS
	Tube Sheet		MS	MS	MS
	Cage		MS	MS	MS
	Hopper		MS	MS	MS
6	Terminal Points				
	Dirty air	Inlet of Poppet Valve, Flanged end			
	Clean air	Outlet of Bag Filter, Flanged end			
	Dust discharge	RALV			
	Compressed air	Inlet of Air Header			
	Electricals	Power Supply for Timer 230 V Ac			

10.2.2.2 Emissions from Process (*Terms of Reference No. Sp. TOR 2*)

The source of process emissions are reactors, where gaseous products are released, or excess gaseous raw material used in production, which mainly contain inorganic gases. The other emissions from process operations and effluent treatment system are mainly known as diffuse emissions containing dusts, fumes and volatile organic compounds. The VOCs from among the diffuse emissions are the main cause of odour in the plant area and its neighborhood. Spillage, leakage and accidental releases are the causes of fugitive emissions, releasing solids, liquids and fumes of volatile organic compounds resulting in soil and ground water contamination in addition to odour in the plant area.

a. Process Emissions: The process emissions contain ammonia, carbondioxide, carbon monoxide, hydrogen, nitrogen, nitrous oxide, oxygen, isobutylene, hydrogen chloride, hydrogen bromide and sulfur dioxide. Ammonia, hydrogen chloride, hydrogen bromide and sulphur dioxide are sent to scrubber in series. The resultant solutions after scrubbing i.e., Sodium chloride solution from Hydrogen chloride gas scrubbing, ammonium bicarbonate solution from carbon monoxide, sodium bromide solution from hydrogen bromide scrubbing, ammonium bicarbonate solution from carbon monoxide scrubbing, ammonium chloride solution from ammonia scrubbing, sodium bisulphite solution from sulfur dioxide scrubbing are sent to ETP. Carbon dioxide, Nitrogen, nitrous oxide and oxygen are let out into atmosphere following a standard operating procedure, isobutylene gas let out into atmosphere safely through a flare stack, while Hydrogen gas is let out into atmosphere through a water column. The quantity of process emissions is presented in [Table 10.6](#).

Schematic diagram of Scrubbing system is presented in **Fig 10.2**. Technical Specifications of two stage scrubber is presented in **Table 10.7**

Table 10.6 Quantity and Mode of Treatment of Process Emissions after Expansion

S.No	Product Name	Stage	Name of Gas	Quantity (Kg/day)	Mode of Treatment
1	Apixaban	I	Hydrogen	0.2	Let into atmosphere through water column
		V	Carbon monoxide	2	To Scrubber
2	Aripiprazole	I	Carbon dioxide	8	Let into atmosphere safely
		III	Carbon dioxide	3.4	
		IV	Carbon dioxide	6.5	
3	Atazanavir Sulphate	III	Isobutylene	88.1	Let into atmosphere safely through a flare stack
			Carbon dioxide	69.2	Let into atmosphere safely
4	Canagliflozin	I	Hydrogen bromide	12.1	To Scrubber
5	Dolutegravir Sodium	II	Carbon dioxide	49.8	Let into atmosphere safely
7	Eletriptan	I	Hydrogen chloride	3.1	To Scrubber
			Carbon dioxide	3.2	Let into atmosphere safely
			Carbonmonoxide	2.1	To Scrubber
		II	Hydrogen chloride	2	To Scrubber
		III	Carbon dioxide	1.9	Let into atmosphere safely
		IV	Hydrogen bromide	2.7	To Scrubber
8	Emitricitabine	I	Hydrogen	11.3	Let into atmosphere through water column
9	Irbesartan	I	Carbon dioxide	0.4	Let into atmosphere safely
			Hydrogen	0.03	Let into atmosphere through water column
			Nitrogen	0.1	Let into atmosphere safely
		IV	Hydrogen bromide	13.5	To Scrubber
			Nitrous Oxide	0.5	To Scrubber
10	Itraconazole	III	Sulfur dioxide	9.1	To Scrubber
11	Lamivudine	III	Sulfur dioxide	419.8	To Scrubber
			Hydrogen chloride	124.1	Let into atmosphere safely
			Sulfur dioxide	103.7	To Scrubber
12	Leviteracetam	I	Sulfur dioxide	308.1	To Scrubber
			Hydrogen chloride	270.1	To Scrubber
13	Linagliptan	II	Nitrogen	1.1	Let into atmosphere safely
		III	Carbon dioxide	1.6	Let into atmosphere safely
14	Lopinavir	I	Carbon dioxide	1	Let into atmosphere safely
15	Olmesartan	I	Carbon dioxide	7	Let into atmosphere safely
16	Ranolazine pure	I	Hydrogen chloride	54.7	To Scrubber
		II	Hydrogen chloride	45.5	To Scrubber

17	Ritonavir	I	Carbon dioxide	10.7	Let into atmosphere safely
18	Rivaroxaban	IV	Sulfur dioxide	14.7	To Scrubber
			Hydrogen chloride	8.4	To Scrubber
19	Rizatriptan Benzoate	I	Carbon dioxide	1.3	Let into atmosphere safely
		V	Carbon dioxide	4	Let into atmosphere safely
20	Rosiglitazone maleate	III	Hydrogen	0.02	Let into atmosphere through water column
21	Sildenafil Citrate	I	Oxygen	4.1	Let into atmosphere safely
			Hydrogen	0.04	Let into atmosphere through water column
		II	Sulfur dioxide	9	To Scrubber
			Hydrogen chloride	10.3	To Scrubber
		III	Sulfur dioxide	8.5	To Scrubber
			Hydrogen chloride	9.7	To Scrubber
22	Sofosobuvir	I	Hydrogen chloride	217.7	To Scrubber
23	Sumatriptan	I	Sulfur dioxide	5.2	To Scrubber
		II	Hydrogen	0.3	Let into atmosphere through water column
24	Tadalafil	I	Sulfur dioxide	3.9	To Scrubber
			Hydrogen chloride	4.4	To Scrubber
25	Tenofovir disoproxil fumarate	I	Carbon dioxide	142	Let into atmosphere safely
26	TPN Base	II	Carbon dioxide	18	Let into atmosphere safely
			Hydrogen chloride	14.9	To Scrubber
27	Valganciclovir HCl	I	Oxygen	59.2	Let into atmosphere safely
		III	Carbon dioxide	18.8	Let into atmosphere safely
28	Valsartan	I	Sulfur dioxide	90.8	Let into atmosphere safely
			Hydrogen chloride	51.8	Let into atmosphere safely
		II	Hydrogen bromide	109	Let into atmosphere through water column
29	Vardenafil HCl Trihydrate	II	Carbon dioxide	1.1	Let into atmosphere safely
		IV	Hydrogen chloride	0.9	Let into atmosphere through water column
30	Viladagliptin	II	Carbon dioxide	4.8	Let into atmosphere safely
31	Zidovudine	I	Ammonia	42.4	Let into atmosphere safely
32	Zolmitriptan	I	Oxygen	2.4	Let into atmosphere safely



Fig 10.2 Schematic Diagram of Scrubbing System

Table 10.7 Technical Specifications of Two Stage Scrubber

Type	Packed Tower Scrubber Two Stage
MOC	PP/FRP
Dimensions	Dia-700mmx 6mtr long
Packing Material	PP dia-25 mm pal rings
Inlet Temp.	35°C
Inlet Gas Pressure	Atmospheric
Scrubbing medium for I st Stage	Caustic Solution 10% Solution
Scrubbing medium for II nd Stage	Caustic Solution 10% Solution
Blower	
MOC	PPFRP
Capacity	7.5HP
RPM	1440
Circulation System	
Flow Rate	6 M ³ /hr
Head	30 Meters
Motor Make	Kirloskar NFLP
MOC	PP PUMP
Storage/ Recirculation Tank	
Capacity	3 KL
Size	1200 Dia X 2600mm Ht.
MOC	PP/FRP

10.2.2.3 Diffuse Emissions (*Terms of Reference No. 7(vi)*)

Emissions are also released from various operations of manufacturing like drying, distillation, extraction etc. These emissions mainly contain volatile contents of the material sent for processing. The emissions are normally passed through vent scrubber before releasing into atmosphere to mitigate odor. The emissions from distillation are passed through condensers, which mitigate odor. Vent condensers in series to reactors, distillation columns, driers and centrifuge etc. are provided to mitigate VOC emissions release. Other vents are connected to common headers and scrubbers. The transfer pumps shall be provided with double mechanical seals. The transfer of solvents will be mainly by closed pipeline systems, while drum transfer is by using air operated diaphragm pumps in closed hoods. The charging of solid raw materials shall be by powder transfer system to avoid dust emissions, safety and hazard of static electricity. Safety relief valves, rupture disc, and breather valve are provided to reactors. Thermal insulation and condensers will be provided for storage tanks of low boiling point solvents. The reactor or solvent storage tank vents when not use shall be kept closed. Photographs presented were obtained from project proponent.



Fig 10.3 Photographs of Existing Control Measures to Mitigate Diffuse Emissions

10.2.2.4 Fugitive Emissions *(Terms of Reference No. 7(vi))*

Fugitive emissions are anticipated from equipment leakage and transfer spills. The periodic maintenance program shall ensure integrity of equipment mitigating the equipment leakage. The spills however shall be managed by adopting spill management scheme as mentioned in the respective MSDS. The fugitive emissions shall be reduced by closed transfer and handling of all hazardous solvents and chemicals. The ventilation system provided will reduce the health impact on employees by way of dilution of work room air and also dispersion of contaminated air.

10.2.2.5 Odour Management *(Terms of Reference No. Sp. TOR (6))*

Odour is caused mainly by diffuse and fugitive emissions of low boiling organic chemicals/ compounds releasing volatile organic compounds. The above-mentioned measures for mitigation and control of diffuse and fugitive emissions shall reduce release of VOC's into atmosphere and the resultant odour.

10.2.3 Solvent Use and Recycle

Solvents are used for extraction of products and as reaction medium. Solvents constitute major consumable material of synthetic organic chemical manufacturing, mainly used as reaction medium. Solvent input ranges from 55 l/day to 166000 l/day based on the compound manufactured on campaign basis on a given day. The used solvents constitute major waste stream of synthetic organic chemical manufacturing. Hence it is proposed to recycle the solvents by distillation for reuse in process, thereby reducing total solvent consumption in the plant and reducing the waste quantity to be disposed. The distillation columns are mainly provided to remove moisture and impurities from spent single solvents, and mixed solvents. The recycled solvents are reused in the process, while the mixed solvents are sold to end users. Distillation process generates residues which are mainly organic in nature containing significant calorific value and can be sent to cement plants for co-incineration as fuel. The total solvent balance product wise, wherein the fate of each solvent based on its physical characteristics and the intensity of process operations is calculated and presented in table 10.8. Photographs presented were obtained from project proponent. Photographs of existing solvent recovery system is presented in [Fig 10.4](#).

Table 10.8 Total Solvent Balance - Product Wise after expansion

S.No	Name of the product	Quantity (Kg/Day)				
		Solvent Input	Recovered	Fugitive loss	To wastewater	Residue
1	Abacavir sulfate	1975	1922.8	28.4	14.9	8.9
2	Almotriptan	2845	2711.1	14	20.1	99.8
3	Amlodipine Maleate	3857.7	3623.1	26.2	10	198.4
4	Apixaban	5809	5470	37.6	18.4	287.4
5	Aripiprazole	6116.7	6005.3	21.4	17.6	72.5
6	Atazanavir Sulphate	25900	24914.3	166.7	110.5	708.5
7	Briviracetam	7000	6563.5	12.5	20	404
8	Canagliflozin	2775	2575.2	8.6	25.5	165.7
9	Candesartan Cilexetil	2200	2103.2	33	18.5	45.3
10	Dapagliflozin Propanediol	2554.2	2418.5	18.6	5.2	112
11	Darunavir	16000	15610	150.3	84	155.7
12	Dolutegravir Sodium	24994	24504.1	215.9	9.4	264.6
13	Efavirenz	166000	162471.5	574.3	576.5	2377.8
14	Eletriptan	3600	3395.5	28.8	25.3	150.5
15	Empagliflozin	2400	2280	2.4	9.6	120
16	Emitricitabine	8661	8483	92.3	3.5	82
17	Famotidine	3230	2933.6	25.8	161.5	109.1
18	Gabapentin	9420	9008.4	43.7	50.1	317.7
19	Irbesartan	4164.4	4075.4	13.4	13.9	61.7
20	Itraconazole	14010	13449.6	112.1	117.9	330.4
21	Lamivudine	21587	20674.9	132.2	137.9	642
22	Lamotrigine	2200	2142	29.9	2.4	25.7
23	Lanconazole	575.1	545.7	6.5		22.9
25	L Carbocisteine	2460.5	2337.5	12.3	29.5	81.2
26	Leviteracetam	9413.2	9168.1	56.9	36	152.1
27	Linagliptan	119.5	116.8	0.6	0.1	2
28	Lopinavir	2660	2596.2	21.6	9.4	32.8
29	Luliconazole	55	53.2	1.6		0.2
30	Mirabegron	1927.6	1831.2	10.1	2.2	84.1
31	Olmesartan	8205	8013.8	70.6	12.9	107.6
32	Ondansetron Hydrochloride Dihydrate	1235	1169.3	5.9	8.1	51.8
33	Paliperidone Palmitate	355	340.2	2.28	1.82	10.7
34	Pantoprazole sodium	2220	2173.2	10.9	8	28
35	Penciclovir	3083.8	2929.6	20.3	3.4	130.5
36	Raltegravir Potassium	1495	1443.6	9.3	19.4	47
37	Ranitidine hydrochloride	8046.3	7644	40.2	74.4	287.7
38	Ranolazine pure	21361.8	20657.9	109.8	64	530
39	Ritonavir	3805	3705.9	34.9	19.9	44.4
40	Rivaroxaban	4030	3891.4	30.2	18.2	90.2

41	Rizatriptan Benzoate	877	844.4	5	5.7	21.9
42	Rosiglitazone maleate	340	323	2.5		14.5
43	Sildenafil Citrate	1810	1725.5	12.8	31.3	40.4
44	Sitagliptin Phosphate	4290	4098.6	23.4	21.8	146.2
45	Sofosobuvir	8800	8637	48	63.6	51.4
46	Solifenacin	1850	1750	15.7	6.3	78
47	Sulfamide	300	265	15.7	4.3	15
48	Sumatriptan	1557	1452.4	9.6	16.6	78.5
49	Tadalafil	136.2	130.8	1.1	1.4	3.2
50	Telmisartan	936	898.6	5.9	6.8	24.6
51	Tenofovir disoproxil fumarate	22700	22192.5	144.1	161.3	202.1
52	TPN Base	1420	1346.8	19.9	15	38.4
53	Trazadone	18000	17200	72	57.9	670.1
54	Valacyclovir hydrochloride	6410	6220.7	35.4	6.3	147.6
55	Valganciclovir HCl	4741.3	4504.6	40.9	5	190.8
56	Valsartan	13924.5	13426.4	66	38.9	393.1
57	Vardenafil HCl Trihydrate	688.5	668	3.6	0.2	16.7
58	Viladagliptin	2245	2095.1	12.4	2.4	135.1
59	Zidovudine	7180	7030.3	52.3	28	69.4
60	Zolmitriptan	315	300.4	1.5	1.2	11.9
Total - Worst Case 20 Products on Campaign Basis		405549.8	393274.3	2074.2	1629.3	8576.2



Fig 10.4 Photographs of existing Solvent Recovery System

10.2.4 Solid Waste *(Terms of Reference No. 3(vi) & 7(vii))*

Solid wastes are generated from process, solvent distillation, wastewater treatment and utilities. Process residue contains mainly un reacted raw materials and byproducts. These are collected from the reactors and other process equipment and stored in drums. Solvent residue is generated from distillation units, the residues are tarry substances with good calorific value, and are stored in drums. The other major waste is salts from multiple effect evaporator and agitated thin film dryer section of effluent treatment system. These salts are stored in HDPE lined bags. All solid waste storage containers/drums/bags are labeled showing the

source, nature of hazard and type of wastes. All the hazardous wastes are stored in a closed shed with fire safety measures, and the shed is provided with a leachate collection facility connected to effluent conveyance lines. The stripper distillate, process residue and solvent residue are sent to cement plants for co-incineration based on acceptability. If these wastes are not suitable for co-incineration, the same is sent to TSDF facility. Mixed solvents shall be sent to authorized recyclers /cement plant for co-incineration while spent solvents are recovered within plant premises. The evaporation salts are sent to TSDF. Filter media, activated carbon and catalysts are sent to TSDF. Waste oil and used batteries from the DG sets are sent to authorized recyclers. The sludge from effluent treatment plant is considered hazardous and the same is sent to TSDF. The other solid wastes expected from the unit are containers, empty drums which are returned to the product seller or sold to authorize buyers after detoxification. Spent solvents constitute the largest wastes, and the same are recycled after distillation on site. 39.2 KLD of mixed solvents are sent to out side agencies for recovery. The quantity and disposal plan for the solid wastes is presented in **Table 10.9**.

Table 10.9 Solid Waste and Mode of Disposal

S.No	Description	Units	Quantity		Mode of Treatment/Disposal
			Permitted	After Expansion	
1	Process residue	TPD	5.076	19.26	Sent to TDSF/Cement Plants for Co-incineration
2	Solvent Residue	TPD		8.57	
3	Stripper Distillate	KLD		4.68	
4	Spent Carbon	Kg/day	530	831.3	
5	Spent Solvents	KLD		354	Recovered within plant premises and reused
6	Spent Mixed Solvents	KLD		39.2	Sent to authorized recovery units/Cement plants for co-incineration
7	Evaporation salts	TPD	29	18.43	Sent to TSDF
8	ETP Sludge	TPD	2.4	4.4	Sent to TSDF
9	Inorganic Residue	Kg/day		990	Sent to TSDF
10	Ash from Boiler and thermic fluid heater	TPD		17.2	Sold to Brick manufactures
11	Detoxified containers & liners	No.s/month		3200	Sold to authorized vendors
12	Waste oil	KLPA		7.2	Sent to Authorized
13	Used batteries	No.s/Yr		52	Recyclers

14	MS/SS/HDPE/PVC as scrap	TPM		9	Sold to authorizes vendors
15	Insulation waste	TPM		1.2	Sent to TSDF/ Authorized vendor.
16	E-WASTE	Kg /month		30	Authorized agency.
17	Off-Spec/Expired Chemicals	TPA		25	TSDF/Cement industries
18	Glass/Glass Bottles	Kg /month		60	Sent to Authorized recyclers after detoxification.

10.2.4.1 Ash Handling System

Ash will be of two types, viz., bottom ash and fly ash. The bed ash will be about 10% of the total ash and the remaining 90% of the total ash will be fly ash. Bag Filter (dust collector) will separate all the fine ash particles from flue gases. The efficiency of Bag filter will be 90-95%. An enclosed pneumatic conveying system will be used to convey the ash to storage bin. Ash will be loaded in to trucks using screw conveyor with water as conditioner to mitigate fugitive emissions.

10.2.5 Noise Pollution

The noise levels may increase due to motors, compressors, turbine, DG set and other activities. The major source of noise generation is turbine which emit noise levels of above 100 dB (A) at a reference distance of 1m from the source. Hearing conservation program is adopted to ensure that employee's hearing is not affected during his working life to an extent greater than that usually occurring with age and to preserve it at a level sufficient for normal speed perception. The following measures are adopted to ensure least impact on sensitive receptors and the workmen.

Measures to Control Noise Pollution

The following engineering control measures are identified for implementation to reduce noise levels/exposure;

- The walls of turbine room will be built with noise absorbing materials.
- The control room of the power plant will be acoustically enclosed.

- The noise generating sources like motors and compressors will be provided with Casings and guard to reduce noise levels
- Attenuating screens will be placed between operators and noise sources.
- Adequate spacing between noise sources and operators will be provided. In free field conditions the sound levels roughly vary with the square of the distance.
- Reflected noise is reduced by use of absorbent materials on roofs, walls and floors.
- Proactive periodic maintenance to correct vibrations and other imbalances.
- Training would be imparted to plant personnel to generate awareness about the damaging effects of noise.
- Personal protective equipment: ear plugs and muffs consisting of fine glass wool, ear muffs consisting of ear cups with a soft seal, fitted with a spring or adjustable headband. Comfort, maintenance and cleaning are important aspects of use.
- Plantation of tall as well as short trees around the plant area will protect the outside environment from any noise and dust nuisance.
- It is possible to reduce the noise levels by 3-5 dB (A) per 30-m width of the green belt.

10.3 Rainwater Harvesting *(Terms of Reference No. 7(x))*

Rain water harvesting shall be adopted by providing rain water harvesting structures along the drains and run off storage sump and tanks. Storm water drains are provided with rain water harvesting structures which will act as flow dissipaters and also as infiltration trenches. Filtration points shall ensure percolation of water and enhance the ground water table. The site area will be provided with 15 nos. of rain water harvesting structures. The roof water shall be collected in 2 x 200 KL capacity sump connected to down spouts of the roofs, and the collected water shall be reused for process and green belt development. The storm water from open areas, and green belt area, and the overflow of the roof water storage sump shall be collected in a storm water storage tank in southeast part of the site and reused for plant and process. The storage pond shall have a capacity of 14600 m³. These measures shall ensure reuse of stored storm water for about 22 days of plant operation expansion. The storm water is quantified using rational formula, for a rainfall intensity of 800 mm, with

constant of 0.5 for open area and 0.3 for green belt area. The total water that can be stored is in the order of 45209 m³/year. The storage tank and the sump shall get refilled during intense rain fall periods, and the stored water shall be reused mainly during monsoon and post monsoon seasons. The location of storm water storage tank, roof water storage sump is presented in [Fig. 10.5](#) and storm water management is presented in [Table 10.10](#).

Table 10.10 Storm Water Management

Land Use	Area in Ha	Vol./hr after development C=0.8 (KL)	Vol./hr before development C=0.6 (KL)	Difference in Discharges (KL)
Roof Area	7.77	1974.8	1481.1	493.7
Road Area	11.66	2962.2	2221.6	740.5
Open Area	19.44	1851.4	3702.7	-1851.4
TOTAL	38.87			-617.12
*C=0.3 after development of greenery				
Area of Catchment, 'A'			37.67	Ha
Run off Coefficient, 'C'			0.5	
Maximum intensity of rainfall, 'I'			800	mm/year
Therefore Q			150695	m ³ /year
Storm water Storage (30% run off)			45209	m ³ /year
Water requirement			2035.2	KLD
No of days usage (Storm water)			22	
Storm water storage pond			14400	m ²
Storm water storage pond Depth			1.2	m
Total Storm water storage pond Capacity			14600	m³

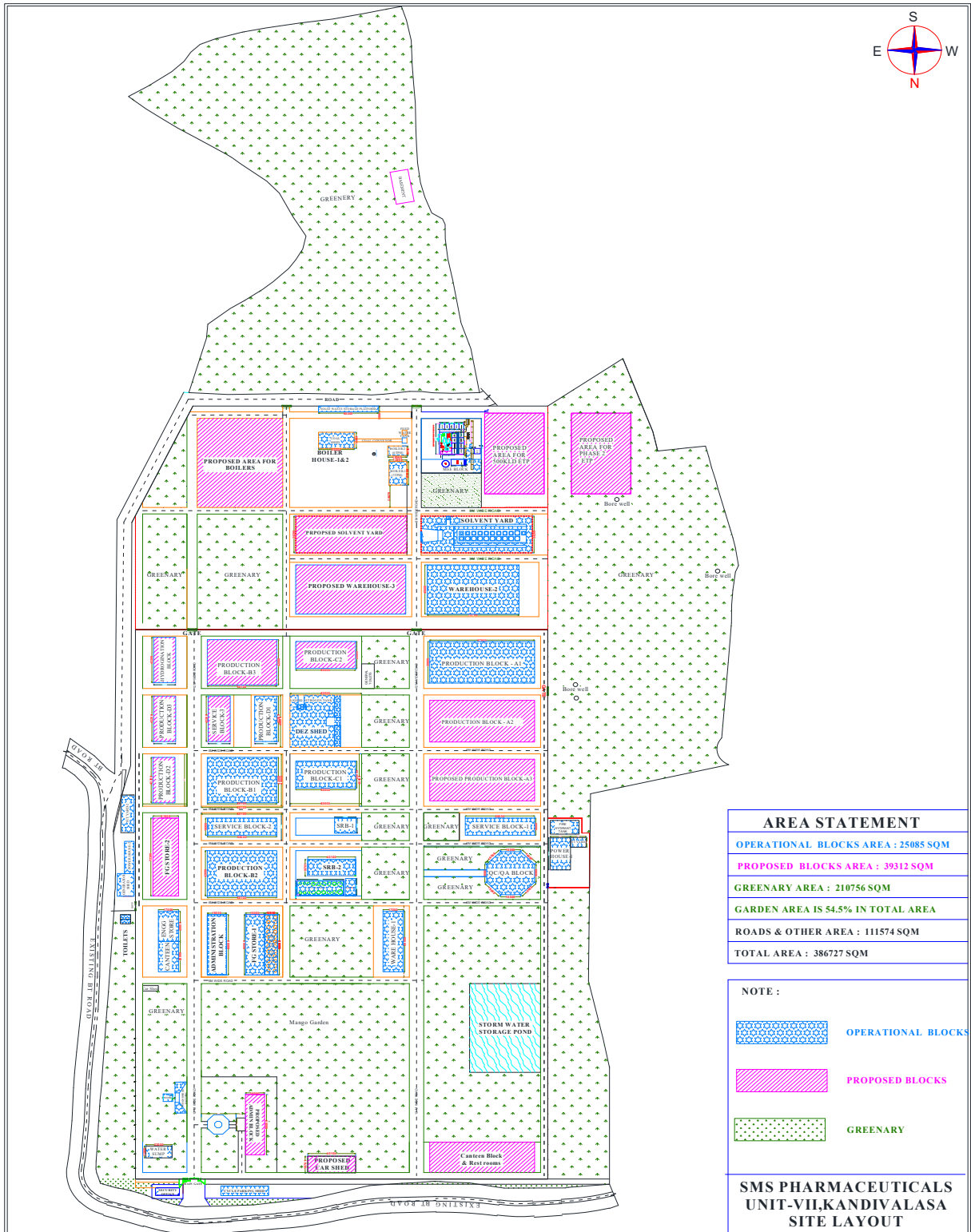


Fig 10.5 Plant Layout Showing Location of Storm Water Storage Pond

10.4 Occupational Safety and Health *(Terms of Reference No. 8(iii))*

Many worker health and safety hazards are posed by synthesis operations. They include safety hazards from moving machine parts, pressurized equipment and pipes, heavy manual handling of materials and equipment, steam, hot liquids, heated surfaces and hot workplace environments, confined spaces and hazardous energy sources (e.g., electricity); and high noise levels.

Acute and chronic health risks may result from worker exposures to hazardous chemicals during synthesis operations. Chemicals with acute health effects can damage the eyes and skin, be corrosive or irritating to body tissues, cause sensitization or allergic reactions or be *asphyxiants*, causing suffocation or oxygen deficiency. Chemicals with chronic health effects may cause cancer, or damage the liver, kidneys or lungs or affect the nervous, endocrine, reproductive or other organ systems. Worker exposure to chemicals can occur during manufacturing when chemicals spill, leak, or discharge from the process system and contaminate areas where workers are present. The most frequently reported industrial exposure occurs during the transfer of materials. The entry of workers into systems, equipment, or enclosures that are contaminated may occur inadvertently, but routine servicing, nonscheduled maintenance, and process monitoring appear to be the kind of activities with potential for significant exposure. Health and safety hazards may be controlled by implementing appropriate control measures (e.g., process modifications, engineering controls, administrative practices, personal and respiratory protective equipment).

The process modification shall be a constant exercise of the Research and development wing of the organization, resulting in reduced pollution loads, and increased yields. The measures proposed are selection of alternative solvents/routes of synthesis, avoidance of hazardous chemicals usage, and application of green chemistry principles.

The engineering controls for reducing occupational hazards are provision of scrubbers, condenser systems for process equipment, piping systems, insulation to reactors, usage of

transfer pumps with mechanical seals, AOD pumps, trolleys for transfer of drums or bags, closed hoods for charging raw materials, dip pipe provision for solvent and liquid raw material charging, level indicators, pressure and temperature indicators, barrier guards on moving machine parts, optimization of chemical inventory, control switches and emergency stop devices to mitigate and avoid physical, chemical, electrical and mechanical hazards.

Work practices proposed for improving occupational safety are induction training programs, safety training programs, rotation of workers, implementation of proactive maintenance schedule, provision of standard operating procedures for all plant operations, access to MSDS for all employees, access to emergency numbers of contact, and avoidance of crowded work place, and provision of occupational safety centre.

Personal protective equipment shall be provided to all the employees including contract employees. All the employees shall be provided with gumshoe, helmet, masks, and goggles. The other equipment like ear muffs, gloves, respirators, aprons etc., will be provided to employees depending on the work area allocated to them. The PPE selection shall strictly follow the prescribed guidelines of MSDS. The budget allocated for personal protective equipment is Rs. 122.5 lakhs per annum and Rs. 65 lakhs for health checkup.

Work Practices:

Safety training classes are conducted to all the employees periodically to educate and train them with regard to proper operation and steps to be taken during emergencies. Work permit system is being strictly implemented. Dedicated ambulance is provided round the clock. The industry has an arrangement with hospitals for referral cases.

10.4.1 Medical Check-up (Terms of Reference No. 8(ii))

M/s SMS Pharmaceuticals Limited, Unit VII has a medical program of pre-employment screening, periodic medical examination, emergency treatment, non-emergency treatment, and record keeping and review. The pre-employment screening and periodic medical examination shall follow the guidelines of factories act. The pre-employment screening shall

obtain medical history, occupational history followed by physical examination and baseline monitoring for specific exposures. The frequency of periodic medical examination and type of evaluation is presented in **Table 10.11**. Annual medical examination report of employees is enclosed at **Annexure**.

Table 10.11 Frequency of Health Monitoring

Occupation	Type of evaluation		Frequency
Process area	Physical Observation	Height Weight	Once a year for regular employees.
	Eyes	Color vision	
	Detailed Test	Hearing Ability; Physical Status, Lung function test, General Condition; Previous Accidents, Skin Infections; Any Physical Handicap	Half yearly for contract employees
	Clinical Observation	Heart; Hydrocele; Central Nervous System; Liver functioning; Diabetes; Any operations undergone; Symptoms of communicable and other contagious disease and Medical fitness	
Noise prone areas	Audiometry		Annually

The plant shall have an occupational health centre to provide emergency and non-emergency treatment, by way of emergency first aid on site, liaison with local hospitals and specialists, arranging decontamination of victims, arranging transport of victims to hospitals, and to transfer medical records, and to provide details of incident and medical history to next care provider. The occupational health centre shall be supervised by a qualified physician. The occupational health centre shall maintain the health records and shall analyse the records for any common symptoms and common health problems which may be due to exposure to chemicals, and or due to other occupational hazards.

10.4.2 Handling of Toxic Chemicals/Materials *(Terms of Reference No. Sp. TOR 14)*

The engineering controls proposed for reducing occupational hazards in handling of toxic chemicals are as follows;

- Separate Storage area with environmental controls
- Dispensing of material in isolated dispensing booth with cross ventilation
- Transfer of toxic powders by Power Transfer System (PTS)

- Level Indicators, sensors, pressure & Temperature indicators provision to reactors
- Transfer by dedicated pipe line
- Dump tank system in case of overflow
- Transfer by using AOD pumps in case of Drum transfer
- Vents connected to common scrubbers.

Administration Controls for handling of toxic chemicals are as follows;

- All chemicals are stored based on respective MSDS
- Periodic health check-up tuned to Toxic chemicals handled.
- All employees are provided with respiratory protection ranging from nose mask to full body suit to prevent toxic chemicals impacting respiratory system of employees.
- Personal Protective Equipment (PPE) based on requirement and suitability.

10.4.3 Treatment of Workers affected by Accidental Spillage of Chemicals

The following is the standard procedure followed in Plant;

- On receiving message of casualty at ECC, Ambulance is sent to the plant / location of occurrence.
- Give topmost priority to the “personal Safety of employees”. Prevention of life is the number priority and people must be removed from the danger area and shifted for medical treatment as early as possible.
- The casualty is rendered first aid by trained first aiders.
- The casualty then shifted to OHC in Ambulance for further treatment.
- Medical aid is administered by FMO / Manager- OHC at OHCS.
- On the Company Manager - Occupational Health assessment, the casualty is transported in Ambulance to defined hospitals for further treatment.

Toxic release gas:

- Check wind direction of wind sack installed at highest point.
- Wear appropriate / necessary PPE if moving near gas leakage area.
- Rescue operators must wear SCBA set before entering the affected section.

- Monitoring of the emission levels in the immediate vicinity by on-duty Environment Protection Manager (Dragger Tubes / PID instrument / Gas detector tubes)
- Water curtains to be started immediately to control drift of gases away from leak spot.
- Contaminated water is to be diverted to effluent treatment plant. Coordination with ETP personnel is a must.

10.5 Prevention, maintenance and operation of Environment Control System

The pollution control equipment, and the effluent treatment systems and effluents will be monitored periodically and will be checked for its performance and pro-active maintenance will be adopted. The environmental monitoring results will be evaluated to identify the problems/under performance of the equipment. Necessary steps will be taken to rectify the identified problems/defects. The management agrees that the evaluation of the performance of pollution control measures and occupational safety measures to arrive at their efficiency and proposes to adopt new measures for efficient pollution control which will be a regular exercise.

All pollution control equipments are adequately designed and operating staff of the pollution control equipment have good experience in the operation and maintenance of the equipment. Standby equipment provided for all critical equipment to ensure continuous operation of pollution control equipment and preventive maintenance is done as per the schedule to avoid breakdown. Characteristics of influent and effluent are monitored on daily basis by the industry and air emissions and effluent characteristics on monthly basis by third party.

10.6 House Keeping

Good house-keeping practices will be adopted. Floor washing is avoided and wet mopping will be adopted to minimize liquid waste generation. Paper waste is minimized by adopting intra office network. Sufficient workspace and proper lighting will be provided.

10.7 Socio Economic Environment *(Terms of Reference No. 11(i) & Add. TOR 6)*

The expansion of project provides an opportunity for the local people to get employment directly or indirectly and helps in the up liftment of the socioeconomic status of the area. The project proponents propose to involve in social activities of the stakeholders/surrounding community by planning the betterment of neighbouring social conditions through awareness and welfare programs will ensure an improved relation, useful in the long run. Many of the beneficiaries of such programs shall include own employees as well. The goodwill of the local populace can never be ignored. Another important facet of social environment identified by the project proponents is a green appearance, hence the management will develop a green belt towards aesthetic beautification as the same is necessary to be considered as a responsible, social neighbour. SMS Pharmaceuticals Limited, Unit VII spent Rs. 96 lakhs in year 2015-16 to 2016-17 on ESR activities. The budget allocated for funding corporate social responsibility activity is as follows;

1. **Social Investment Funding:** 2% of the profits of the unit are spent on socio economic development programs in consultation with revenue authorities and public representative annually. 2.5% of the capital cost i.e., Rs. 15 crores shall be spent additionally during 2019-2024. The list shall be finalized after incorporating the demands that arise during public consultation process. The objective is to obtain a social license from the stake holders who are likely to be affected due to the expansion and the proposed manufacturing activities.
2. **Local Content:** About 300 no. of employees are from the surrounding villages. Local produce like rice, vegetables, milk etc is procured from surrounding villagers by the canteen.
3. **Capacity building:** Skill development, and provision of infrastructural facilities for drinking water, education and health.
4. **Payment of Taxes:** Presently the organization is paying taxes crores per year towards various central and state taxes. The amount will increase after expansion.

The ESR programs identified by the management as part of corporate social responsibility program are presented in **Table 10.12**. The development programs are identified from schedule VII of companies act 2013. Photographs of ESR activities carried out by SMS Pharmaceuticals Limited, Unit VII is presented in **Fig 10.6**

Table 10.12 Activity Wise CSR - Budget (2019-20 to 2023-24) - Program

S.No	Name of the Village	Activity					Total Rs. Lakhs
		Health Camps	School Infrastructure	RO Plants	Sanitation	Plantation	
		Cost (in Rs. Lakhs)					
1	Kovvada	60	78	75	90	23	326
2	Gumpam	60	78	75	90	20	323
3	Govindapuram	45	70	70	80	20	285
5	Puspatirega	45	85	70	80	18	298
5	Kanimetta	45	85	60	60	18	268
	Total	255	396	350	400	99	1500



Health Centre at Gumpam Village



Health Centre at Kovvada Village



Construction of School Building at Govindpauram Village



Construction of School Building at Govindpauram Village



Health Camp at Kandivalasa and Pusapatirega Villages



Distribution of School Uniform at Kandivalasa Village



Community Health Centre

Fig 10.6 ESR Activities Carries out by SMS Pharmaceuticals Limited, Unit VII

10.8 Transport systems

All the raw materials and finished products are transported by road. There will be 12-15 additional truck trips per day to the factory due to proposed expansion. Traffic signs are placed in the battery limit. The drivers of the vehicles will be provided with TREM cards and will be explained the measure to be adopted during various emergencies. Drivers transporting hazardous chemicals are periodically trained.

10.9 Reduce, Recovery and Reuse *(Terms of Reference No. 7(vii))*

It is the endeavor of the project authorities to increase the yields of the products through constant research and development activity. The development activity shall concentrate on increasing the yields, using less quantity of raw material, using alternative solvents with low hazards adopting green chemistry principles. The solvents shall be recycled for reuse in the process by distillation. The mother liquors from the first crop shall be reused for process. The cleaning cycles will be reduced by adopting appropriate production plan with minimum changeovers of the product. Hydro jets or high-pressure cleaning shall be adopted for washing the reactors to minimize washing effluents. It is proposed to use third and fourth washing water for first and second washing of the reactor and centrifuges. Step down steam pressure will be used for process heating requirements and effluent treatment system. A cross functional team shall constantly evaluate various options of reduce, reuse and recycle for water conservation, reduction in wastewater generation, effluent segregation, reuse of wastes, alternate treatment methods, leakage/spillage control, avoidance of overflow and contamination. As part of the above exercise the proponent identified few compounds which can be recovered as byproducts and sold. It is also proposed to explore recovery of various salts from MEE salts, and from process effluents to reduce effluent loads, and quantity of solid waste.

10.10 Energy Conservation

It is proposed to use screw compressors (Air/Refrigeration) for energy efficiency (10 - 12% saving), evaporative condensers in the chilling circuit to reduce overall power, Cooling tower

fan control to switch off at times not required (Low temp), energy efficient pumps to conserve energy.

10.11 Green Belt Development *(Terms of Reference No. 7(ix) & Add. TOR 9)*

The management developed green belt in a total area of 32 acres covering the boundary of the site as part of environment management plan and proposed to increase density to enhance environmental quality through mitigation of fugitive emissions, attenuation of noise levels, balancing eco-environment, prevention of soil erosion, and creation of aesthetic environment. Greenbelt plan presented in [Fig. 10.7](#).



Green Belt Photographs

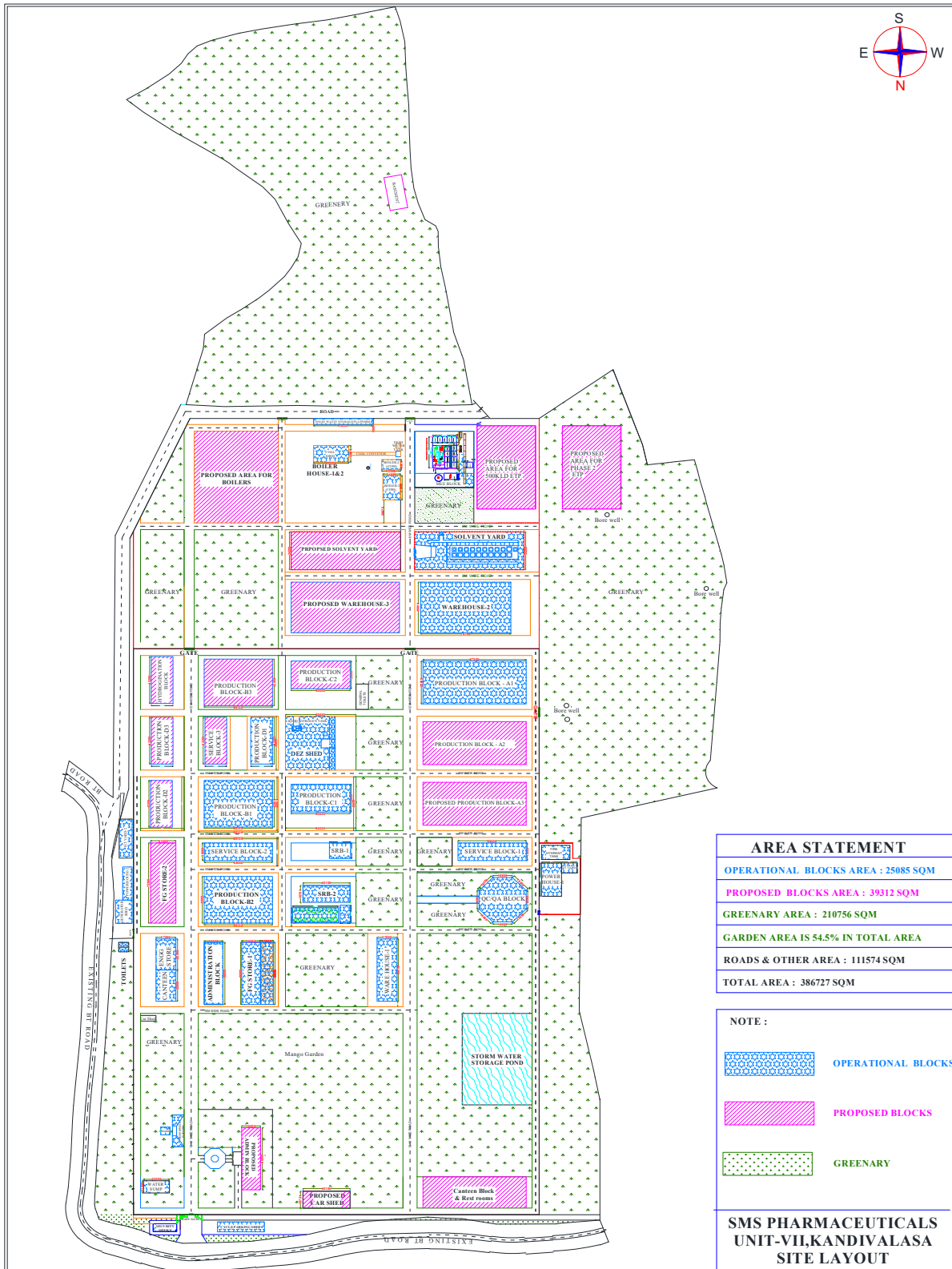


Fig 10.7 Green Belt Development of SMS Pharmaceuticals Limited, Unit VII

10.12 Corporate Environmental Responsibility (Terms of Reference No. 9(i))

The Management of SMS Pharmaceuticals Limited, Unit VII commits to operate all its units in an environmentally friendly manner, while protecting health and safety of its employees. The management is committed to prevention of pollution, injury and ill-health to its employees. SMS Pharmaceuticals Limited will comply applicable laws and other requirements.

Broad guidelines of Policy

- Carryout business in a sustainable manner, ensuring safety for all and protection of the surrounding environment.
- Comply with the applicable statutory, regulatory & other requirements with respect to Environment, Health and Safety (EHS)
- Integrate EHS considerations into planning and decision making in all areas of Piramal business, including those dealing with purchase of plant, equipment, machinery and material as well as selection and placement of personnel.
- Identify EHS hazards, risks, aspects & impacts through periodic assessments & audits and implement necessary control measures.
- Assess the training needs of employees & contract workers and provide them necessary training on the EHS issues, concerns & best practices.
- Encourage employees at all levels to accept responsibility and accountability for achieving the objects of the policy.
- Assign responsibility on contractors and vendors to comply with the company EHS policies and follow all applicable legal requirements.
- Design and develop facilities that are energy efficient & generate less waste through recycle and reuse of materials to reduce the impact on environment.
- Maintain and continually improve EHS systems at all our manufacturing sites through the implementation of least technology and EHS best practices.

10.13 Environment Management Cell *(Terms of Reference No. 9(iii), 9(iv) & Add. TOR 8)*

The Environment Management Cell of the project is headed by the President, Senior vice president, vice president operations, DGM- EHS, followed by manager, assistant manager, Dy. Manager and technicians/fitters.

Records shall be maintained for the analysis of raw effluents and treated effluents, ambient air quality data, stack emissions monitoring results, micro- meteorological data and noise levels. These records are not only required for the perusal of the pollution control board authorities but also to derive at the efficiencies of the pollution control equipment as the objective of the project proponent is not only compliance with statutory regulations, but also a serious commitment towards clean environment.

The industry shall be regularly maintaining the records as per the hazardous waste regulations and EPA regulations and is applying for the annual consents for air and water, and renewal of authorization for the storage of hazardous waste.

10.14 CREP Guideline and Compliance

CREP Guideline	Compliance
Segregation of waste streams	Segregation of waste streams at source
Detoxification and treatment of high COD waste streams	High COD waste streams are neutralized and detoxified as present practice
Management of solid waste	Hazardous waste is sent to TSDF.
Minimum scale of production to afford cost of pollution control	Production capacities optimized.
Long term strategies for reduction in waste	Reduction of waste generation by increasing the yields is a major R&D activity.
Control of air pollution	Scrubbers provided to all vents and air emission of reactions apart from ESP to boilers.
Self - regulation by industry through regular monitoring and environmental auditing	Third party monitoring conducted quarterly
Optimizing the inventory of hazardous chemicals	Storage of chemicals optimized for one week.

10.15 Other Management Practices

The industry will maintain records as per the hazardous waste regulations and EPA regulations and apply for the annual consents for air and water, and renewal of

authorization for the storage of hazardous waste as per Hazardous Waste (Handling & Management) Rules, 1989 and subsequent amendments. The records of hazardous waste manifest will be maintained.

The industry shall obtain the consent for operation (CFO) as required under section 25/26 of the Water Act, 1974 and under section 21/22 of Air Act, 1981 before trial production and commissioning from the State Pollution Control Board. The CFO will be renewed each year by the industry. The industry will obtain the necessary permissions under Hazardous Waste (Management and Handling) Rules 1989, and Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, issued by the Ministry of Environment and Forests, New Delhi. The industry will submit environmental statement every year before September 30, and monthly water cess returns. The management ensures that it will comply with all the directions and regulations issued by the Ministry of Environment and Forests, New Delhi, State and Central Pollution Control Boards. The Consent for Establishment, Consent for Operation will be displayed in a conspicuous location for the information of the inspecting authorities of different departments.

10.16 Cost Estimate for Environment Management Plan (Terms of Reference No. 7(xi))

It is estimated that the total capital cost for implementing the Environment Management plan is Rs. 43.89 crores, while the recurring costs for the same is Rs. 53.82 crores/year. It may be noted that water pollution control followed by air pollution control was allocated the highest budget, and the highest recurring costs were observed for ETP operation. The cost estimate is presented in **Table 10.13**. The item wise tentative capital cost estimate for environment management measures is presented in **Table 10.14**

Table 10.13 Environmental Management Cost estimate

S.No	Description	Capital	Recurring Cost
1	Air pollution Control	1387	40
2	Water pollution Control	2630	4845
3	Noise pollution Control	31	8
4	Environment Monitoring and Management	60	12
5	Occupational Health and Safety	194.7	26
6	Green Belt	15	6
7	Others (S. Waste)	72	445
Total (Lakhs)		4389.2	5382

Note: Value in Rs. Lakhs

Table 10.14 Item Wise Tentative Capital Cost Estimate for Environment Management

S.No	Description	Cost (Rs. Lakhs)
I	Air pollution	
	Bag Filter	555
	Scrubbers	200
	Condensers	184
	Vacuum pumps	210
	Spill control kits	4
	Closed Hoods and AOD pumps	38
	Dust Collectors	144
	Coal handling system	32
	Ash handling system	20
	Total - I	1387
II	Safety	
	Breather Valves	6
	Rupture disks	9.6
	Trolleys	1
	Fire hydrant system	1
	Gas detection system	37.5
	Safety relief valves	13.5
	Fire extinguishers	3.2
	Fire buckets	0.4
	Total - II	72.2
III	Occupational safety	
	Occupational safety and health center with facilities	10
	Self-contained breathing apparatus	80
	Personal protective equipment	12.5
	Eye wash and body wash showers	20
	Total - III	122.5

IV	Water	
	Effluent treatment system	2500
	Storm water drains	20
	Storm water storage tank	30
	Fire hydrant storage tank	30
	Effluent and sewage transfer lines	50
	Total - IV	2630
V	Noise	
	Acoustic enclosures	8
	Guards, casing, attenuating screens	15
	Vibration control pads	6
	Others	2
	Total - V	31
VI	Solid waste	
	Storage area for hazardous waste	45
	Detoxification area	12
	Ash handling system	15
	Total - VI	72
VII	Green Belt	15
	Total - VIII	15
VIII	Environmental monitoring	
	Laboratory	25
	Monitoring equipment	35
	Total - VIII	60
	Total (I+II+III+IV+V+VI+VII+VIII)	4389.2

CHAPTER 11.0 EXECUTIVE SUMMARY

11.0 Introduction

M/s. SMS Pharmaceuticals Limited, Unit VII obtained Environment Clearance Vide letter no. F. No. J-11011/361/2006-IA II (I) dated: 16.04.2007 and CRZ clearance vide letter no. 11-45/2007-IA III dated: 08.10.2007 for marine disposal of treated wastewater through dedicated pipeline to sea. It is now proposed to expand the API manufacturing capacity from 179.05 TPM to 740.76 TPM with inclusion of a captive power plant of 2 x 2 MW capacity in existing site area of 95.56 acres. The capital cost for expansion is Rs. 600 crores for additional production blocks, utilities, enhancement of treatment facilities, storages and additional equipment to increase manufacturing capacity, at Sy. Nos. 160, 161, 163 to 168 and 170 Kandivalasa Village, Sy. No. 72 Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh.

The terms of reference for the environmental impact assessment studies was obtained from MoEF&CC vide letter no. IA-J-11011/12/2018-IA II (I) dated 05.02.2018. The certified compliance letter from the regional office of MoEFCC, Bangalore is obtained vide letter no. F.No. EP /12.1/526/AP/1864 dated 20.11.2017 and F.No. EP /12.1/604/AP/1863 dated 20.11.2017 for conditions mentioned in the environmental clearances and CRZ clearance obtained for marine outfall as mentioned above. Public Hearing was conducted on 12.07.2018 as part of environmental clearance process.

11.1 Location of the Project:

The project site of 95.56 acres is located at Sy. Nos. 160, 161, 163 to 168 and 170, Kandivalasa Village, Sy. No. 72, Kovvada Agraharam Village, Pusapatirega Mandal, Vizianagaram District, Andhra Pradesh. There is no additional land acquisition for the proposed expansion and the available land of 96.56 acres is sufficient for expansion. The site is situated at the intersection of 18°06'02" (N) latitude and 83°35'22" (E) longitude. The site elevation above mean sea level (MSL) is in the range of 38-45 m. The plant site is surrounded by NH-5 to Chintapalli Road in North and East direction, open lands in south and west directions. The nearest village from the plant is Kovvada Agraharam village located at a distance of 1.7 km in southwest direction. The main approach road AH45

(NH-5) is at a distance of 1.9 km in north direction. The nearest Town Vizianagaram is at a distance of 16 km in northwest direction and Nellimarla railway station is at a distance of 17 km in northwest direction and nearest airport is Visakhapatnam located at a distance of 56 km in southwest direction. Kandivalasagedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 3.4 km in east direction, and Champavathigedda, a seasonal stream is flowing from northwest to southeast direction at a distance of 7.4 km in southwest direction. Bay of Bengal is at a distance of 6.7 km in SE direction. There are three reserve forests in the study area, Kumili RF is at a distance of 2.6 km in northeast direction, Konada RF is at a distance of 7.6 km in southwest direction, Damarasingi RF is at a distance of 8.2 km in northwest direction. There is no National Park, sanctuary, critically polluted area and interstate boundary within the impact area of 10 km surrounding the site. Pydibhimavaram industrial area, which has a number of pharmaceutical manufacturing industries is located at a distance of 4.5 km in northeast direction. There are few discreetly located active pharma ingredient manufacturing units, outside Pydibhimavaram industrial area, within the impact area.

11.2 Product Profile

The manufacturing capacity both before and after expansion are presented in [Table 11.1](#) and the list of by-products after expansion is presented in [Table 11.2](#)

Table 11.1 Manufacturing Capacity

S.No	Name of Product	Capacity (TPM)	
		Permitted	After Expansion
1	Efavirenz	16	120
2	Lopinavir	3	5
3	Emtricitabine	1.5	20
4	Tenofavir	5	60
5	Atazanavir	0.5	15
6	Valcyclovir	10	30
7	Ritonavir	1	5
8	Zidovudine	7	20
9	Lamivudine	2	75
10	Valsartan	13	13
11	Abacavir	5	10
12	TPN Base	3	3
13	Pantoprazole	2	5
14	Ranitidine	90	90
15	Levetiracetam	10	20

16	Temisartan	0.5	2
17	Olmisartan	0.5	5
18	Candesartan	0.3	2
19	Ibresartan	0.25	2
20	Itraconazole	1.5	3
21	L-Carbocy-Stiene	2	10
22	Sulfamide	3	3
23	Gabapentin	1	40
24	Valganociclovir	1	5
25	Sitagliptin		10
26	Vildagliptin		2
27	Briviracetam		10
28	Amlodipine		5
29	Penciclovir		1
30	Arpiprazole		2
31	Rosiglitazone		0.5
32	Canagliflozin		2
33	Dapagliflozin		2
34	Empagliflozin		20
35	Ranolzine		10
36	Lanoconazole		0.05
37	Paliperidone Palmitate		0.1
38	Mirabegron		0.5
39	Solefinacin		1
40	Lamotrazine		5
41	Sumatriptan		0.5
42	Famotidine		5
43	Almotriptan		0.1
44	Ondansertan		0.5
45	Zolmitriptan		0.5
46	Rizatriptan		0.5
47	Elitriptan		0.25
48	Tadalafil		0.5
49	Sildenafilcitrate		2
50	Lanthanum Carbonate		2
51	Luliconazole		0.01
52	Verdinafil		0.25
53	Raltegravir		5
54	Dolutegravir		25
55	Darunavir		15
56	Linagliptin		0.5
57	Rivaroxaban		3
58	Apixaban		1
59	Sofosbuvir		30
60	Trazadone		15
	Total	179.05	740.76
61	Co-generation Power Plant	---	2 x 2 MW

Table 11.2 List of By-Products - After expansion

S.No	Name of Product	Stage	Name of By-product	Quantity	
				Kg/day	TPM
1	Atazanavir Sulphate	III	Triethylamine HCl	521.2	15.6
2	Dapagliflozin Propanediol	I	N-Methylmorpholine HCl	121.7	3.6
3	Darunavir	II	1-Hydroxy pyrrolidine-2,5-dione	210.2	6.3
4	Dolutegravir Sodium	III	Toluene	175.8	5.3
5	Efavirenz	V	Trichloro methanol	3430.9	102.9
6	Emitricitabine	I	Menthol	438.7	13.2
			Isopropyl Alcohol	168.7	5.1
		II	Triethyl amine HCl	377.2	11.3
7	Leviteracetam	II	Potassium Chloride	876.0	26.3
8	Sofosobuvir	I	Triethyl amine HCl	821.4	24.6
		III	4-Trifluoromethyl phenol	306.2	9.2
9	Tenofovir disoproxil fumarate	I	p-Toulene sulfonic acid	555.1	16.7
			Ethanol	296.9	8.9
10	TPN Base	II	Ammonium chloride	43.7	1.3
11	Valacyclovir HCl	III	Benzoyl formate	377.3	11.3
12	Zidovudine	I	Trityl chloride	695.4	20.86

11.3 Manufacturing Process

Chemical synthesis produces majority of API's currently in the market. Chemical synthesis consists of four steps - reaction, separation, purification, and drying. Large volumes of solvents are used during chemical syntheses, extractions, and solvent interchanges. The manufacturing process of the above-mentioned molecules involve various types of reactions like acetylyzation, protection, deprotection, hydrolysis etc. The manufacturing process of all the compounds, reactions involved, material balance are presented in annexure of EIA report.

The cogeneration plants shall use steam turbines, and the steam is generated by using a 20 TPH @ 67 bar (a) pressure coal fired boilers for 2 x 2 MW co-generation power plants. Step down pressure of about 9.5 TPH of steam is extracted at 10 to 15 bar pressure to meet process heating requirements and also effluent treatment system.

11.4 Utilities

The proposed expansion requires additional steam for both process and effluent treatment system. It is proposed to establish coal fired boilers of 1 x 20 TPH, 1 x 12 TPH, and 2 x 10

TPH capacity and 1 x 10 lac k.cal/hr and 1 x 2 lac. K.cal/hr coal fired thermic fluid heaters for process requirement in addition to the existing 1 x 6 TPH, and 1 x 3 TPH coal fired boilers. It is proposed to keep proposed 1 x 12 TPH coal fired boiler and the existing 1 x 6 TPH and 1 x 3 TPH coal fired boilers as standby after expansion. The DG sets required for emergency power during load shut down is estimated at 12000 kVA and accordingly 7 x 1500 kVA DG sets are proposed in place of exiting 1 x 125kVA. The list of utilities is presented in **Table 11.3**.

Table 11.3 List of Utilities

S. No	Description	Unit	Capacity		
			Existing	Proposed	Total after expansion
1	Coal Fired Boilers	TPH	1 x 6	1 x 20	1 x 20
			1 x 3	1 x 12	1 x 12*
				2 x 10	2 x 10
					1 x 6*
2	Themic Fluid Heater	K. Cal/hr		1 x 2 Lac	1 x 2 Lac
				1 x 10 Lac	1 x 10 Lac
3	DG Set**	KVA	1 x 125	7 x 1500	7 x 1500
					1 x 125

* Standby

**DG sets will be used during load shut down by AP TRANSCO.

11.5 Water Requirement

Water is required for process, scrubbers, washing, cooling tower makeup, steam generation and domestic purposes. The total water requirement after expansion increased from 324 KLD to 2035 KLD. The required water shall be drawn from ground water supply by APIIC from Thota palli reservoir. The water balance for daily consumption is presented in **Table 11.4**.

Table 11.4 Water Balance

Purpose	INPUT (KLD)	OUTPUT (KLD)	
	Fresh Water	Loss	Effluent
Process	400.2		430.7*
Washings	60		60
Scrubber	40		40
Boiler Feed	300	255	45
Cooling Tower	1100	890	210
DM Regeneration	80		80
Domestic	35	7	32
Gardening	20	20	
Gross Total	2035	1172	897

** Includes water formed during reaction and water in raw material*

11.6 Baseline Environmental Data

The baseline data was collected in the study area during October to December 2017. The baseline data includes collection of samples of ground water, surface water and soil, monitoring of ambient air quality, noise levels, ecological status and meteorological parameters. The analytical results show that the values are within the prescribed limits for air quality. The ground water quality is observed to be above the limits for potable purpose when compared to the prescribed standards of IS: 10500 – 2012 at few locations.

11.7 Identification and Quantification of Impacts

The impact assessment report has identified various sources of pollution and quantified the pollution loads due to proposed expansion. It has also identified the technologies to be adopted for the mitigation and control of the same. The sources of pollution are air emissions from utilities and process; liquid effluents from process, utilities and domestic usage; solid wastes from process, treatment systems and utilities; and noise pollution from utilities, and process equipment.

11.7.1 Impacts on Air quality: The impacts on air quality shall be due to the emissions from, Coal Fired Boilers and standby DG sets. The incremental concentrations are quantified using ISC-AERMOD model based on ISCST3 Algorithm. The results indicate marginal increase in ambient air quality concentration. The predicted values for PM, PM₁₀, PM_{2.5}, SO₂ and NO_x are 4.08, 1.66, 0.73, 8.06 and 15.72µg/m³ respectively and the maximum values are observed at a distance of 1.0 km from the center of plant site in northeast direction, and the cumulative values of baseline air quality combined with predicted values are found to be within the prescribed limits of National Ambient Air Quality Standards. The mitigative and control measures of air pollution shall ensure that the impact on air quality is local – within the site area and its surroundings. The fugitive and diffuse emissions were quantified and a box model was used to predict air borne concentrations, and the results indicate the work room concentrations less than threshold limit values (TLV) for various solvents.

11.7.2 Impacts on Water: Water is essentially used for process and utilities and domestic purposes. The total fresh water required of quantity 2035 KLD after expansion. No impact on water quality is expected due to the discharge of effluents, as treated effluent will be disposed to sea by using marine outfall system.

11.7.3 Impacts on Noise quality: The noise levels may increase due to turbines, motors, compressors, DG set and other activities. The major source of noise generation is turbine which emit noise levels of above 100 dB (A) at a reference distance of 1m from the source. The predicted cumulative noise levels (as calculated by the logarithmic model without noise attenuation) ranged between 55 and 75 dB (A) at distances of 62 to 185m. The increase in noise levels shall have neutral impact, restricted to within site area.

11.7.4 Impacts on Soil: The solid wastes generated from process, utilities and effluent treatment plant may have significant negative impacts if disposed indiscriminately. The total solid waste will be stored separately in Hazardous storage area. Solid waste will be sent to cement plants for co-incineration based on calorific value or sent to TSDF. The operational phase impacts shall be neutral due to effective implementation of mitigative measures in handling, storing and transferring of solid wastes, effluents and chemicals, and development of green belt.

11.7.5 Impacts on Ecology: There are no endangered species of flora and fauna in the impact area. The impact on biological environment is neutral with the effect confined mainly to the site area.

11.8 Environmental Monitoring Programme

It is proposed to monitor Ambient Air Quality (AAQ) for PM₁₀, PM_{2.5}, SO₂ and NO_x, work room for VOC concentrations, stack emissions for boiler and DG sets, noise levels on quarterly basis. Water, treated wastewater on daily basis, Soil analysis will be done once in a year.

11.9 Additional Studies

Risk assessment was conducted and the heat radiation damage distances of pool fire in the tank farm was limited to 12 m for a heat radiation of 4 KW/m², and the same was within the plant premises.

11.10 Project Benefits

The proposed expansion will provide employment to 300 people. The proposed project will also generate indirect employment to the locals during construction phase in the order of 150 people for a period of 18-24 months. The project shall have positive impact on socioeconomic environment due to provision of employment both direct and indirect in addition to proposed corporate environmental responsibility activities and taxes accrued to local body and state government.

11.11 Environment Management Plan

The management plan is drawn in consultation with project proponents and technical consultants after evaluating various mitigation and control measures to address the impacts identified, predicted and monitored. The impacts during construction stage are temporary and less significant, the management plan for impacts identified during operation stage is described as follows;

11.11.1 Liquid Effluents

The effluents generated in the process, separation techniques and during purification contain organic and inorganic soluble raw materials, adducts, solvents, and products. Hence the effluents contain both organic and inorganic salts and chemicals in various quantities. Effluents from process, washings, scrubbing media, garment washings and utility blow downs will be sent to the effluent treatment system. The treated effluent will be disposed to sea by using marine outfall system. Domestic wastewater is sent to sewage treatment plant and treated wastewater is reused for greenbelt development. Total Effluent generated and mode of treatment before and after expansion is presented in

Table 11.5.

Table 11.5 Total Effluent Generated and Mode of Treatment

S.No	Description	Quantity (KLD)		Mode of Treatment/Disposal
		Permitted	After Expansion	
I	High TDS Effluents			
1	Process	71.91	430.7	Effluent is stripped in a steam stripper to remove organics and then concentrated in multiple effect evaporators (MEE) followed by drying in agitated thin film dryer (ATFD). Stripper condensate will be sent to cement plants for Co-
2	Washings	20	60	
3	Scrubber	---	40	

				Incineration. Salt from ATFD is sent to TSDF. Distillate from MEE and ATFD is sent for further treatment in biological treatment plant.
	Total - I	91.91	530.7	
II	Low TDS Effluents			
1	Process	3.6	--	Sent to biological treatment plant and disposed to sea from guard ponds on site, through Marine Outfall system after bioassay, only when it meets the disposal standards.
2	Boiler Blow downs	16	45	
3	Cooling tower blow downs	12.5	210	
4	Domestic wastewater	16	31.5	
5	RO/DM Rejects	53.5	80	
	Total - II	101.6	366.5	
Grand Total (I+II)		193.51	897.2	

11.11.2 Effluent Treatment System

The effluents are segregated into two streams; high TDS/ COD and Low TDS/COD stream. The segregation is at source and is stream wise. Effluent from process, washings and scrubbers are considered as high TDS and high COD streams. Effluent from Boiler, cooling tower blow downs, DM/softener rejects and domestic wastewater are considered as Low TDS and low COD streams. The effluent treatment system shall be developed in modules at the same location for ease of operation.

I. High TDS/ COD Effluents

The treatment system for treating High TDS/ COD effluents consists of equalization, neutralization, settling tank, stripper, multiple effect evaporator (MEE) followed by agitated thin film dryer (ATFD). The organic distillate from the stripper is sent to cement plants for co-incineration and aqueous bottom from stripper is sent to MEE followed by ATFD for evaporation. The condensate from the MEE and ATFD are sent to Effluent treatment plant based on biological treatment. Salts from ATFD are disposed to TSDF.

II. Low TDS/ COD Effluents

These effluents along with the condensate from MEE and ATFD are treated in primary treatment consisting of equalization, neutralization, and primary sedimentation followed by secondary biological treatment consisting of aeration tank and clarifier. The treated effluents after biological treatment will be stored in Guard ponds and sent to marine disposal after meeting the standards in bioassay test.

11.11.3 Air Pollution

The sources of air pollution are boilers, and thermic fluid heaters which use coal as fuel and DG sets which use HSD as fuel. Bag filters are proposed as air pollution control equipment for 1 x 20 TPH, 1 x 12 TPH (standby) and 2 x 10 TPH coal fired boilers. DG sets shall be provided with required stack height based on CPCB formula. Process emissions contain ammonia, carbondioxide, carbon monoxide, hydrogen, nitrogen, nitrous oxide, oxygen, isobutylene, hydrogen chloride, hydrogen bromide and sulfur dioxide. Ammonia, hydrogen chloride, hydrogen bromide and sulphur dioxide are sent to scrubber in series. The resultant solutions after scrubbing i.e., Sodium chloride solution from Hydrogen chloride gas scrubbing, ammonium bicarbonate solution from carbon monoxide, sodium bromide solution from hydrogen bromide scrubbing, ammonium bicarbonate solution from carbon monoxide scrubbing, ammonium chloride solution from ammonia scrubbing, sodium bisulphite solution from sulfur dioxide scrubbing are sent to ETP. Carbon dioxide, Nitrogen, nitrous oxide and oxygen are let out into atmosphere following a standard operating procedure, isobutylene gas let out into atmosphere safely through a flare stack, while Hydrogen gas is let out into atmosphere through a water column.

Emissions are also released from various operations of manufacturing like centrifuge, drying, distillation, extraction etc. These emissions mainly contain volatile contents of the material used for processing. It is proposed to provide vent condensers in series to reactors, distillation columns, driers and centrifuge etc. to mitigate VOC emissions release. Other vents are connected to common headers and scrubbers.

11.11.4 Solvent Use and Recycle

Solvents are used for extraction of products and as reaction medium. Used solvents are recovered by distillation, for reuse. Residues from distillation columns and mixed solvents shall be sent to TSDF for incineration or cement plants for co-incineration. If any of the distilled spent solvents are not reused due to statutory reasons the same shall be sold to end users.

11.11.5 Solid Waste

Solid wastes are generated from process, solvent distillation, effluent treatment system, DG sets and boilers. Stripper distillate, process residue and solvent residue are sent to cement plants for co-incineration based on acceptability as the same contain significant calorific value and are predominantly organic in nature. If these wastes are not suitable for co-incineration, the same are sent to TSDF facility. The evaporation salts from ATFD, and sludge from ETP are sent to TSDF for landfill. Waste oil and used batteries from the DG sets are sent to authorized recyclers. Other solid wastes expected from the unit are containers, empty drums which are returned to the product seller or sold to authorized buyers after detoxification. Coal ash from boiler is sold to brick manufacturers.

11.11.6 Noise Pollution

Noise is anticipated from turbines, motors, compressors, centrifuges and DG sets. DG set shall be provided with acoustic enclosure. Noise absorbing walls are proposed for turbine room and the control room shall be acoustically enclosed. Engineering controls like acoustic enclosures, barriers, shields, and anti-vibrating pads are provided to ensure reduction of noise levels and vibration. Employees working in noise generating areas shall be provided with appropriate personnel protective equipment.

11.11.7 Occupational Safety and Health

Direct exposure to chemicals or its raw materials may affect health of employees. Direct exposure to hazardous materials is eliminated by providing closed handling facilities. Personal Protective Equipment (PPE) i.e., hand gloves, safety goggles, safety shoes, safety helmets, respiratory masks etc. are provided to all the employees working in the plant. Company has a policy of providing PPEs to all personnel including contract workers. Periodic medical checkup in addition to checkup during recruitment is adopted to monitor health status of employees.

11.11.8 Prevention, maintenance and operation of Environment Control Systems

The pollution control equipment, and the effluent treatment system is monitored periodically to estimate their efficiency and performance potential as part of adoptive management. Proactive maintenance and monitoring program for all equipment and

machinery is adopted to identify the problems/under performance of the equipment. Necessary measures will be adopted to rectify the identified problems/defects. The management agrees that the results of monitoring will be reviewed periodically to adopt new measures if necessary, for efficient pollution control.

11.11.9 Transport systems

All the raw materials and finished products are transported by road. Dedicated parking facility is provided for transport vehicles. There will be 12-15 truck trip per day to the factory for transporting raw materials and products. Traffic signs will be placed in the battery limit. The drivers of vehicles will be provided with TREM cards of chemicals and materials to be transported and will be explained the measure to be adopted during various emergencies.

11.11.10 Reduce, Recycle and Reuse

A number of measures are proposed to achieve high yields and reduce generation of wastes. It shall be endeavor of the R&D team to improve yields through constant research and development activities. The solvents shall be recycled for reuse in the process after distillation. Mother liquors from the first crop shall be reused for process. The steam condensate shall be reused for boiler feed. Treated wastewater from sewage treatment plant is reused for greenbelt development. It is also proposed to explore recovery of various salts from MEE salts, and from process effluents to reduce effluent loads, and quantity of solid waste.

11.11.11 Green Belt Development

The management developed green belt in a total area of 32 acres and proposed to increase density to enhance environmental quality through mitigation of fugitive emissions, attenuation of noise levels, balancing eco-environment, prevention of soil erosion, and creation of aesthetic environment

11.11.12 Post Project Monitoring

Environmental monitoring for water, air, noise and solid waste quality will be conducted periodically either by proponent or third party. The frequency of monitoring and the

quality parameters shall be as suggested by the Ministry of Environment and Forests and Climate Change, Government of India.

11.11.13 Environment Management Department

The Environment Management Cell of the project is headed by the President, Senior vice president, vice president operations, DGM- EHS, followed by manager, assistant manager, Dy. Manager and technicians/fitters.

CHAPTER 12.0 DISCLOSURE OF CONSULTANTS ENGAGED

Declaration by Experts Contributing to the EIA

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA coordinator:




Name: **G.V. Reddy**


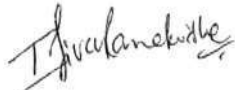



Signature and Date: **January 28, 2019**


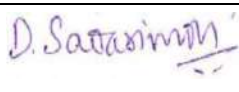
Period of involvement: **August 2017**

Contact information: **Team Labs and Consultants, B115 - 117, 509, Aditya Enclave, Ameerpet, Hyderabad 500038.**

Functional area experts:

S. No.	Functional areas	Name of the expert/s	Involvement (period and task**) Period of involvement: August 2017, till date	Signature and date
1	AP	T.Ravi kiran	Site visit, Design of AAQ network, supervision of AAQ monitoring, Compilation of emissions and characteristics, assessment of impacts due to the proposed expansion, identification of mitigation measures, preparation of EMP for AP, Preparation of monitoring plan for AP.	
2	WP	G.V.Reddy	Site visit, identification of monitoring stations, supervision of sampling, Characterization of effluent streams, segregation of effluent streams, ZLD for effluent treatment, assessment of impacts due to the proposed expansion, identification of mitigation measures, preparation of EMP for WP, Preparation of monitoring plan for WP.	
3	SHW	G.V.Reddy	Site visit, Characterization of solid wastes, storage, and disposal plan for	

			various solid wastes, assessment of impacts due to the proposed expansion, identification of mitigation measures, preparation of EMP for SHW.	
4	SE	K. Nanaji	Site visit, primary and secondary data collection of the impact area, assessment of impacts due to the expansion project on socio economic status and project economy, preparation of CSR plan, Preparation of SE part of EIA report.	
5	EB	I. Sivarama Krishna	Site visit, primary and secondary data collection related to ecology and biodiversity, assessment of impacts based on IAIA guidelines, preparation of mitigation measures, preparation of green belt plan and cost estimate, preparation of EB part of EIA report.	
6	HG	G.V.A. Ramakrishna	Identification of water sheds of the area by preparing the drainage map, assessment of ground water potential of the site and impact area, preparation of rain water harvesting plan, assessment of impacts due to ground water abstraction and mitigation measures.	
7	SC	D. Sundar Rao	Identification of soil sampling locations and characterization of the soils, interpretation of soil analysis reports, assessment of impacts due to spillages, accidental releases of chemicals, effluents etc., and mitigation measures.	
8	AQ	M. Srinivasa Reddy	Assisting AP FAE in identifying the AAQ monitoring stations by providing normal climatological and other historical data, Identification of Micrometeorological data monitoring station, supervision of met data collection using Automatic weather station, Preparation of emission details, Air quality impact prediction modeling, Calculation of work room concentrations of solvents using box model, Assessment of results and preparation of isopleths, assisting the AP FAE and EIA coordinator in preparation	

			of EMP.	
9	LU	G.V.A. Ramakrishna	Preparation of land use land cover map using satellite imagery, ground truth study, assessing the impacts due to expansion. Preparation of FAE report.	
10	RH	D. Sadasivudu	Site visit, assessment of hazop reports, identification of sources of hazards, assessment of storages proposed in comparison with statutory regulations and calculation of FETI to assess the scope of risk assessment, preparation of isopleths for various scenarios as part of consequence analysis, identification of mitigation measures preparation of disaster management plan.	

Declaration by the Head of the accredited consultant organization/ authorized person

I, G.V. Reddy hereby, confirm that the above-mentioned experts prepared the EIA report for M/s. SMS Pharmaceuticals Limited, Unit VII. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature:



Name: G.V. Reddy
Designation: Director

Name of the EIA consultant organization: Team Labs And Consultants
NABET Certificate No: S. No. 150 of List 'A' - Accredited EIA Consultant Organizations complying with Version 3 of the Scheme - as on Rev. 72 January, 2019

S. No.	Consultant Organization	Scope of Accreditation			Project or Activity as per Schedule of MoEFCC Notification dated September 14, 2006 and subsequent Amendments
		As per NABET Scheme		Category	
		Sector Number	Name of Sector		
150	<p style="text-align: center;">TEAM Labs and Consultants</p> <p>Address: B- 115 & 509, Annapurna Block, Aditya Enclave, Ameerpet, Hyderabad – 500038</p> <p>e. mail: teamlabs@gmail.com</p> <p>Tel.: 040 – 23748666/ 23748616 09866415966</p> <p><i>Conditions apply</i></p>	1	Mining of minerals including Open cast / Underground mining	A	1 (a) (i)
		4	Thermal power plants	A	1 (d)
		8	Metallurgical industries (ferrous & non ferrous)	A	3 (a)
		9	Cement plants	A	3 (b)
		11	Coke oven plants	B	4 (b)
		13	Chlor-alkali industry	A	4 (d)
		16	Chemical fertilizers	A	5 (a)
		17	Pesticides industry and pesticide specific intermediates (excluding formulations)	A	5 (b)
		21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A	5 (f)
		22	Distilleries	A	5 (g)
		25	Sugar Industry	B	5 (j)
		31	Industrial estates/ parks/ complexes/Areas, export processing Zones (EPZs), Special	A	7 (c)

S. No.	Consultant Organization	Scope of Accreditation As per NABET Scheme			Project or Activity as per Schedule of MoEFCC Notification dated September 14, 2006 and subsequent Amendments
		Sector Number	Name of Sector	Category	
			economic zones(SEZs), Biotech Parks, Leather Complexes		
		34	Highways	A	7 (f)
		38	Building and construction projects	B	8(a)
		39	Townships and Area development projects	B	8 (b)
151	<p>Terracon Ecotech Pvt. Ltd. Address: 202, Kingston, Tejpal Road, Vile Parle (E), Mumbai 400057, India e. mail: info@terraconindia.com Tel.:022-2613939/40/41, 9820828087 <i>Conditions apply</i></p>	1	Mining of minerals - Open cast mining only	B	1 (a) (i)
		2	Off shore and on shore oil and gas exploration, development and production	A	1 (b)
		3	River valley projects	A	1 (c)
		27	Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/coral reefs /ecologically sensitive Areas including LNG terminal	A	6 (a)
		33	Ports, harbours, break waters and dredging	A	7 (e)
		34	Highways	A	7 (f)
		37	Common municipal solid waste management facility	B	7(i)

SMS PHARMACEUTICALS LIMITED, UNIT - VII

**SY.NO. 160,161,163 TO 168 AND 170 (KANDIVALASA VILLAGE),
SY. NO.72 (KOVVADA AGRAHARAM VILLAGE),
PUSAPATIREGA MANDAL, VIZIANAGARAM DISTRICT,
ANDHRA PRADESH**

3. PUBLIC CONSULTATION

Project No. 0119-21-01

January 2019

**SMS Pharmaceuticals Ltd.
Plot No. 19-III,
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**STUDIES AND DOCUMENTATION BY
TEAM Labs and Consultants
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Hyderabad-500 038.
Phone: 040-23748 555/23748616,
Telefax: 040-23748666**

**SUBMITTED TO
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI**

13. PUBLIC CONSULTATION

13.1 Introduction

The Ministry of Environment, Forest and Climate Change, (MoEFCC) Government of India issued Environmental Impact Assessment notification S.O. 1533 dated September 16, 2006 mandating prior environmental clearance for manufacture of (Bulk drugs and intermediates excluding drug formulations) industry under category 'A' for projects located outside notified industrial area/estate. The proposed expansion project of M/s. SMS Pharmaceuticals Limited., Unit-VII is located at Sy. Nos. 160, 161, 163 to 168 and 170 Kandivalasa village, Sy. No. 72 Kovvada Agraharam village, Pusapatriega mandal, Vizianagaram district, Andhra Pradesh. The proponents obtained terms of reference for preparation of environmental impact assessment report from the MoEFCC, which mandated public consultation vide letter no. IA-J-11011/12/2018-IA II (I) dated 05.02.2018. Accordingly, the draft Environmental Impact Assessment was submitted to Regional Officer, A.P Pollution Control Board, Regional Office Vizianagaram District for conducting public hearing. The public hearing for the proposed expansion of bulk drug and intermediate manufacturing unit was conducted on 12.07.2018 at the existing site premises of M/s. SMS Pharmaceuticals Limited., Unit-VII. The public hearing was chaired by Sri K. Venkata Ramana Reddy, District Joint Collector, Vizianagaram District and Sri T. Sudarsanam, Environmental Engineer, APPCB, Regional Office, Vizianagaram.

13.2 Advertisement

Press notification regarding the date, time and venue of the Environmental public hearing for the proposed expansion was issued in Andhra Jyothi (Telugu daily) and The Times of India (English daily) newspapers on 09.06.2018. Copy of the advertisement is enclosed.

Minutes of the meeting

The minutes of the public hearing is enclosed along with the attendance sheet. Concerns expressed by speakers during public hearing and responses of the proponent are presented in **Table 13.1**. Response to written representations is presented in **Table 13.2**.

13.2 Concerns expressed by public**Table 13.1 Concerns Raised in Public Hearing and Responses**

S.No	Issue raised by	Issue	Proponent's Response
1	Sri M. Venkata Ramana, Kandivalasa Village Ex-Upa Sarpanch	He expressed his happiness stating that the company is giving job opportunities to the locals based on their educational qualifications and skill. The Industry has allocated 1.25 Crores towards corporate social responsibility and has taken up construction of high school building in Pusapatirega village, bore well at Kandivalasa village, health centers at Gumpam and Kovvada villages, Water plants to Rangampeta and Rayudupeta villages consulting with MLA, MPTC, MPP and Sarpanch etc., and also hoped that M/s SMS Pharmaceuticals will take up further CSR programs for the benefit of the villagers. He Further expressed that M/s. SMS Pharma shall have to take up further expansion projects in future and move very intimately as far as possible with the villagers as the pusapatirega mandal is a backward area in the district.	Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal. Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.
2	Sri Akiri Prasada Rao, ZPTC, Pusapatirega	Hestated that the industry shall have to adopt the latest technologies and shall take all necessary measures to not to trouble the surrounding villagers. He felt happy expressing that M/s. SMS Pharma is far better when compared to surrounding other factories in respect of controlling the pollution levels & providing local employment and also renovation of Z.P school building with CSR budget of 75 lakhs. He further stated that the industry shall have to provide employment giving priority to the local people only and shall make sure that there shall not be any education and medical & drinking water problems to the surrounding villages. He further stated that there are around 10 Z.P high school in this area and requested the management to take up CSR	The Proponent assured that the expansion shall follow the prescribed norms of MoEFCC and APPCB to ensure least impact on the surroundings. He said that the management will provide employment to the local people on priority basis as per their qualifications and suitability. Proponent informed that they have started construction of school building in Pusapatirega mandal. Proponent assured to take up CSR activities in addition to CER activities in improving education, health and

		activities in the school's phase wise. He also stated that there is around 80,000 population in their Mandal and all are backward castes of which there shall be justice to be done in all aspects.	drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.
3	Sri. P. Sanyasi Naidu, Sarpanch	He expressed that they anticipated troubles due to establishment of such industries in their area as it being a backward area in the district. He also expressed that they have not faced any pollution pollutions due to the said industry and felt happy expressing that the management is enquiring with the problems of the villages to resolve them in a friendly manner. He further stated that the management response in quite very good in spending the CSR funds for health centers providing RO plant in the villages, distribution of books and school uniforms etc. He further stated that due to establishment of such projects there shall be economical growth in the area giving better opportunities to the villagers.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.
4	Sri.D. Appanna, Zilla Matsya Karya Sangam Adyakshulu	He started that the sea shore villagers have to be further improved as they discharge their treated effluents into sea. He further pleaded that the other industries shall also have to take care of them.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.
5	Sri V. Jagannadham, Upa - Sarpanch, Govindapuram (V)	He started that the industry looks like a software company with lot of greenbelt. He further stated the industry is discharging the effluents and gases generated in their premises from time to time thereby saving the environment. He suggested that the management shall provide employment based on skill, CSR budget must be spent in the surrounding villages on development of school, providing maternity ward, diarrhea patients ward. He stated that A.P. State shall have to be No. 1 and it is responsibility of all of us to encourage the development of industries.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings. Proponent informed that they have started construction of school building in Pusapatirega mandal. Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.

<p>6</p>	<p>Sri K. Prasada Rao, Vempadam Village</p>	<p>He stated that M/s. SMS Pharma is the only company which is providing employment to the locals. He also stated that there are major mistakes of the management regarding the CSR activities. He further stated that the management shall have to take up CSR activities like high school construction in Vempadam village & development of Lord Venkateshwara Swamy temple in the village which is 180 years old. He suggested that the management shall have to take measures assessing the characteristics and pollution load, pay daily according to the work. He further blessed that the industry shall be alive for another 100 years and has to develop further and further.</p>	<p>Proponent ensured that the management will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
<p>7</p>	<p>Sri.M.Srimahachalam, Chintapalli village</p>	<p>He started that there are many unemployed people in the surrounding villages, we are delighted that we will get more jobs in the present expansion project. There are four panchayaths surrounding the marine discharge point of M/s. SMSPharmanamelychintapalli, Pedathadivanipenta, Duppalavalasa& Konada which shall be developed as there is Fish death due to discharge of effluent into Sea. He further requested the PCB authorities to take care that there shall not be any fish death and shall discharge only the treated water into sea. He further suggested that the management shall have to include all the villages in the CSR activities surrounding 10 Kms radius.</p>	<p>Proponent said that the management will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent assured that the company will be established and operated as per government norms without causing any pollution problems to the surrounding area.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in</p>

			<p>Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
8	Sri D.Bhuloka, Konada Village	<p>He started that the company must be still excelled providing jobs to local protecting the environment. He further stated that the management shall have to take up measures for treating the effluent as the surrounding coastal villager's livelihood is fish catch and there are around 13,000 fishers' man at coast. He also pleaded that themanagement shall have to uplift theeconomic status of the surrounding villagers on priority basis as there is gradual decline of the fish growth due to discharge of treated water into sea. He further stated that they are taking up CSR activities in the surrounding 5 to 6 villages only requested the management shall have to cover all the surroundings 26 panchayaths of the pusapatirega Mandal & shall provide employment to the local people only.</p>	<p>The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings. Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
9	Sri P.Laxmi Narayana, Sarpanch, Chodam Agraharam Village	<p>He started that, they are happy to welcome all the surrounding industries like SMS, HBL, CPF etc., as the industries are very caring and responsible towards the surrounding villagers by means of taking up activities like distribution of eggs to the Anganwadi schools, providing employment to the local and by developing</p>	<p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p>

		greenbelt in the surrounding areas.	Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.
10	Sri P.Nuka Raju, Pathivadapeta(V)	He started that the industry shall have to take the demand-oriented village welfare programs in the two villages namely Thammayyapalem, Barripeta as the industry pipelines of M/s. SMS & M/s. Mylan industries were laid in between the two villages of the pathivadapeta panchayath. He further stated that earlier they used to face smell problems, damage of pipeline laid across the villages. He felt happy expressing that the PCB authorities have resolved the above said problems and also other pollution related issues. He further requested that the fisheries department shall have to take measures of proper fish growth in the coastal areas. He also started that the management shall have to provide employment to the local people only.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings. Proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability
11	Sri.M.Janardhana Rao, Pusapatirega	He started that the management shall have to provide employment to the local people only besides adopting the surrounding villages, completing the Taraka Rama TheerthaSagar Project, to take measures to not to dispose the effluents into ponds, to take up measures to eradicate filaria in the surrounding habitation of pusapatirega mandal like Gollaveedhi, KellaVeedhi&Chakalipeta, provide drainage facilities at	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.

		the school. He further stated that the traditional crop of paddy cultivation is getting damaged as the effluents of M/s. Mylan industries is being discharged into River Champavathi into which surrounding 30 pounds joins from pusapatirega to Nathavalasa.	
12	Sri Bheemisetty Babjee	He expressed his happiness that present conditions got far improved from earlier conditions prevailing in the district at the time of 1983. He also expressed that there is no negativity from the villagers against the industries. He further stated the there is every need to increase the PCB staff as there is industrial growth in the district and lot of pollution problem in the district. He suggested that the management shall have to take CSR activities like introduction of MMR (Rubella) Vaccine to Pregnant Women in the Villages, measures to improve literacy rate in the rural area, employment to the local; based on the skill.	<p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p> <p>Proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability and so assured that they will generate the data base of literates in co-ordination with district administration.</p>
13	Sri M.Sankara Rao, Ex -Sarpanch, Rellivalasa Village	He started that they do not bother that how many expansions the management go for, provided they should provide jobs to local peoples only, to develop the surroundings both socially and economically, improve the daily wages to the workers and also stated that the people in this area are very innocent.	<p>Proponent ensured that the management will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc.,</p>

			<p>and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
14	Sri K.ParasuNaidu , Sarpanch,Kovvasa Agraharam Village	<p>He started that the industrialization is must to develop the area both socially and economically. He stated that earlier the people depended on agricultural activity but as the surrounding villagers have given their land to the industries the management in turn shall provide the job based on skill.</p>	<p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
15	Sri N.Venkata Ramana,Pusapatirega	<p>He started that his Mandal is a backward area in all means and also stated that the people are innocent and will bear all the losses quietly. He further stated that the industrial development need to be there and the industries are not following the rule that they shall provide 60% off jobs to the local people only. He also stated that there are pollution problems in this area. He further stated that not that they do not want the industries, it is their request that industries shall have to</p>	<p>The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.</p> <p>Proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p>

		provide employment to the local only. He also stated that they will welcome the company and requested the management that they should construct the temples in the local area.	
16.	Sri P. Satyam, Retd.Head Master, Kandivalasa	He stated that providing the job is not the substitute for pollution and also stated that as they are all based on agricultural activity. He further stated that the so called industries shall not exploit the villagers as the surrounding villagers are all poor & innocent. He stated that the Vizianagaram district is a peaceful district and it is not a revolutionary district. He also stated that PCB in lying back in solving the pollution issues related to Veda Biofuel and HBL Power. He also stated that earlier they have filed several affidavits regarding the pollution problems and also stated that PCB used to attend the high court every Saturday and Wednesday. He further stated that the pollution problems are a bit eradicated and requested to control the pollution immediately.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.
17	Sri D. Appa Rao, Kovvada (V)	He stated that the land of around 25 acres in Sy.no.42 got damaged due to discharge of effluents from M/s. Mylan Industries and also 12 wells were polluted. He also stated that they are fighting since 1996 but till date no justice was done to them. He requested to solve all the pollution problems immediately and also to assure that the industries shall not create pollution in future to the surrounding 5 villages.	The Proponent assured that the expansion shall follow the prescribed norms of MoEF and APPCB to ensure least impact on the surroundings.

Table 13.2 Response to Public Representations

S. No	Represented by	Representation	Proponent's Response
1	Vootkuri Sunanda Reddy Lawyer & Environmentalist Sivaji nagar, Nalgonda District , Tlelangana	<p>He stated that he is the first environmental defender to support industries in the country, He congratulated the management of M/s. SMS pharmaceuticals Limited, Unit- 7. Generally, environmentalist disagree bulk drugs and intermediate industries, but for the development of the state and for the purpose of the 15 -35 years unemployed which are about 40 Crores, he supports the expansion. He requests the management to provide jobs for the unemployed. He also stated that there is a need for a company like M/s. SMS pharmaceuticals Limited, Unit- 7 for our country which occupies 2 % in the total world, in that 17 % ofthe people are suffering from various health issues who need production of Medicines for the people who are suffering from unhealthy issues. He suggested the Management of M/s SMS pharmaceuticals Limited, Unit- 7 proposed for its expansion protecting the environment, without causing any pollution follow the below references</p> <ol style="list-style-type: none"> 1. The Base line survey of air, Water and soil are satisfactory. So, he asked the, management to collect the details of health status, yield of crops, underground waters, so that, the data will be used for future reference. And to produce these details in the final report. 2. The total plant area is 96 acres and, in this rain, water collected might be around 30 Cr lt. In this, Total underground water might be 6 Cr lt. The industry takes 75Crs lt. This much water requirement may affect underground water. So, to prevent this he suggested the management to keep Rain water harvesting structures to store the water. 3. So, to Prevent this rain water must be stored and to make rain water as underground water Rain water Harvesting structures must be implemented. He also suggested to construct rain water harvesting structures to surrounding 	<p>The proponent assured that the Industry will follow the standards prescribed by Ministry of environment forests and climate change with respect to emissions and effluents without causing any pollution problems to the surroundings area.</p> <p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>

		<p>areas of the industry. So as possible they should see that the rain water must be stored for saving water.</p> <ol style="list-style-type: none"> 4. He stated that it is good to know that the green belt is 33 % of total plant area.as an environmentalist he suggests that as the natural resources are limited in the country but, the population is increasing day by day for which the resources might get extinct. So, to protect the natural resources, plans must be implemented for increase of Plantation from 45 % to 50 %. 5. He suggested to implement plantations in the nearby of the industry though village Plantation Programme increase greenery in the villages. 6. Also suggested to implement revenue plantations in roads of nearby villages of the industry. 7. He requested to grow the plants which gives fruits and have medicinal value in place of common plants. 8. He requests to give importance to the local people who are unemployed youth to give job opportunities. 9. He suggested to implement skill development programs in the villages so that they can employ the youth in their industry. The rest of them will work as trainee in the industry and get job opportunity in other industries 10. Management should coordinate the villagers, and the head of the village and form a committee to conduct CSR activity through CSR fund. Coordination Committee should implement target-oriented plans and they must select demand-oriented plans in them. And implement the programs from CSR fund and gain faith of the villagers. 11. He ensures that the industry will become an ideal one protecting the environment. <p>He also ensures that, M/s. SMS pharmaceuticals Limited, Unit- 7 management will protect the environment and run the industry by the local villagers. He congratulates the EIA consultant for making the EIA report in details. He requests the MoEF&CC to</p>	
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		grant all permissions for the industry for its expansion.	
2	A. Mattaiah, Mother Organization (N.G.O), President	Supporting the expansion of the industry he states that the Management of the industry to provide employment opportunities to the Local and surrounding villagers. He requested to adopt the nearby villages and conduct Educational, Medicinal and Health care programs and other welfare activities for its development. Management should provide Personal Protective equipment and medical services to the workers of the industry. The proponent shall assure to take up welfare activities by using CSR budget and take up welfare activities.	<p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>
3	Ch. Nagaraju M.A. (L.L.B), President Green development and Save Environment Society	<p>Supporting the expansion of the industry he states that</p> <ol style="list-style-type: none"> 1. He requests to give importance to the local people who are unemployed youth to give job opportunities. 2. He requested to adopt the nearby villages and conduct Educational, Medicinal and Health care programs and other welfare activities for its development. 3. CSR budget for local villagers. 4. Industry should provide Personal Protective equipment and medical services to the workers of the industry. 5. Skill Development Programs. <p>He requests the MoEF&CC to grant all permissions for the industry for its expansion.</p>	<p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in</p>

			improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.
4	B. Srinivas Social Worker, Green Rural Development Society, N.G.O Organization	<p>Supporting the expansion of the project he stated that</p> <ol style="list-style-type: none"> 1. He requested to adopt the nearby villages and conduct Educational, Medicinal and Health care programs and other welfare activities for its development. 2. The Management of the industry to provide employment opportunities to the Local and surrounding villagers. 3. The proponent shall assure to take up welfare activities by using CSR budget and take up welfare activities and should provide Personal Protective equipment and medical services to the workers of the industry. <p>He requests the MoEF&CC to grant all permissions for the industry for its expansion.</p>	<p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p> <p>The company will provide Personal Protective equipment and medical services to the workers of the industry.</p>
5	CH. Nagaraju, N.G.O	<p>Supporting the expansion of the project follow the below references</p> <ol style="list-style-type: none"> 1. He requested to adopt the nearby villages and conduct Educational, Medicinal and Health care programs and other welfare activities for its development. 2. CSR budget for local villagers. 	<p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like</p>

		<p>3. Management should provide Personal Protective equipment and medical services to the workers of the industry.</p> <p>4. He suggested to implement skill development programs in the villages so that they can employ the youth in their industry. The rest of them will work as trainee in the industry and get job opportunity in other industries.</p> <p>He requests the MoEF&CC to grant all permissions for the industry for its expansion.</p>	<p>providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p> <p>The company will provide Personal Protective equipment and medical services to the workers of the industry.</p>
6	<p>H. Madhubabu, Environment Volunteer, Rural Environment Education and Health Awareness (REEHAS), Hyderabad</p>	<p>Supporting the expansion of the project he stated that all environmentalists are opposing the industries but I am supporting the industries why because, in the time of independence our country population is 30 crores but now it is increased to 120 crores, every year 50 lakhs graduates are coming for employment but government giving employment to only 5 lakhs people, others are getting job opportunities in private sector so we must welcome to the industries.</p> <p>1.The proponent of M/S SMS Pharmaceuticals Ltd proposed to expand their products intermediates (API's)as mentioned above.</p> <p>2.The environmental consultant M/S Team Labs & Consultant Pvt. Ltd. Of this project study area covered 10 km radius around the proposed project area, they studied locations of air ambient quality, noise levels recorded, water sample collected, soil samples also collected these all are in norms CPCB. This is satisfactory.</p>	<p>The proponent assured that they will provide employment to the local people on priority basis as per their qualifications and suitability.</p> <p>Proponent stated that they have allocated 1.25 crores towards CSR activities like providing water plants, health centers etc., and further informed that they have started construction of school building in Pusapatirega mandal.</p> <p>Proponent assured to take up CSR activities in addition to CER activities in improving education, health and drinking water facilities in the surrounding villages in consultation with revenue authorities and public representatives.</p>

		<ol style="list-style-type: none"> 3. The consultant, please take health state of the village people in 10km radius around is must, why because it is very useful in future. 4. Please take crop production details from near agriculture land also. 5. For operation of the project water requirement is 2035 KLD it is taking from the ground water and Thotapalli reservoir, in summer season chance to down fall water level so please arrange rain water harvesting system. 6. Please utilize the waste water to plantation, sprinkling on roads. It controls dust pollution when your vehicles transport time. 7. Your taking area 32 Acres (33%) plantation for green belt is good, it is CPCB norms, but I am requesting to increase if any possible. 8. You take avenue plantation to near villages, road side, it is useful to save environment. Plant fruit baring and medicals value trees. 9. Please give employment opportunities to local people first. And conduct the skill programs for local youth like ITI, Diploma. They will get opportunities other industries also. 10. Give medical facilities to near villages, Conduct medical camps regularly. 11. Give drinking water facility to near villages. 12. Give good education to near village children. 13. Develop all main roads and street roads of near villages. 14. The project will contribute additional revenue to the State & Central Govt. 15. For using of CSR budget please from a Co-ordination 	<p>The company will provide Personal Protective equipment and medical services to the workers of the industry.</p>
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		<p>committee with village people, Govt. officials and company people, and find necessary work for villages not target oriented works.</p> <p>I am recommending authorities of pollution control panel of MoEF&CC for grant permission to the above Proponent.</p>	
7	P.L.N. Rao, Social Worker	<p>He opposed the proposed expansion and stated that the industry is being released their effluents into surrounding lakes and their grievance was also appeared in the newspapers, but there was no action initiated by the government and pleaded not to play with the lives of the people. He further stated that the ground water in the Pusapatirega (V) is polluted, which is the reason for opposing this expansion.</p>	<p>The proponent assured that the Industry will follow the standards prescribed by Ministry of environment forests and climate change with respect to emissions and effluents without causing any pollution problems to the surroundings area.</p>
8	N. Ramesh Naidu, Guntakallu (M), Anantapur (D), Andhrapradesh.	<p>He opposed the proposed expansion and stated that the increase in production capacity, 2x2 MW Co- Generation Power plant will spoil the surrounding Reserve Forest, Animals, Insecticides.</p> <p>He further stated that the industry is being released their effluents into surrounding lakes and their grievance was also appeared in the newspapers, but there was no action initiated by the government and pleaded not to play with the lives of the people. Ground water in the Surrounding villages is polluted, which is the reason for opposing this expansion.</p>	<p>The proponent assured that the Industry will follow the standards prescribed by Ministry of environment forests and climate change with respect to emissions and effluents without causing any pollution problems to the surroundings area.</p>

MINUTES OF THE ENVIRONMENTAL PUBLIC CONSULTATION FOR THE PROPOSED EXPANSION OF EXISTING SYNTHETIC ORGANIC CHEMICALS INDUSTRY (DYES & DYE INTERMEDIATES) OF M/S.SMS PHARMACEUTICALS LTD., UNIT - VII WITH THE TOTAL PROJECT COST OF THE PLANT IS RS. 600.0 CRORES (EXISTING: RS.306.54 CRORES & EXPANSION: RS.293.46 CRORES) AND IT IS PROPOSED TO BE ESTABLISHED IN THE EXISTING PREMISES AND AFTER EXPANSION THE TOTAL LAND ACQUIRED IS 96.56 ACRES INCLUDING THE EXISTING LAND OF 73.5 ACRES LOCATED AT R.SY. NO. 160, 161, 163 TO 168 AND 170 OF KANDIVALASA (V) AND R.SY.NO.72 OF KOVVADA AGRAHARAM (V), POOSAPATIREGA (M), VIZIANAGARAM DISTRICT, ANDHRA PRADESH.

The following are Present

Panel Members:

- 1 Sri. K.Venkata Ramana Reddy,
District Joint Collector,
Vizianagaram.
- 2 Sri. T. Sudarsanam,
Environmental Engineer, APPCB,
Regional Office, Vizianagaram.

At the outset, while welcoming the gathering, the Environmental Engineer explained the features of the Ministry of Environment and Forests (MoEF), Government of India, EIA Notification dated 14/09/2006. According to EIA Notification, Environmental Public consultation is mandatory for getting Environmental Clearance for carrying this kind of establishment / expansion of Bulk drug & Pharmaceuticals from Ministry of Environment and Forests and Climate Change, New Delhi (MoEF), Govt. of India. He stated that M/s. SMS Pharmaceuticals Ltd., Unit - VII, have applied for Environmental Clearance for the proposed expansion of Existing synthetic organic chemicals (dyes & dye Intermediates) industry in 03/01/2018 with MoEF, New Delhi. The Ministry Authorities have appraised the project and issued Terms of References (TORs) to this project i.e. M/s. SMS Pharmaceuticals Ltd., Unit - VII authorities to go for Public Consultation. He informed that the press notice was issued on 09/06/2018 in two newspapers i.e., "Andhra Jyothi" (Telugu) & "The Times of India" (English) and disseminated the same to the general public through beat of tom-tom in the villages intimating about the proposed Public Consultation to be held on 12/07/2018 with project details for inviting suggestions, views, comments and objections from the public for carrying out the proposed Expansion of synthetic organic chemicals (dyes & dye Intermediates) industry by M/s. SMS Pharmaceuticals Ltd., Unit - VII, R. Sy. No. 160, 161, 163 to 168 and 170 of Kandivalasa (V) and R. Sy. No.72 of Kovvada Agraharam (V), Poosapatirega (M), Vizianagaram District, Andhra


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Pradesh, India and further informed that the EIA report was placed in the offices of Panchayaths, Tahsildar in English and Telugu languages for information of general public.

Seven written representation was received within the stipulated time i.e. 30 days from the date of issue of notification favoring the proposed expansion of synthetic organic chemicals (dyes & dye intermediates) industry. Five representations welcomed the project stating that the proposed project management shall assure to protect the environment in the surrounding areas, to take up welfare activities through CSR budget and also provide employment to the local people only. Two representations were against the proposed project. The copies of the same are appended to the minutes.

The District Joint Collector, Vizianagaram has explained that this unit is already established/existing synthetic organic chemicals (dyes & dye intermediates) industry in this area and now the industry proposed to expand their production capacity. He, then, requested the public to express their opinion, objections if any regarding the proposed expansion project. He also stated that the public may also approach the pollution control Board to express their views.

Sri N.Hema Durga Prasad, General Manager of M/s. SMS Pharmaceuticals Ltd.,
Unit - VII informed that they have established the existing unit 10 years back i.e in 2008. He stated that they are giving 90 % of the job opportunities to the locals only. He further informed that there are 500 graduates working in their plant, out of which around 400 to 450 are from the local villages only. He also informed that around 100 persons from the local areas are working in their plant on daily wages basis. He further stated that they have allocated an amount of 1.25 Crores towards CSR activities like providing water Plants, health centers etc., and further informed that recently they have started construction of school building in Pusapatirega Mandal and expressed happiness that the surrounding villagers have supported them. He further hoped that their support will be there in the coming days also. He further informed that their consultant will explain the details of the technical aspects of the proposed project along with EIA study revelations.

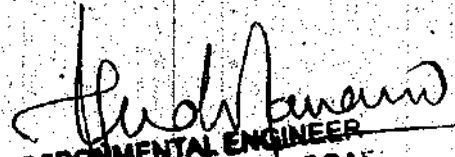
Sri G.V. Reddy, Team Consultancy, Consultant of the proposed project has explained the public about the details of the proposed expansion of the existing Bulk drug and Pharmaceuticals Unit which are as follows: -

- ❖ **M/s. SMS Pharmaceuticals Ltd.,** was established in the year 2008 and now expanding from 179.05 TPM to 740.76 TPM and the project area is located in two villages i.e Kovvada Agraharam and Kandivalasa village.
- ❖ The Environmental Consultant of the proposed project has studied the base line data for Ambient Air Quality, Surface & Ground Water Quality, Noise and Soil Quality in 8 stations

in the surrounding 10 Km radius from the proposed expansion project area to assess the existing Environmental scenario in the area from October -December 2017.

- ❖ The sources of air pollution in the proposed expansion activity are utility emissions from boilers, process emissions from reactions and operations, emissions from pollution control facilities and storages. Emissions are released from various operations of manufacturing like centrifuge, drying, distillation, extraction etc., It is proposed to provide vent condensers in series to reactors, distillation columns, driers and centrifuge etc., to mitigate the VOC emissions release. Other vents are connected to common headers and scrubbers.
- ❖ The effluents contain both organic and inorganic salts and Chemicals. Effluents from process, washings, scrubbing media and utility blow downs will be sent to the ETP. The treated effluent will be disposed to Sea by using marine outfall System. The total effluent generated after expansion would be around 897 KLD.
- ❖ Solid wastes are generated from process, Solvent distillation, ETP and boilers. Stripper distillate, process residue and solvent residue are sent to cement plants for co-incineration or to TSDF.
- ❖ The management developed green belt in a total area of 32 acres and also proposed to increase density to enhance environmental quality.
- ❖ The management proposes to spend 0.5% of the capital cost of expansion towards Corporate Environment Responsibility (CSR) in the surrounding villages for Organization of medical camps in surrounding villages, training, awareness and skill development programs, women empowerment, drinking water facility and Educational facilities under CSR activities.

Sri M.Venkata Ramana, Kandivalasa Village Ex-Upa Sarpanch, stated that M/s SMS Pharmaceuticals limited has come for public hearing as per the rules and regulations framed by the Law. He expressed his happiness stating that the company is giving job opportunities to the locals based on their educational qualifications and skill. The industry has allocated 1.25 Crores towards corporate social responsibility and has taken up construction of high school building in Pusapatirega village, bore well at Kandivalasa village, health centers at Gumpam & Kovyada villages, Water plants to Rangampeta & Rayudupeta villages consulting with MLA, MPTC, MPP and Sarpanch etc., and also hoped that M/s. SMS pharmaceuticals will take up further CSR programs for the benefit of the villagers. He further expressed that M/s. SMS Pharma shall have to take up further expansion projects in future and move very intimately as far as possible with the villagers as the Pusapatirega mandal is a backward area in the district.


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Sri Akiri Prasada Rao, ZPTC, Pusapatirega while welcoming the proposed project stated that Hon'ble Chief Minister is visiting the other countries hoping development of our country both socially and economically welcoming the new projects. He further stated that the industry shall have to adopt the latest technologies and shall take all necessary measures to not to trouble the surrounding villagers. He felt happy expressing that M/s. SMS Pharma is far better when compared to the surrounding other factories in respect of controlling the pollution levels & providing local employment and also renovation of Z.P school building with CSR budget of 75 lakhs. He further stated that the industry shall have to provide employment giving priority to the local people only and shall make sure that there shall not be any education and medical & drinking water problems to the surrounding villages. He further stated that there are around 10 Z.P high Schools in this area and requested the management to take up CSR activities in the schools phase wise. He also stated that there is around 80,000 population in their Mandal and all are backward castes for which there shall be justice to be done in all aspects.

Sri. P.Sanyasi Naidu, Sarpanch, while welcoming the project stated that it had been 10 yrs that this existing project was established and earlier they used to face smell problems due to operation of these industries. He expressed that they anticipated troubles due to establishment of such industries in their area as it being a backward area in the district. He also expressed that they have not faced any pollution pollutions due to the said industry and felt happy expressing that the management is enquiring with the problems of the villagers to resolve them in a friendly manner. He further stated that the management response is quite very good in spending the CSR funds for health centers, providing RO plants in the villages, distribution of books and school uniforms etc. He further stated that due to establishment of such projects there shall be economical growth in the area giving better opportunities to the villagers.

Sri. D. Appanna, Zilla Matsya Karya Sangam Advakshulu, while welcoming the proposed project stated that this is one of the best company operating in their area in co-ordination with the local villagers meeting the panchayathi requirements and following safety measures. He stated that the sea shore villages have to be further improved as they discharge their treated effluents into Sea. He further pleaded that the other industries shall also have to take care of them.

Sri V. Jagannadham, Upa-Sarpanch, Govindapuram(V) while welcoming the proposed project, stated that M/s. SMS Pharma is located in between four villages. He stated that the said industry looks like a software company with lot of greenbelt. He further stated the industry is discharging the effluents and gases generated in their premises from time to time thereby saving the environment. He suggested that the management shall provide employment based on skill, CSR budget must be spent in the surrounding villages on development of school, providing maternity ward, diarrhea patients' ward. He stated that A.P. State shall have to be No.1 and it is the responsibility of all of us to encourage the development of industries.

Sri K.Prasada Rao, Vempadam Village, while welcoming the project expressed his happiness that it is their fortune that M/s. SMS Pharma is going for expansion. He stated that M/s. SMS Pharma is the only one company which is providing employment to the locals. He also stated that there are minor mistakes of the management regarding the CSR activities. He further stated that the management shall have to take up CSR activities like high school construction in Vempadam village & development of Lord Venkateswara Swamy temple in the village which is 180 years old. He suggested that the management shall have to take measures assessing the characteristics and pollution load, Pay daily according to the work. He further blessed that the industry shall be alive for another 100 years and has to develop further and further.

Sri.M.Simhachalam,Chintapalli Village, while welcoming the project stated that there are many unemployed people in the surrounding villages, we are delighted that we will get more jobs in the present expansion project. There are four panchayaths surrounding the marine discharge point of M/s. SMS Pharma namely Chintapalli, Pedathadivanipeta, Duppalavalasa & Konada which shall be developed as there is Fish death due to discharge of the effluent into Sea. He further requested the PCB authorities to take care that there shall not be any fish death and shall discharge only the treated water into sea. He further suggested that the management shall have to include all the villages in the CSR activities surrounding 10 Kms radius.

Sri D.Bhuloka,Konada Village while welcoming the proposed project stated that all the industries in the Pusapatirega mandal are supporting well to the surrounding villages. He stated that the company must be still excelled providing jobs to the locals protecting the environment. He further stated that the management shall have to take up measures for treating the effluent as the surrounding coastal villagers livelihood is fish catch and there are around 13,000 fisherman at the coast. He also pleaded that the management shall have to uplift the economical status of the surrounding villagers on priority basis as there is gradual decline of fish growth due to discharge of treated water into Sea. He further stated that they are taking up CSR activities in the surrounding 5 to 6 villages only and requested that the management shall have to cover all the surrounding 26 panchayaths of the Pusapatirega Mandal & shall provide employment to the local people only.

Sri P.Laxmi Narayana, Sarpanch, Chodam Agraharam Village while welcoming the proposed project stated that, they are happy to welcome all the surrounding industries like SMS,HBL,CPF etc., as the industries are very caring and responsible towards the surrounding villagers by means of taking up activities like distribution of eggs to the Anganwadi Schools, providing employment to the locals and by developing greenbelt in the surrounding areas.

Sri.P.Nuka Raju,Pathivadapeta(V), while welcoming the project stated that the industry shall have to take the demand oriented village welfare programs in the two villages namely Thammayyapalem, Barripeta as the industry pipelines of M/s SMS & M/s Mylan Industries were laid in between the two villages of the Pathivadapeta panchayath. He further stated that earlier

they used to face smell problems, damage of pipelines laid across the villages. He felt happy expressing that the PCB authorities have resolved the above said problems and also other pollution related issues. He further requested that the fisheries department shall have to take measures for proper fish growth in the coastal areas. He also stated that the management shall have to provide employment to the local people only.

Sri.M. Janardhana Rao, Pusapatirega, while welcoming the project stated that the management shall have to provide employment to the local people only besides adopting the surrounding villages, completing the Taraka Rama Theertha Sagar Project, to take measures to not to dispose the effluents into ponds, to take up measures to eradicate filaria in the surrounding habitations of Pusapatirega mandal like Gollaveedhi, kella veedhi & Chakallipeta, provide drainage facilities at the schools. He further stated that the traditional crop of paddy cultivation is getting damaged as the effluents of M/s. Mylan Industries is being discharged into River Champavathi into which surrounding 30 ponds joins from Pusapatirega to Nathavalasa.

Sri Bheemisetty Babjee while welcoming the proposed project expressed his happiness that present conditions got far improved from earlier conditions prevailing in the district at the time of 1983. He also expressed that there is no negativity from the villagers against the industries. He further stated that there is every need to increase the PCB staff as there is industrial growth in the district and lot of pollution problems in the district. He suggested that the management shall have to take CSR activities like introduction of MMR (Rubella) Vaccine to Pregnant Women in the villages, measures to improve literacy rate in the rural areas, employment to the locals based on the skill.

Sri M.Sankara Rao, Ex-Sarpanch, Rellivalasa Village while welcoming the project stated that they do not bother that how many expansions the management go for, provided they should provide jobs to the local people only, to develop the surroundings both socially and economically, improve the daily wages to the workers and also stated that the people in this area are very innocent.

Sri K.Parasu Naidu, Sarpanch, Kovvada Agraharam Village while welcoming the project stated that the industrialization is must to develop the area both socially and economically. He stated that earlier the people depended on agricultural activity but as the surrounding villagers have given their land to the industries the management in turn shall provide the jobs based on skill.

Sri N.Venkata Ramana, Pusapatirega while welcoming the project stated that this mandal is a backward area in all means and also stated that the people are innocent and will bear all the losses quietly. He further stated that the industrial development need to be there and the industries are not following the rule that they shall provide 60 % of jobs to the local people only. He also stated that there are pollution problems in this area. He further stated that not that they do not want the industries, it is their request that the industries shall have to

provide employment to the locals only. He also stated that they will welcome the company and requested the management that they should construct the temples in the local area.

Sri P.Satyam, Retd.Head Master,Kandivalasa while welcoming the project stated that there are only two problems one is employment and the other is pollution. He quoted that pollution free life is the fundamental right of every citizen. He stated that providing the jobs is not the substitute for pollution and also stated that as they are all based on agricultural activity. He further stated that the so called industries shall not exploit the villagers as the surrounding villagers are all poor & innocent. He stated that the Vizianagaram district is a peaceful district and it is not a revolutionary district. He also stated that PCB is lying back in solving the pollution issues related to Veda Biofuel and HBL Power. He also stated that earlier they have filed several affidavits regarding the pollution problems and also stated that PCB used to attend the high court every Saturday and Wednesday. He further stated that the pollution problems are a bit eradicated and requested to control the pollution immediately.

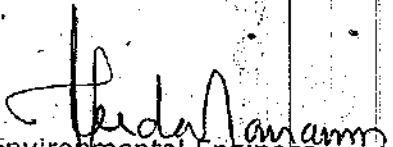
Sri D.Appa Rao, Kovvada(V) while welcoming the project expressed his grievance that the management is not providing jobs to the local graduates in spite of pursuing with the industries regularly. He stated that the land of around 25 acres in Sy.no.42 got damaged due to discharge of effluents from M/s. Mylan Industries and also 12 wells were polluted. He also stated that they are fighting since 1996 but till date no justice was done to them. He requested to solve all the pollution problems immediately and also to assure that the industries shall not create pollution in future to the surrounding 5 villages.

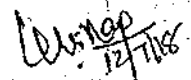
While concluding the proceedings of the Public Consultation, the District Joint Collector, Vizianagaram stated that the management shall have to give first preference to control pollution and second preference to provide employment to locals.

Sri N.Hema Durga Prasad, General Manager of M/s. SMS Pharmaceuticals Ltd.,
Unit - VII while replying to the issues raised in the public hearing stated the following:

- 1) He welcomed the suggestions made by the public and promised that they will fulfill all the suggestions.
- 2) The management will provide employment to the local people on priority basis as per their qualifications and suitability.
- 3) He assured that the company will be established and operated as per Government norms without causing any pollution problems to the surrounding area.

The District Joint collector further thanked everyone informed that all the proceedings of the hearing was recorded and will be sent to the Ministry of Environment, Forest and Climate Change, Govt. of India for taking further necessary action in respect of Environmental Clearance.


Environmental Engineer
APPCB-RO-Vizianagaram


District Joint Collector,
Vizianagaram District.



A.P. POLLUTION CONTROL BOARD

Regional Office: Plot No. 11, 1st Floor, Shivaji Colony,
Pradeep Nagar, Vizianagaram - 002.

ENVIRONMENTAL PUBLIC CONSULTATION NOTIFICATION

In accordance with the EIA Notification No.S.O.1533, dated 14th September, 2006 and its subsequent amendments and the circulars issued thereof, the Ministry of Environment & Forest, Government of India under Environment (Protection) Act, 1986, the A.P. Pollution Control Board, hereby issues Public Consultation Notification for setting up of expansion of existing synthetic organic chemicals industry (dyes & dye intermediates) from 179.05 TPM to 740.76 TPM and Captive power plant of 2x2 MW. The total project cost of the plant is Rs. 600.0 Crores (Existing: Rs.306.54 Crores & Expansion: Rs.293.46 Crores) and it is proposed to be established in the existing premises and after expansion the total land acquired is 96.58 Acres including the existing land of 73.5 Acres located at R. Sy. No. 160,161,163 to 168 and 170 of Kandivalasa (V) and R.Sy.No.72 of Kovvada Agraharam (V), Poosapatirega (M), Vizianagaram District, Andhra Pradesh.

Project details are as mentioned below:

1	Name & Address of the Project Office:	M/s. SMS Pharmaceuticals Ltd., Unit - VII, R. Sy. No. 160,161,163 to 168 and 170 of Kandivalasa (V) and R. Sy. No.72 of Kovvada Agraharam (V), Poosapatirega (M), Vizianagaram District, Andhra Pradesh, 91 40 66288888, Ext. 941, Mobile: 91 8374455510; E-mail: info@smspharma.com
2	Location of the Project	R. Sy. No.160,161,163 to 168 and 170 of Kandivalasa (V) and R. Sy. No. 72 of Kovvada Agraharam (V), Poosapatirega (M), Vizianagaram District, Andhra Pradesh, India.
3	Name of the Authorized person to be contacted with address & Phone No.	Sri C. Chandra Sekhar, Corporate Head - EHS, M/s. SMS Pharmaceuticals Ltd., Unit - VII, Plot No.19-III, Road No.71, Opp. Bharatiya Vidya Bahavan Public School, Jubilee Hills, Hyderabad - 500 096, Phone No. 91 40 66288888, Ext. 941, Mobile: 91 8374455510, E-mail: info@smspharma.com
4	Project Cost	Rs. 600.0 Crores (After Expansion).
5	Line of Activity	Synthetic Organic Chemicals Industry (Dyes & Dye Intermediates).
6	Date, Time & Venue of Public Hearing	Date: 12/07/2018 (Thursday); Time: 10:30 AM, Venue: Near the existing premises of M/s. SMS Pharmaceuticals Ltd., Unit - VII.

7. Place of availability of Executive Summary & REIA Report / Management Plan along with soft copies which are kept open for public:

- Office of the District Collector, Vizianagaram.
- Office of the Chief Executive Officer, Zilla Parishad, Vizianagaram.
- Office of the General Manager, District Industries Center, Vizianagaram.
- Office of the Member Secretary, A.P. Pollution Control Board, near Sun Rise Hospital, Pushpa Hotel Center, Chalamavari Street, Kasturibaipet, Vijayawada - 520 010.
- Office of the Joint Chief Environmental Engineer, APPCB, Zonal Office, Vuda Layout, Madahayadhaga, Behind RTA Office, Visakhapatnam - 530018.
- O/o, the MoEF & CC, Regional Office (South Eastern Zone), 1st & 2nd Floor, HEPQ Building, No. 34, Cathedral Garden Road, Nungambakkam, Chennai - 600 034.
- Office of the District Revenue Office, Vizianagaram District.
- Office of the Revenue Divisional Office, Vizianagaram District.
- Office of the Tahasildar, Poosapatirega (Village & Mandal), Vizianagaram District.
- Gram Panchayat Office, Kandivalasa (V), Poosapatirega (M), Vizianagaram District.
- Gram Panchayat Office, K. Agraharam (V), Poosapatirega (M), Vizianagaram District.
- Office of the Environmental Engineer, A.P. Pollution Control Board, Regional Office, Plot No.11, 1st Floor, Shivaji Colony, Pradeep Nagar, Vizianagaram - 535 004.

Suggestions, Views, Comments and Objections of the public on environmental issues if any on the above project are invited on or before 12/07/2018. All the persons can also make written suggestions to the under signed officer of the Andhra Pradesh Pollution Control Board on or before 12/07/2018. All the persons can also participate in the public hearing on the date and venue specified above.


Date: 06/06/2018.
Place: Vizianagaram

Sd/- ENVIRONMENTAL ENGINEER
A.P. Pollution Control Board
Regional Office: Vizianagaram


ENVIRONMENTAL ENGINEER
A.P. POLLUTION CONTROL BOARD
REGIONAL OFFICE
VIZIANAGARAM

ఆంధ్రప్రదేశ్

(కా.ప.సం. 09 నంబర్ 01 2018)



ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి

ప్రాంతీయ కార్యాలయం, ప్లాట్ నెం. 11, శివాజీ కాలనీ, ప్రదీప్ నగర్,
విజయనగరం - 535 002, ఫోన్: 08922-227370

సామాన్య ప్రజాస్వామ్య సేవల ప్రకటన

భారత ప్రభుత్వ పర్యావరణ మరియు అటవీ మంత్రిత్వ శాఖ పర్యావరణ చట్టం 1986 క్రింద విడుదల చేసిన ఎస్.ఐ.నెం.1533, తే 14-09-2006 ది మరియు తదుపరి సర్దుబాట్ల ప్రకారం మెస్సర్స్ ఎస్.ఎమ్.ఎస్. ఫార్మాస్యూటికల్స్ లిమిటెడ్, యూనిట్-7, సర్వే నెం.160,161,163 నుండి 168 మరియు 170, కందివలస (గ్రామం) మరియు సర్వే నెం.72, కొవ్వూడ ఆగ్రహారం (గ్రామం), పూసపాటిరేగ(మండలం) విజయనగరం జిల్లాలో బియ్యదాగ్ (బెషర్ మరియు బెషర్ ఉత్పత్తులు) పరిశ్రమ వారు ప్రస్తుతం ఉన్న బియ్యదాగ్ (బెషర్ మరియు బెషర్ ఉత్పత్తులు) పరిశ్రమ విస్తరణకు సంబంధించి అసగూ 179.05 టి.పి.యమ్ నుండి 740.76 టి.పి.యమ్ మరియు 2x2 మోగావాట్, మొత్తం ప్రాజెక్టు గాను రూ.600.0 కోట్లు (ప్రస్తుతం : 306.54 కోట్ల రూపాయలు మరియు 293.46 కోట్ల రూపాయలు విస్తరణకు గాను) ప్రతిపాదనకు సంబంధించి పర్యావరణ ప్రజాస్వామ్య సేవల సదున్న నిర్వహించుట గురించి ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి విజయనగరం జిల్లా వారు జారీచేయు ప్రకటన

ప్రాజెక్టు వివరములు క్రింది విధంగా ఉన్నది :

1	సంస్థ పేరు మరియు చిరునామా	మెస్సర్స్ ఎస్.ఎమ్.ఎస్. ఫార్మాస్యూటికల్స్ లిమిటెడ్, యూనిట్-7 సర్వే నెం.160, 161,163 నుండి 168 మరియు 170, కందివలస (గ్రామం) మరియు సర్వే నెం.72, కొవ్వూడ ఆగ్రహారం (గ్రామం), పూసపాటిరేగ(మండలం), విజయనగరం జిల్లా, ఆంధ్రప్రదేశ్, ఫోన్ నెం. 91 40 66 288888, 941, సెల్ నెం:91 837445510, e-mail:info@smspharma.com
2	ప్రాజెక్టు స్థలం	సర్వే నెం.160, 161, 163 నుండి 168 మరియు 170, కందివలస (గ్రామం) మరియు సర్వే నెం. 72, కొవ్వూడ ఆగ్రహారం (గ్రామం) పూసపాటిరేగ (మండలం, విజయనగరం జిల్లా, ఆంధ్రప్రదేశ్.
3	అధికృత వ్యక్తి పేరు మరియు చిరునామా	శ్రీ సి.చంద్రశేఖర్, కార్పొరేట్ హెడ్ - ఐ.ఎస్.ఎస్., మెస్సర్స్ ఎస్.ఎమ్.ఎస్. ఫార్మాస్యూటికల్స్ లిమిటెడ్, యూనిట్-7, ప్లాట్ నెం. 19-II, రోడ్ నెం.71, భారతీయ విద్యాభవన్ పబ్లిక్ స్కూల్, జూబ్లీహిల్స్, హైదరాబాద్ - 500 096, ఫోన్ నెం. 91 40 66288888,941 సెల్ నెం:91 837445510, e-mail:info@smspharma.com
4	ప్రాజెక్టు విలువ	రూ.600.0 కోట్లు (విస్తరణ తరువాత)
5	ఉత్పత్తి వివరములు	బియ్యదాగ్ (బెషర్ మరియు బెషర్ ఉత్పత్తులు).
6	శే.డి. సమయం మరియు జరుగు స్థలం	శే.డి : 12-07-2018 నం, (గురువారం) సమయం ఉ.10.30 గం.లకు మరియు జరుగు స్థలం ప్రస్తుతం ఉన్న పరిశ్రమ అయిన మెస్సర్స్ ఎస్.ఎమ్.ఎస్. ఫార్మాస్యూటికల్స్ లిమిటెడ్, యూనిట్-7 దగ్గర

7. ప్రాజెక్టు కార్యనిర్వాహక సమాచారం, ప్రాజెక్టు పర్యావరణ ప్రభావ అంచనా మరియు కార్యాచరణ ప్రణాళిక నివేదిక మరియు (సాఫ్ట్ కాపీలు) ప్రజలు చూచుటకు అందుబాటులో ఉంచబడిన ప్రదేశములు :

1) జిల్లా కలెక్టరు వారి కార్యాలయం, విజయనగరం. 2) ముఖ్యకార్యనిర్వాహకాధికారి వారి కార్యాలయం, జిల్లా పరిషత్, విజయనగరం. 3) జిల్లా పరిశ్రమల శాఖ, ఇంటర్మీడియట్ ఎస్టేట్, విజయనగరం. 4) సభ్య కార్యదర్శి, ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి, సన్లైన్ హాస్పిటల్ దారి, పుష్ప హాటల్ సెంటర్, చలమవారి వీధి, కస్తూరిబాయి పేట, విజయవాడ - 520 010. 5) జోనల్ కార్యాలయం, ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి, ఉదా లేఅవుట్, పూర్వధార, ఆర్.టి.ఎ.ఆఫీస్ వెనుక, విశాఖపట్టణం. -6) కేంద్ర పర్యావరణ మరియు అటవీ కేంద్రీయ కార్యాలయం మరియు క్వెమెట్ ఫేంజీ (సౌత్ ఈస్టర్న్ జోన్), 1వ మరియు 2వ అంతస్తు, హెచ్.ఐ.సి.సి. బిల్డింగ్ నెం.34, కేతెడ్రల్ గార్డెన్ రోడ్, సుగాంబాకమ్, చెన్నై - 600034. 7) జిల్లా రెవెన్యూ అధికారి వారి కార్యాలయం, విజయనగరం జిల్లా. 8) రెవెన్యూ డివిజన్ లో అధికారి వారి కార్యాలయం, విజయనగరం జిల్లా. 9) తహశీల్దార్ కార్యాలయం, పూసపాటిరేగ (గ్రామం మరియు మండలం), విజయనగరం జిల్లా. 10) గ్రామపంచాయతీ కార్యాలయం, కందివలస (గ్రామం), పూసపాటిరేగ (మండలం), విజయనగరం జిల్లా. 11) గ్రామపంచాయతీ కార్యాలయం, కొవ్వూడ ఆగ్రహారం(గ్రామం), పూసపాటిరేగ (మండలం), విజయనగరం జిల్లా. 12) ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి, ప్రాంతీయ కార్యాలయం, ప్లాట్ నెం.11, శివాజీ కాలనీ, ప్రదీప్ నగర్, విజయనగరం-535 004.

పై తెలియజేసిన ప్రాజెక్టుకు సంబంధించి ఏమైనా సూచనలు, సలహాలు, అభిప్రాయాలు మరియు ఆశ్చర్యాలను ఉన్న యెడల తే 12-07-2018 దిన గాని, దానికి ముందుగాని ఈ క్రింది సంతకము చేసిన అధికారి వారికి రిచివ్ పూర్వకముగా సంబంధపచ్చు మరియు పైన సూచించిన తేదీ మరియు ప్రదేశము వద్ద పర్యావరణ ప్రజాస్వామ్య సేవల సదున్నలో పాల్గొని గాని తెలియజేయవచ్చు.

సం/
(సామాన్య ప్రజాస్వామ్య)
ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి.
ప్రాంతీయ కార్యాలయం, విజయనగరం.

స్థలం : విజయనగరం,
తే.డి : 08-06-2018.


ENVIRONMENTAL ENGINEER
A.P.POLLUTION CONTROL BOARD
REGIONAL OFFICE
VIZIANAGARAM

SMS PHARMACEUTICALS LIMITED, UNIT - VII

**SY.NO. 160,161,163 TO 168 AND 170 (KANDIVALASA VILLAGE),
SY. NO.72 (KOVVADA AGRAHARAM VILLAGE),
PUSAPATIREGA MANDAL, VIZIANAGARAM DISTRICT,
ANDHRA PRADESH**

4. COMPLIANCE OF TERMS OF REFERENCE

Project No. 0119-21-01

January 2019

**SMS Pharmaceuticals Ltd.
Plot No. 19-III,
Opp. Bharatiya Vidya Bhavan Public School,
Road No. 71, Jubilee Hills,
Hyderabad – 502307
Phone: +91 040-6628 8888, 8374455510
E-mail ID: chandrashaker@smspharma.com**

**STUDIES AND DOCUMENTATION BY
TEAM Labs and Consultants
B-115-117 & 509, Annapurna Block,
Aditya Enclave, Ameerpet,
Hyderabad-500 038.
Phone: 040-23748 555/23748616,
Telefax: 040-23748666**

**SUBMITTED TO
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI**

No.IA-J-11011/12/2018-IA-II(I)
Government of India
Minister of Environment, Forest and Climate Change
Impact Assessment Division

Indira Paryavaran Bhavan,
Vayu Wing, 3rd Floor, Aliganj,
Jor Bagh Road, New Delhi-110003
05 Feb 2018

To,

M/s SMS PHARMACEUTICALS LIMITED
SMS Pharmaceuticals Limited, Unit VII,
Vizianagaram-535204
Andhra Pradesh

Tel.No.040-66288888; Email:chandrashaker@smspharma.com

Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

- | | |
|---|---|
| 1. Proposal No.: | IA/AP/IND2/72041/2018 |
| 2. Name of the Proposal: | SMS Pharmaceuticals Limited, Unit VII |
| 3. Category of the Proposal: | Industrial Projects - 2 |
| 4. Project/Activity applied for: | 5(f) Synthetic organic chemicals industry (dyes & dye intermediates; bulk |
| 5. Date of submission for TOR: | 03 Jan 2018 |

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

5(f):STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR SYNTHETIC ORGANIC CHEMICALS INDUSTRY (DYES & DYE INTERMEDIATES; BULK DRUGS AND INTERMEDIATES EXCLUDING DRUG FORMULATIONS; SYNTHETIC RUBBERS; BASIC ORGANIC CHEMICALS, OTHER SYNTHETIC ORGANIC CHEMICALS AND CHEMICAL INTERMEDIATES) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

A. STANDARD TERMS OF REFERENCE

1) Executive Summary

2) Introduction

- i. Details of the EIA Consultant including NABET accreditation
- ii. Information about the project proponent
- iii. Importance and benefits of the project

3) Project Description

- i. Cost of project and time of completion.
- ii. Products with capacities for the proposed project.
- iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.
- iv. List of raw materials required and their source along with mode of transportation.
- v. Other chemicals and materials required with quantities and storage capacities
- vi. Details of Emission, effluents, hazardous waste generation and their management.
- vii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)
- viii. Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided
- ix. Hazard identification and details of proposed safety systems.
- x. Expansion/modernization proposals:
 - c. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

addition, status of compliance of Consent to Operate for the ongoing existing operation of the project from SPCB shall be attached with the EIA-EMP report.

- d. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.

4) Site Details

- i. Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.
- ii. A toposheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)
- iii. Details w.r.t. option analysis for selection of site
- iv. Co-ordinates (lat-long) of all four corners of the site.
- v. Google map-Earth downloaded of the project site.
- vi. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.
- vii. Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.
- viii. Landuse break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)
- ix. A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area
- x. Geological features and Geo-hydrological status of the study area shall be included.
- xi. Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)
- xii. Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.
- xiii. R&R details in respect of land in line with state Government policy.

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

5) Forest and wildlife related issues (if applicable):

- i. Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)
- ii. Landuse map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (*in case of projects involving forest land more than 40 ha*)
- iii. Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.
- iv. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.
- v. Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.
- vi. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.

6) Environmental Status

- i. Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.
- ii. AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.
- iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.
- iv. Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.
- v. Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.
- vi. Ground water monitoring at minimum at 8 locations shall be included.
- vii. Noise levels monitoring at 8 locations within the study area.
- viii. Soil Characteristic as per CPCB guidelines.
- ix. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

- x. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.
- xi. Socio-economic status of the study area.

7) Impact and Environment Management Plan

- i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.
- ii. Water Quality modelling - in case of discharge in water body
- iii. Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.
- iv. A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.
- v. Details of stack emission and action plan for control of emissions to meet standards.
- vi. Measures for fugitive emission control
- vii. Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.
- viii. Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.
- ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.
- x. Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.

- xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.
- xii. Action plan for post-project environmental monitoring shall be submitted.
- xiii. Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.

8) Occupational health

- i. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers
- ii. Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.
- iii. Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,
- iv. Annual report of health status of workers with special reference to Occupational Health and Safety.

9) Corporate Environment Policy

- i. Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.
- ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.
- iii. What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.
- iv. Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

- 10) Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.
- 11) Enterprise Social Commitment (ESC)
 - i. Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic development activities need to be elaborated upon.
- 12) Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.
- 13) 'A tabular chart with index for point wise compliance of above TOR.

B. SPECIFIC TERMS OF REFERENCE FOR EIA STUDIES FOR SYNTHETIC ORGANIC CHEMICALS INDUSTRY (DYES & DYE INTERMEDIATES; BULK DRUGS AND INTERMEDIATES EXCLUDING DRUG FORMULATIONS; SYNTHETIC RUBBERS; BASIC ORGANIC CHEMICALS, OTHER SYNTHETIC ORGANIC CHEMICALS AND CHEMICAL INTERMEDIATES)

1. Details on solvents to be used, measures for solvent recovery and for emissions control.
2. Details of process emissions from the proposed unit and its arrangement to control.
3. Ambient air quality data should include VOC, other process-specific pollutants* like NH₃*, chlorine*, HCl*, HBr*, H₂S*, HF*, etc., (*-as applicable)
4. Work zone monitoring arrangements for hazardous chemicals.
5. Detailed effluent treatment scheme including segregation of effluent streams for units adopting 'Zero' liquid discharge.
6. Action plan for odour control to be submitted.
7. A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic solid/hazardous waste generated.
8. Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF, if any.
9. Action plan for utilization of MEE/dryers salts.
10. Material Safety Data Sheet for all the Chemicals are being used/will be used.
11. Authorization/Membership for the disposal of solid/hazardous waste in TSDF.

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

12. Details of incinerator if to be installed.
13. Risk assessment for storage and handling of hazardous chemicals/solvents. Action plan for handling & safety system to be incorporated.
14. Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.

Compliance of Terms of Reference

Compliance of Standard TOR for "Synthetic Organic Chemicals Industry (dyes and dye intermediates; bulk drugs and intermediates excluding drug formation; synthetic rubber; basic organic chemicals, other synthetic organic chemicals and chemical intermediates" Issued by MoEF&CC for EIA/EMP report for Projects/Activates requiring Environmental Clearance Under EIA Notification, 2006

TOR Letter: F.No.IA-J-11011/12/2018-IA II (I)

Date: 05.02.2018

S.No	Compliance of Terms or Reference	Response
A. STANDARD TERMS OF REFERENCE		
1	Executive Summary	Included in EIA report.
2	Introduction	
	i. Details of the EIA Consultant including NABET accreditation	EIA Consultants: Team Labs and Consultants List of QCI/NABET Consultants: S.No.150 (Rev. 72 - January, 2019)
	ii. Information about the project proponent	Presented in Chapter 1 of EIA report at Page No. 1-2
	iii. Importance and benefits of the project	Presented in Chapter 1 of EIA report at Page No. 1-2
3	Project Description	
	i. Cost of project and time of completion.	Cost of Project for Proposed Expansion is 600 crores.
	ii. Products with capacities for the proposed project.	Presented in Chapter 1 of EIA report at Page No. 1-3
	iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	Presented in Chapter 1 of EIA report at Page No. 1-3. The proposed expansion is within the existing site area of 95.56 acres.
	iv. List of raw materials required and their source along with mode of transportation.	Presented in Chapter 7 of EIA report at Page No. 7-6
	v. Other chemicals and materials required with quantities and storage capacities	Presented in Chapter 7 of EIA report at Page No. 7-6
	vi. Details of Emission, effluents, hazardous waste generation and their management.	Presented in Chapter 10 Chapter 10. Effluents: 10-4 to 10-8 Emissions: 10-9 to 10-20 Hazardous Waste: 10-20 to 10-22.
	vii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)	Total water required: 2035 KLD Detailed water balance is presented in Chapter 2 of EIA Report at Page No. 2-4
	viii. Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided	Presented in Chapter 2 of EIA Report at Page No. 2-3. Enclosed as separate annexure.
	ix. Hazard identification and details of proposed safety systems.	Presented in Chapter 7 of EIA report at Page No. 7-25 to 7-29.
	x. Expansion/modernization proposals:	

	a.	Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing existing operation of the project from SPCB shall be attached with the EIA-EMP report.	Copy of Environmental Clearance and status of compliance of conditions stipulated in EC presented in Annexure. Point wise compliance of Consent for Operate (CFO) Presented at Annexure - II.															
	b.	In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.	Not Applicable															
4	Site Details																	
	i.	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	M/s. SMS Pharmaceuticals Limited, Unit VII, Sy. Nos. 160, 161, 163 to 168 and 170 Kandivalasa Village, Sy. No. 72 Kovvada Agraharam Village, Pusapatriega Mandal, Vizianagaram District, Andhra Pradesh. The proposed expansion is within the existing site area of 95.56 acres															
	ii.	A topo sheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)	Presented in Chapter 1 of EIA report at Page No. 1-8.															
	iii.	Details w.r.t. option analysis for selection of site	The proposed expansion is within the existing site area of 165 acres															
	iv.	Co-ordinates (lat-long) of all four corners of the site.	<table border="1"> <thead> <tr> <th>S.No</th> <th>Latitude</th> <th>Longitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>18°06'15.56"</td> <td>83°35'17.60"</td> </tr> <tr> <td>2</td> <td>18°06'12.35"</td> <td>83°35'31.86"</td> </tr> <tr> <td>3</td> <td>18°06'0.33"</td> <td>83°35'28.33"</td> </tr> <tr> <td>4</td> <td>18°05'58.11"</td> <td>83°35'29.19"</td> </tr> </tbody> </table>	S.No	Latitude	Longitude	1	18°06'15.56"	83°35'17.60"	2	18°06'12.35"	83°35'31.86"	3	18°06'0.33"	83°35'28.33"	4	18°05'58.11"	83°35'29.19"
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			5	18°5'47.67"	83°35'22.09"
			6	18°05'46.43"	83°35'14.69"
			7	18°05'51.92"	83°35'14.98"
			8	18°05'51.23"	83°35'11.12"
			9	18°05'56.52"	83°35'9.26"
			10	18°06'3.95"	83°35'14.94"
	v.	Google map-Earth downloaded of the project site.	Enclosed at Annexure - I		
	vi.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	Plant layout is presented in Chapter 1 of EIA report at Page No. 1-9		
	vii.	Photographs of the proposed and existing (if applicable) plant site. If existing, show Photographs of plantation/greenbelt, in particular.	Photographs of Plant site is presented in Chapter 1 of EIA report at Page No. 1-7		
	viii.	Land use break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)	Plant layout is presented in Chapter 1 of EIA report at Page No. 1-9		
	ix.	A list of major industries with name and type within study area (10km radius) shall be Incorporated. Land use details of the study area	Land use and Land Cover map of the study area is presented in Chapter 3 of EIA report at Page No. 3-9.		
	x.	Geological features and Geo-hydrological status of the study area shall be included.	Presented in Chapter 3 of EIA report at Page No. 3-4 to 3-7		
	xi.	Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence Frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the Project site and maximum Flood Level of the river shall also be provided. (mega green field projects)	Drainage pattern of the impact area is presented in Chapter 3 of EIA report at Page No. 3-15		
	xii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	The proposed expansion is within the existing site area of 95.56 acres.		
	xiii.	R&R details in respect of land in line with state Government policy.	Not Applicable.		
5	Forest and wildlife related issues (if applicable):				
	i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	Not Applicable		
	ii.	Land use map based on High resolution satellite	The proposed expansion is within the		

		imagery (GPS) of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha)	existing site area of 95.56 acres, however land use map is presented in Chapter 3 of EIA report at Page No. 3-9
	iii.	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	Not Applicable
	iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	There are no National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals within the impact area of 10 km.
	v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.	Not Applicable
	vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not Applicable
6	Environmental Status		
	i.	Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	Site-specific micrometeorological data presented in Chapter 3 of EIA report at Page No. 3-22 to 3-24
	ii.	AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the predominant wind direction, population zone and sensitive receptors including reserved forests.	AAQ data presented in Chapter 3 of EIA report at Page No. 3-25
	iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	AAQ data is presented in Chapter 3 of EIA report at Page No. 3-31
	iv.	Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.	Surface water Monitoring locations presented in Chapter 3 of EIA report at Page No. 3-13.
	v.	Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.	No. The site is located at Sy. Nos. 160, 161, 163 to 168 and 170 Kandivalasa

			Village, Sy. No. 72 Kovvada Agrapharam Village, Pusapatrigga Mandal, Vizianagaram District, Andhra Pradesh.
	vi.	Ground water monitoring at minimum at 8 locations shall be included.	Ground Monitoring locations presented in Chapter 3 of EIA report at Page No. 3-16 to 3-18.
	vii.	Noise levels monitoring at 8 locations within the study area.	Noise levels monitoring is presented in Chapter 3 of EIA report at Page No. 3-33 to 3-35
	viii.	Soil Characteristic as per CPCB guidelines.	Soil Characteristics is presented in Chapter 3 of EIA report at Page No. 3-8-3-12
	ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	Traffic study of the area is presented in Chapter 3 of EIA report at Page No. 3-34 The additional traffic generated due to the proposed expansion shall be 12-15 truck trips per day.
	x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Flora and Fauna of the Impact area is presented in Chapter 3 of EIA report at Page No. 3-44 to 3-67
	xi.	Socio-economic status of the study area.	Socio-Economic status of the impact area is presented in Chapter 3 of EIA report at Page No. 3-36
7	Impact and Environment Management Plan		
	i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	Predictions of ground level concentrations using ISC-AERMOD using ISCST3 model is of the pollutants presented in Chapter 4 of EIA report at Page No. 4-12. The additional traffic generated due to the proposed project shall be 12-15 truck trips per day. There will be marginal increase in the traffic density. Emissions considered from transport of vehicles as line source.
	ii.	Water Quality modelling - in case of discharge in water body	Details of effluent before and after treatment is presented in Chapter 10 of EIA report at Page No. 10-4
	iii.	Impact of the transport of the raw materials and	There will be 12-15 truck trips per day.

		end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor cum- rail transport shall be examined.	Truck transport Incidents and concerns are presented in Chapter 7 of EIA report at Page No. 7-52.
	iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E (P) Rules.	Quantity, quality of effluent generated from different operation is presented in Chapter 10 Chapter 10 of EIA report at Page No. 10-4 to 10-8. Effluent Treatment System is presented in Chapter 10 of EIA report at Page No. 10-7.
	v.	Details of stack emission and action plan for control of emissions to meet standards.	Presented in Chapter 10 Chapter 10 of EIA report at Page No. 10-9.
	vi.	Measures for fugitive emission control	Presented in Chapter 10 of EIA report at Page No. 10-16.
	vii.	Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover Techniques, Energy conservation, and natural resource conservation.	Presented in Chapter 10 of EIA report at Page No. 10-20. Reduce, reuse and recycled concept is presented in waste-minimization, Energy conservation is presented in Chapter 10 of EIA report at Page No. 10-34.
	viii	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Ash generated from coal fired boilers is 17.2 TPD after expansion and same sold to brick manufactures and cement plants
	ix.	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Green belt is developed in an area of 32 acres. Layout showing green belt development is presented in Chapter 10 at Page No. 10-36.
	x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Presented in Chapter 10 of EIA report at Page No. 10-23 to 10-25.
	xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	Total Capital Cost: Rs. 600 crores EMP Cost estimate: Rs. 43.89 crores Recurring Cost on EMP: Rs. 53.82 crores/annum. Details are presented in Chapter 10 at

			Page no. 10-39
	xii.	Action plan for post-project environmental monitoring shall be submitted.	Presented in Chapter 6 of EIA report at Page No. 6-8 to 6-9
	xiii	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	Disaster Management Plan is presented in Chapter 7 of EIA report at Page No.7-56. Onsite and Offsite Disaster is presented in Chapter 7 of EIA report at Page No.7-57.
8	Occupational Health		
	i.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers	Total: 187.5 Lakhs/annum PPE: 122.5 Lakhs/annum Health Check-up: 65 Lakhs/annum
	ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and Periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	Medical health check-up is presented in Chapter 10 of EIA report at Page No. 10-27 Medical examination report of employees is enclosed at Annexure - III.
	iii.	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,	Presented in Chapter 10 of EIA report at Page No. 10-26. Suitable PPE is prescribed to the employees working in area where the conc. Exceeds PEL values. Simultaneously the project and R&D team are consulted to suggest mitigative measures and or engineering control measures. The focus shall always be in ensuring concentration within PEL by adopting engineering controls as when requires.
	iv.	Annual report of health status of workers with special reference to Occupational Health and Safety.	Annual report of Health Status of workers is enclosed at Annexure - III
9	Corporate Environment Policy		
	i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	Corporate Environment Policy is presented in Chapter 10 of EIA report at Page No. 10-37.
	ii.	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation /	Environment engineer is responsible to bring to focus to higher management in case of deviation/ violation of the

		violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	environmental or forest norms / conditions.
	iii.	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance Conditions? Details of this system may be given.	Environment Management Cell is presented in Chapter 10 of EIA report at Page No. 10-38.
	iv.	Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report	Environment Management Cell is presented in Chapter 10 of EIA report at Page No. 10-38.
10		Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.	Presented in Chapter 10 of EIA report at Page No. 10-2.
11		Enterprise Social Commitment (ESC)	
	i.	Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic development activities need to be elaborated upon.	Corporate Social Responsibilities - Budget is presented in Chapter 10 of EIA report at Page No. 1-32. Public Hearing was conducted on 12.07.2018 at plant premises.
12		Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.	No Individual Court case against the Project.
13		A tabular chart with index for point wise compliance of above TOR.	Enclosed at Compliance of Terms of Reference along with EIA & EMP.
B. SPECIFIC TOR			
1		Details on solvents to be used, measures for solvent recovery and for emissions control.	Details of solvents used and balance is presented in Chapter 2 of EIA report at Page No. 2-8 to 2-32.
2		Details of process emissions from the proposed unit and its arrangement to control.	Detail of process emission and mode of treatment is presented in Chapter 10 of EIA report at Page No. 10-13 to 2-16.
3		Ambient air quality data should include VOC, other process-specific pollutants* like NH ₃ *, chlorine*, HCl*, HBr*, H ₂ S*, HF*,etc., (*-as applicable)	AAQ data is presented in Chapter 3 of EIA report at Page No. 3-31
4		Work zone monitoring arrangements for hazardous chemicals.	Presented in Chapter 6 of EIA report at Page No. 6-10.

5	Detailed effluent treatment scheme including segregation of effluent streams for units adopting 'Zero' liquid discharge.	Details of Effluent Treatment System is presented in Chapter 10 of EIA report at Page No. 10-5 to 10-8
6	Action plan for odour control to be submitted.	Presented in Chapter 10 of EIA report at Page No. 10-17
7	A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic solid/hazardous waste generated.	Enclosed at Annexure - IV
8	Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF, if any.	Enclosed at Annexure - V
9	Action plan for utilization of MEE/dryers salts.	Salts generated from MEE/ATFD sent to TSDF.
10	Material Safety Data Sheet for all the Chemicals are being used/will be used.	Enclosed at Annexure - VI
11	Authorization/Membership for the disposal of solid/hazardous waste in TSDF.	Enclosed at Annexure - V
12	Details of incinerator if to be installed.	Not Applicable. Organic waste sent to TSDF/cements plant for co-incineration.
13	Risk assessment for storage and handling of hazardous chemicals/solvents. Action plan for handling & safety system to be incorporated.	Presented in Chapter 7 of EIA report
14	Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.	Presented in Chapter 10 of EIA report at Page No. 10-28.

SMS PHARMACEUTICALS LIMITED, UNIT - VII

SY.NO. 160,161,163 TO 168 AND 170 (KANDIVALASA VILLAGE),

SY. NO.72 (KOVVADA AGRAHARAM VILLAGE),

PUSAPATIREGA MANDAL, VIZIANAGARAM DISTRICT,

ANDHRA PRADESH

STUDIES AND DOCUMENTATION BY

TEAM Labs and Consultants

QCI: MoEFCC OM, List A-1, S.No.25.

(An ISO 9001:2008, ISO 14001:2004 &

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