DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

(for Public Hearing Submission)

Proposed Manufacturing of Active Pharmaceutical Ingredients & Intermediates Unit

at Plot No. 38, Survey Nos. 16 & 17, TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu

M/s. Juvenus Drugs

No. 55, Raj Flat, Near Ring Road, Devakai Nagar,
Ponniamman Medu, Chennai - 600110.

TOR Issued vide TO25B2405TN5666099N dated: 16.06.2025
Baseline Monitoring Period: March 2025 to May 2025

October 2025

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CHAPTER 1
INTRODUCTION

1.1 PURPOSE OF THE REPORT

M/s. Juvenus Drugs (Project Proponent) has proposed to develop an Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit. The proposed activity falls under category Category "B1", Schedule Sl. No. 5(f) - "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)" of Environmental Impact Assessment (EIA) Notification 2006. The EIA Notification S.O.1533 (E), dated 14th September 2006 and subsequent amendments issued under the provisions of Environment (Protection) Act, 1986, has made it mandatory to obtain prior Environmental Clearance for all scheduled project activities. Environmental Impact Assessment (EIA) of a project helps in evaluating the environmental consequences and suggests suitable management measures for mitigating potential risks and impacts. SEIAA-TN has accorded Terms of Reference for the projects vide TOR Identification No. TO25B2405TN5666099N dated: 16.06.2025.

The project proponent has engaged a NABET Accredited Consultant, M/s. Eco Services India Private Limited, Chennai towards preparation of EIA Report. Accordingly, this report is prepared in line with the requirements of MoEF&CC towards seeking an Environmental Clearance for this project. (Certificate No. NABET/EIA/24-27/RA0332).

1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of the Project

The proposed project is a green field project which is evident from the historical imagery of the Google Earth. The project site is located in Tamil Nadu Small Industries Development Corporation Limited (TANSIDCO), Tindivanam which is situated approximately 4.45 kms from Tindivanam City.

The TANSIDCO, Tindivanam is a Mega Pharma Cluster spanning across 113 Acres in Villupuram district, Tamil Nadu. The Cluster is developed under the Mega Cluster/Pharma Park Scheme with a plan to accommodate 40 pharmaceutical companies with common facilities. A plot of 5,867.95 Sq.m (1.45 Acres) is allotted to M/s. Juvenus Drugs by TANSIDCO, Tindivanam on outright sale basis for the development of Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit.

1.2.2 Identification of Project Proponent

The project proponent is a trusted pharmaceutical manufacturer of **Low-Volume, High-Value Active Pharmaceutical Intermediates**. They specialize in challenging chemistry to foster

innovation and deliver advanced solutions. Their services cover every phase of client research from discovery and research & development to process optimization ensuring cost-effectiveness while adhering to stringent quality norms.

The Head office address of the project proponent is at No. 55, Raj flat, Near Ring Road, Devakai Nagar, Ponniamman Medu, Chennai - 600110.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature of the Project

The proposed project involves the manufacturing of Valproic Acid, Sodium Valproate, Divalproex Sodium, Magnesium Valproate, Gabapentin, Pregabalin, Leflunomide, Iguratimod, Rivaroxaban, Itopride Hydrochloride, Permethol Sodium, Amitriptyline Hydrochloride, Dothiepin Hydrochloride, Sumatriptan, Clidinium Bromide, Montelukast Sodium, Ataluren, Linezolid, Valethamate Bromide along with R&D (Pre-production) with a total capacity of 15.66 T/Month (187.92 T/Annum).

1.3.2 Location and Size

The project site is located at Plot No. 38, Survey No. 16 & 17, TANSIDCO, Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The geo-graphical co-ordinates at center of the project site are 12°15'12.58"N, 79°37'9.87"E.

The total plot area of the project site is 5,867.95 Sq.m (1.45 Acres). The cost of the proposed project is Rs. 4.52 Crores.

1.3.3 Employment Generation

The projects will generate employment of 60 during construction and 41 during operation period, respectively. The employees will be sourced locality.

1.3.4 Site Photographs

The photographs of the project site (**Figure 1.1**) taken on 10.10.2025 are shown below.








Figure 1.1 Photographs of the Project Site

1.3.5 Importance and Benefits of the project

TANSIDCO has setup a Mega Pharma Cluster at Tindivanam to reduce individual capital investment for MSMEs and large pharma firms by encouraging them to develop API and Intermediate Manufacturing Units**.** The proposed project will contribute towards strengthening the Tamil Nadu's pharmaceutical manufacturing base.

The benefits through this proposed project are as follows:

- Generation of direct and indirect employment.
- Improves of economic growth of the region.
- The company will contribute towards quality education, sanitation facilities in the government schools of the surrounding villages under Corporate Environmental Responsibility (CER) funds.

1.3.6 Demand Supply Gap

The demand supply gap for Active Pharmaceutical Ingredients (APIs) and intermediates is steadily widening due to increase in global pharmaceutical requirements and disruptions in the supply chain. Further, demand continues to rise due to population growth and healthcare facilities, while domestic production capacity remains limited, leading to high dependence on imports. Additional constraints such as regulatory hurdles, raw material shortages and geopolitical uncertainties further affect supply security. To overcome this gap, many countries are focusing on local API production. This imbalance shall be addressed through targeted investments in advanced manufacturing infrastructure, process technology and enabling policy frameworks.

Accordingly, the Government of Tamil Nadu has proposed to develop a Mega Pharma Cluster at Tindivanam at a cost of 150 crores to strengthen indigenous API and intermediate production.

1.4 TERMS OF REFERENCE (TOR) COMPLIANCE REPORT

The compliance to the conditions specified in the TOR is reported in **Table 1.1**.

Table 1.1 – Terms of Reference (TOR) Compliance Report
Ref: TOR Identification No: TO25B2405TN5666099N

S.No.	TERMS OF REFERENCE	COMPLIANCE
	SEIAA SPECIFIC CONDITIONS:	
1.	The toxic fumes anticipated due to the project activities.	There are no toxic fumes from the process or the project activity.
2.	The Persistent Organic Pollutants (POPs) anticipated and their quantities.	There are no Persistent Organic Pollutants (POPs) involved in the proposed project. As per REACH (EU) guidelines, all export products must be free from POPs, chlorophenols, APEO, and NPEO. Accordingly, all raw materials are tested by Intertek prior to procurement to ensure compliance and confirmation that they are POP-free.
3.	The possibilities of biomagnification	There are no possibilities for biomagnification. The below listed activities are followed for proposed project • Chemicals in warehouse, which has concrete base to avoid direct contact with soil. • There is no discharge of water outside the Industry premises. ZLD is adopted for the proposed project.
4.	Impact on human health, biodiversity, food chain, atmosphere and water resources because of the POPs emitted from project activity.	There are no Persistent Organic Pollutants (POPs) involved in the proposed project. As per REACH (EU) guidelines, all export products must be free from POPs, chlorophenols, APEO, and NPEO. Accordingly, all raw materials are tested by Intertek prior to procurement to ensure compliance and confirmation that they are POP-free.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>5.</td><td>Impact on soil, soil biota and vegetation.</td><td>The details are given in Chapter 3-3.8 of this EIA report.</td></tr>
<tr><td>6.</td><td>Impact on climate change.</td><td>The proposed API manufacturing project will have a minimal impact on climate change as appropriate mitigation and control measures are being implemented. The primary sources contributing to greenhouse gas (GHG) emissions during operation include energy consumption (electricity and fuel for boilers and DG sets) and process-related emissions.</td></tr>
<tr><td>7.</td><td>Carbon sequestration strategies adopted.</td><td>Commitment towards the environmental sustainability, the total land area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in below Table.

List of Species Proposed to be Planted within the Project Premises
<table>
<tr><th>S.No.</th><th>Common Name (Trees)</th><th>Botanical Name (Tree)</th></tr>
<tr><td>1.</td><td>Pongamia glabra</td><td>Pungan</td></tr>
<tr><td>2.</td><td>Michelia champaca</td><td>Shenbagam</td></tr>
<tr><td>3.</td><td>Ficus religiosa</td><td>Arasu</td></tr>
<tr><td>4.</td><td>Azadirachta indica</td><td>Vembu</td></tr>
<tr><td>5.</td><td>Terminalia arjuna</td><td>Neermardhu</td></tr>
<tr><td>6.</td><td>Calophyllum inophyllum</td><td>Punnai</td></tr>
<tr><td>7.</td><td>Syzygium cumini</td><td>Naval</td></tr>
<tr><td>8.</td><td>Madhuca longifolia</td><td>IIipai</td></tr>
<tr><td>9.</td><td>Mimusops elengi</td><td>Magilam</td></tr>
</table></td></tr>
<tr><td>8.</td><td>Smart technologies adopted to improve energy efficiency.</td><td>50% Roof Top with Solar panel will installed.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
9.	Occupational Health & safety details shall be furnished.	The details of Occupational Health & safety are provided in Chapter 10 of this EIA report.
10.	Impact on wildlife, mammals, fishes and possibilities of behavioural change because of the pollutants emitted.	There is no Impact on wildlife, mammals, fishes and possibilities of behavioural change because of the pollutants emitted.
11.	CO_2 emission and action for containing it.	The Co2 emission and action plan study will be included in the final EIA report.
12.	Anticipated Green House Gas emissions and mitigation strategies	**Hazard Identification and Proposed Safety Systems** A clean energy mechanism is integral to ensuring sustainable operations and minimizing environmental impact. The following measures are proposed to reduce the project's carbon footprint and enhance energy efficiency: The project will incorporate solar power by installing rooftop solar panels throughout the facility. This initiative will help meet a portion of the total energy demand through renewable sources, thereby reducing dependence on conventional fossil fuel-based electricity. Solar energy, being clean and sustainable, will significantly lower greenhouse gas emissions and contribute to the project's overall energy efficiency. The facility will employ energy-efficient machinery and systems that comply with international energy standards. This includes high-efficiency motors, pumps and heating systems designed to minimize energy consumption. Additionally, **Variable Frequency Drives (VFDs)** will be installed to regulate motor operations based on real-time demand, further optimizing power use and improving energy efficiency.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td colspan="3">SEAC CONDITIONS – SITE SPECIFIC</td></tr>
<tr><td>1.</td><td>The PP shall submit details regarding the suitability of the proposed activity, along with a report that includes information on the machinery, flow chart of the operation, storage of raw materials, storage of products, air pollution, water pollution, fugitive emissions and their control, and waste management.</td><td>Considering the condition, all the aspects mentioned — including the suitability of the proposed activity, detailed information on machinery, process flow chart, storage of raw materials and products, air and water pollution control measures, fugitive emission management and waste management practices — have been comprehensively covered and addressed in this EIA report. The details are addressed in Chapter 2 of this EIA report.</td></tr>
<tr><td>2.</td><td>The PP shall conduct a soil test at the proposed site and submit a report on any potential leaching of harmful / heavy chemicals due to the proposed activity.</td><td>The details of soil test at the project site is given in Chapter 3-3.8 of this EIA report.</td></tr>
<tr><td>3.</td><td>The PP shall furnish the mass balance for the product.</td><td>
<table>
<tr><th>S. No.</th><th>Name of the Raw material</th><th>Quantity (T/M)</th><th>Name of the output</th><th>Quantity (T/M)</th></tr>
<tr><td>1</td><td>Diethyl malonate</td><td>3.600</td><td>Valproic acid</td><td>3.000</td></tr>
<tr><td>2</td><td>Sodium Hydroxide</td><td>1.800</td><td>Sodium valproate</td><td>3.000</td></tr>
<tr><td>3</td><td>n-propyl bromide</td><td>5.550</td><td>Divalproex sodium</td><td>3.000</td></tr>
</table>
</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE				
		4	Water	12.000	Magnesium valproate	1.000
		5	Stage-1	5.250	Gabapentin	1.000
		6	Sodium Hydroxide	1.740	Pregabalin	1.000
		7	Hydrochloric acid	5.250	Leflunomide	0.050
		8	Water	15.000	Iguratimod	0.100
		9	2-Propyl pentanoic acid	2.610	Rivaroxaban	0.050
		10	Sodium hydroxide	0.724	Itopride Hydrochloride	0.200
		11	Water	1.500	Permethol Sodium	0.025
		12	2-propyl pentanoic acid	1.455	Amitriptyline Hydrochloride	0.500
		13	Sodium-2-propyl pentanoate	1.605	Duloxetine Hydrochloride	0.500
		14	Water	1.500	Sumatriptan	0.060
		15	2-propyl pentanoic acid	0.935	Clidinium Bromide	0.080
		16	Magnesium oxide	0.130	Montelukast Sodium	0.500
		17	IPA	2.780	Ataluren	0.050
		18	Acetone	2.000	Linezolid	1.000
		19	Cyclohexane-1,1-diacetic acid monoamide	1.610	Valethamate bromide	0.050
		20	Sodium Hydroxide	0.890	R&D	0.495
		21	Sodium Hypochlorite 12%	5.200	**Total Product Output**	**15.660**
		22	Hydrochloric acid	0.230		
		23	Stage-1	1.100	Process emission	5.992
		24	Hydrochloric acid	0.800	Organic Residue	25.564
		25	Acetone	2.500	Solvent Rec & Loss	211.639
		26	Sodium Hydroxide	0.280	Intermediates	19.993
		27	Water	3.000	Effluent	101.063

S.No.	TERMS OF REFERENCE	COMPLIANCE				
		28	Stage-2	1.400	Solid waste	23.772
		29	Sodium Hydroxide	0.270	Spent carbon	0.302
		30	Acetone	1.000	Spent Catalyst	0.100
		31	n-propanol	1.000	**Total**	**404.085**
		32	Water	1.500		
		33	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	4.942		
		34	Sulphuric acid	2.000		
		35	Sodium Hydroxide	0.430		
		36	Sodium Hypochlorite	5.010		
		37	Activated carbon	0.082		
		38	Celite	0.014		
		39	Iso propyl alcohol	5.000		
		40	5-methyl-1,2-oxazole-4-carboxylic acid	0.040		
		41	4-(trifluoromethyl)aniline	0.046		
		42	Thionyl chloride	0.038		
		43	Toluene	0.056		
		44	Sodium bi carbonate	0.026		
		45	Water	0.120		
		46	Leflunomide Crude	0.066		
		47	Ethyl acetate	0.330		
		48	Toluene	0.082		
		49	N, N-Dimethylformamide	0.089		
		50	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	0.094		

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		51	N, N-Dimethylformamide dimethyl acetal	0.089	
		52	Water	0.167	
		53	Hydrochloric acid	0.051	
		54	4-Hydroxy benzaldehyde	0.074	
		55	(2-Chloroethyl)-dimethylamine - hydrochloride	0.087	
		56	Triethyl amine	0.120	
		57	Chloroform	1.000	
		58	Water	1.200	
		59	Stage-1	0.112	
		60	Hydroxyl amine sulfate	0.074	
		61	Raney Ni	0.010	
		62	Iso Propyl alcohol	1.200	
		63	Hydrogen gas	0.002	
		64	Stage-2	0.108	
		65	3, 4-Dimethoxy benzoyl chloride	0.110	
		66	Toluene	0.800	
		67	Water	0.400	
		68	Stage-3	0.210	
		69	Iso Propyl alcohol	2.000	
		70	Activated carbon	0.007	
		71	Water	0.400	
		72	Para benzo quinone	0.040	
		73	Acetyl chloride	0.130	
		74	Sodium acetate	0.182	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		75	Con.Sulphuric acid	0.008	
		76	Water	0.600	
		77	Stage-I	0.092	
		78	Ethyl aceto acetate	0.047	
		79	75% Sulphuric acid	0.363	
		80	Water	0.438	
		81	Toluene	0.063	
		82	Stage-II	0.055	
		83	Dimethyl formamide	0.551	
		84	Sodium carbonate	0.076	
		85	Ethyl bromo acetate	0.056	
		86	Stage-III	0.039	
		87	Water	0.225	
		88	Acetone	0.225	
		89	Sodium hydroxide	0.005	
		90	Dibenzosuberone	0.350	
		91	3-Chloro-N,N-dimethyl propan-1-amine	0.205	
		92	Ammonium Chloride	0.090	
		93	Magnesium	0.041	
		94	Tetra hydro furan	0.250	
		95	Toluene	0.100	
		96	Iso Propyl alcohol	0.200	
		97	Water	0.500	
		98	Stage-1	0.480	
		99	Hydrochloric Acid	0.062	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		100	Toluene	0.600	
		101	Acetone	0.250	
		102	Activated Carbon	0.020	
		103	Water	0.400	
		104	(s)-3-(Methylamino)-1-(thiophen -2-yl)propane-1-ol	0.675	
		105	1-Fluoro naphthalene	1.000	
		106	Sodium hydride (60%) in Paraffin oil	0.270	
		107	Toluene	4.100	
		108	DMSO	2.250	
		109	Ethyl acetate	12.200	
		110	Potassium acetate	0.035	
		111	Ammonium chloride	0.250	
		112	Sodium chloride	0.880	
		113	Water	4.250	
		114	Stage-1	1.000	
		115	Ethyl acetate	5.800	
		116	IPA HCl	0.825	
		117	Activated carbon	0.025	
		118	Acetone	5.800	
		119	Iso Propyl alcohol	0.500	
		120	3-(2-Hydroxyethyl)-N-methyl-1H-indole-5 methanesulphonamide	0.125	
		121	Dichloromethane	3.125	
		122	Pyridine	0.019	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		123	Thionyl chloride	0.063	
		124	Hydrochloric acid	0.005	
		125	Water	0.625	
		126	Stage-1	0.100	
		127	Iso Propyl alcoholic dimethyl amine	3.540	
		128	Methyl 2-hydroxy-2,2 diphenyl acetate	0.110	
		129	Cyclohexane	0.320	
		130	Methyl benzilate	0.046	
		131	Water	0.472	
		132	Clidinium base	0.149	
		133	Iso propyl alcohol	1.100	
		134	Methyl bromide	0.312	
		135	Activated Carbon	0.020	
		136	Acetone	1.000	
		137	(S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl) phenyl)propan1-ol	0.500	
		138	Toluene	1.750	
		139	Acetic acid	0.275	
		140	Sodium hydroxide	0.075	
		141	Methylene dichloride	2.500	
		142	DIPEA	0.225	
		143	Methane sulfonyl chloride	0.130	
		144	DMSO	0.750	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		145	2-(1-(mercaptomethyl) cyclopropyl)acetic acid	0.190	
		146	Sodium methoxide solution	0.240	
		147	Pet ether	1.250	
		148	Water	1.500	
		149	Stage-1	0.500	
		150	Sodium Hydroxide	0.038	
		151	Iso propyl alcohol	3.000	
		152	3-cyanobenzoic acid	0.063	
		153	Dimethyl formamide	0.750	
		154	Potassium carbonate	0.067	
		155	Methyl iodide	0.049	
		156	Hexane	0.650	
		157	Water	0.600	
		158	Stage-1	0.056	
		159	Iso propyl alcohol	0.800	
		160	50% hydroxylamine	0.070	
		161	Hexane	0.237	
		162	Stage-2	0.067	
		163	Tetrahydrofuran	0.305	
		164	Diisopropyl ethylamine	0.079	
		165	2-fluoro benzoyl chloride	0.059	
		166	Ethyl acetate	0.400	
		167	Hexane	0.250	
		168	Toluene	0.250	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		169	Stage-III	0.055	
		170	Toluene	0.650	
		171	Stage-IV	0.053	
		172	Tetrahydrofuran	0.259	
		173	Sodium hydroxide	0.322	
		174	Ethyl acetate	0.280	
		175	Water	0.750	
		176	1,2-difluoro-4 nitrobenzene	1.400	
		177	Morpholine	2.270	
		178	Isopropyl alcohol	9.800	
		179	Water	3.820	
		180	Stage-1	1.800	
		181	Iron(III) chloride	0.190	
		182	Activated charcoal	0.800	
		183	Hydrazine hydrate	2.000	
		184	Iso Propyl alcohol	19.500	
		185	Ethyl acetate	6.000	
		186	Water	2.070	
		187	Stage-2	1.350	
		188	Sodium bicarbonate	1.440	
		189	Ethyl chloroformate	0.896	
		190	Dichloromethane	7.760	
		191	Water	22.275	
		192	Stage-3	1.778	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		193	2-(oxiran-2-ylmethyl)isoindoline-1,3-dione	1.990	
		194	Triethylamine	0.075	
		195	Methyl isobutyl ketone	2.660	
		196	Ethyl acetate	14.220	
		197	Stage-4	2.340	
		198	80% hydrazine hydrate	1.826	
		199	Iso Propyl alcohol	12.000	
		200	Water	9.200	
		201	Dichloromethane	54.000	
		202	Hexane	4.680	
		203	Stage-5	1.400	
		204	Acetic acid	1.490	
		205	Toluene	8.420	
		206	Benzy Cyanide	0.038	
		207	2-bromo butane	0.111	
		208	Choline chloride	0.099	
		209	Sodium hydroxide	0.091	
		210	Toluene	0.206	
		211	water	0.190	
		212	Stage-1	0.057	
		213	Mono ethylene glycol	0.090	
		214	Sodium Hydroxide	0.189	
		215	Con. HCl	0.268	
		216	water	0.440	

S.No.	TERMS OF REFERENCE	COMPLIANCE			
		217	Stage-2	0.055	
		218	Dimethyl formamide	1.548	
		219	Thionyl chloride	0.035	
		220	2-diethyl amino ethanol	0.035	
		221	Triethyl amine	0.062	
		222	Toluene	0.275	
		223	Sodium hydroxide	0.025	
		224	water	2.742	
		225	Stage-3	0.050	
		226	Methyl Bromide	0.030	
		227	Ethyl acetate	0.250	
		228	4(4-amino phenyl) morpholin-3-one	0.040	
		229	N-(s)-glycidyl Pthalamide	0.055	
		230	Isopropyl alcohol	0.440	
		231	Stage-1	0.080	
		232	Carbonyldiimidazole	0.050	
		233	Potassium carbonate	0.039	
		234	Dichloromethane	3.000	
		235	water	2.000	
		236	Stage-2	0.077	
		237	Iso propyl alcohol	0.709	
		238	40% Methyl amine	0.071	
		239	Con. Hydrochloric acid	0.085	
		240	Stage-3	0.058	
		241	5-Chloro thiopene-2- -carbonylchloride	0.027	

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>242</td><td>Triethylamine</td><td>0.015</td><td></td></tr>
<tr><td>243</td><td>Isopropyl alcohol</td><td>0.075</td><td></td></tr>
<tr><td>244</td><td>water</td><td>0.125</td><td></td></tr>
<tr><td>245</td><td>Stage-4</td><td>0.056</td><td></td></tr>
<tr><td>246</td><td>Acetone</td><td>0.075</td><td></td></tr>
<tr><td>247</td><td>Charcoal</td><td>0.001</td><td></td></tr>
<tr><td></td><td>Total</td><td>404.085</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>4.</td><td>The PP shall provide the commercial names of the raw materials and specify the form in which the raw materials will be purchased.</td><td>
List of Major Raw Materials:
<table>
<tr><th>S. No.</th><th>Raw Materials</th><th>Commercial Name</th><th>Physical form</th><th>Storage</th></tr>
<tr><td>1.</td><td>Diethyl malonate</td><td>Malonic acid diethyl ester</td><td>Liquid</td><td>Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.</td></tr>
<tr><td>2.</td><td>2-Propyl pentanoic acid</td><td>Valproic acid</td><td>Liquid</td><td>Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.</td></tr>
<tr><td>3.</td><td>Cyclohexane-1,1-diacetic acid monoamide</td><td>Gabapentin Intermediate</td><td>Solid</td><td>Store in cool, dry place and tightly closed drums.</td></tr>
</table>
</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE				
		4.	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	Pregabalin intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		5.	5-methyl-1,2-oxazole-4-carboxylic acid	Leflunomide Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		6.	4-(trifluoromethyl)aniline	p-Trifluoromethylaniline	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		7.	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	Rivaroxaban Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		8.	4(4-amino phenyl) morpholin-3-one	Itopride Intermediate	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area

S.No.	TERMS OF REFERENCE	COMPLIANCE				
						away from heat and ignition sources.
		9.	4-Hydroxy benzaldehyde	p-Hydroxybenzaldehyde	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		10.	Para benzo quinone	p-Benzoquinone	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		11.	Dibenzosuberone	Dibenzocycloheptanone	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		12.	(S)-3-(Methylamino)-1-(thiophen-2 yl)propane-1-ol	Duloxetine Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.

S.No.	TERMS OF REFERENCE	COMPLIANCE				
		13.	3-(2-Hydroxyethyl)-N-methyl-1H--indole-5 methanesulphonamide	Sumatriptan Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		14.	Methyl 2-hydroxy-2,2 diphenyl acetate	Amitriptyline Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		15.	(S)-1-(3-(2-(7-chloroquinolin-2-yl) vinyl) phenyl)-3-(2- (2-hydroxypropan -2-yl)phenyl) propan-1-ol	Hydroxychloroquine Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		16.	3-cyanobenzoic acid	m-Cyanobenzoic acid	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		17.	1,2-difluoro-4 nitrobenzene	Difluoronitrobenzene	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area

S.No.	TERMS OF REFERENCE	COMPLIANCE				
						away from heat and ignition sources.
		18.	2-bromo butane	sec-Butyl bromide	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		19.	Choline chloride	Vitamin B4 / Choline salt	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		20.	Iso propyl alcohol	IPA / Isopropanol	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
		21.	Acetone	Dimethyl ketone	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.

S.No.	TERMS OF REFERENCE	COMPLIANCE
		22. N-Hexane | Hexane | Liquid | Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources. 23. Toluene | Methylbenzene | Liquid | Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
5.	The PP shall furnish the MSDS along with chemical structure for each raw material to be utilized for manufacturing the product.	The MSDS along with the chemical structure for each raw material is enclosed as Annexure - X.
6.	The PP shall generate/buy green energy for a minimum of 50% of its total power consumption.	50% of rooftop solar panel will be installed and the power will be utilized for common areas lightning.
7.	The PP shall provide roof top solar panel to cover 75% of its roof area.	50% of rooftop solar panel will be installed and the power will be utilized for common areas lightning.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>8.</td><td>The PP shall develop 33% green belt with native tree species all along the periphery of project boundary with geo reference and furnish the details with photographs in the EIA report.</td><td>The area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in the below table.

List of Species Proposed to be Planted within the Project Premises
<table><tr><th>S.No.</th><th>Common Name (Trees)</th><th>Botanical Name (Tree)</th></tr><tr><td>1.</td><td>Pongamia glabra</td><td>Pungan</td></tr><tr><td>2.</td><td>Michelia champaca</td><td>Shenbagam</td></tr><tr><td>3.</td><td>Ficus religiosa</td><td>Arasu</td></tr><tr><td>4.</td><td>Azadirachta indica</td><td>Vembu</td></tr><tr><td>5.</td><td>Terminalia arjuna</td><td>Neermardhu</td></tr><tr><td>6.</td><td>Calophyllum inophyllum</td><td>Punnai</td></tr><tr><td>7.</td><td>Syzygium cumini</td><td>Naval</td></tr><tr><td>8.</td><td>Madhuca longifolia</td><td>IIipai</td></tr><tr><td>9.</td><td>Mimusops elengi</td><td>Magilam</td></tr></table></td></tr>
<tr><td>9.</td><td>The PP shall furnish a comparative study of energy efficiency in its plant vis a vis the global standards.</td><td>The details are provided in Chapter 4 and 10 of this EIA report.</td></tr>
<tr><td>10.</td><td>The PP shall furnish the details of all Air pollution control measures to be provided to control the emissions to be generated</td><td>Air Pollution Control Measures:
• Wet scrubber with a stack height of 11 m (AGL) will be provided for Process Stack.
• Common Stack with monitoring facility to control the Particulate Matter (PM) emissions will be installed for Boiler stack with a height of 11 m (AGL)
• DG stack with a height of 10 m (AGL) will be provided
• Adequate Greenbelt area will be provided within the project premises.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>from its manufacturing process at various stages.</td><td></td></tr>
<tr><td>11.</td><td>The PP shall furnish the emergency/disaster management plan.</td><td>The details of the emergency / disaster management plan is provided in Chapter 7 of this EIA report.</td></tr>
<tr><td>12.</td><td>The PP shall furnish the fire license obtained from the competent authority.</td><td>The fire NOC is enclosed as Annexure – XIV.</td></tr>
<tr><td>13.</td><td>The PP shall provide the DG set details with eco-friendly alternate fuel other than diesel.</td><td>125 kva capacity of DG is provided and it will be eco-friendly and low Sulphur HSD will be used.</td></tr>
<tr><td>14.</td><td>The PP shall furnish all the Hazardous wastes and Non-hazardous solid wastes to be generated from its manufacturing process and how it’s disposed scientifically.</td><td>Non-Hazardous Waste Solid Waste:
<table>
<tr><th rowspan="2">S.No.</th><th rowspan="2">Component</th><th rowspan="2">Occupancy</th><th rowspan="2">Per Capita waste generation (kg/day)</th><th rowspan="2">Total waste generation (kg/day)</th><th>Biodegradable Waste</th><th>Non-Biodegradable waste</th></tr>
<tr><th>@ 60% of total waste generation (kg/day)</th><th>@ 40% of total waste generation (kg/day)</th></tr>
<tr><td>1.</td><td>Maintenance Staff</td><td>41</td><td>0.3</td><td>12.3</td><td>7.38</td><td>4.92</td></tr>
<tr><td>2.</td><td>Canteen</td><td>41</td><td>0.3</td><td>12.3</td><td>7.38</td><td>4.92</td></tr>
<tr><td colspan="4">Total</td><td>24.6</td><td>14.76</td><td>9.84</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>

Hazardous Waste:

<table>
<tr><th>S. No.</th><th>Description of Waste</th><th>Category as per HWM Rules 2016</th><th>Quantity T/Annum</th><th>Storage Method</th><th>Method of disposal</th></tr>
<tr><td>1.</td><td>Used oil</td><td>5.1</td><td>0.2</td><td rowspan="9">Hazardous waste generated will be stored inside a hazardous waste storage shed having impervious floor</td><td rowspan="3">Will be collected and disposed through TNPCB Authorized recycler</td></tr>
<tr><td>2.</td><td>Waste or residue containing oil</td><td>5.2</td><td>0.1</td></tr>
<tr><td>3.</td><td>Contaminated cotton rags or other cleaning materials</td><td>33.2</td><td>0.1</td></tr>
<tr><td>4.</td><td>Concentration and evaporation residue</td><td>37.3</td><td>36</td><td rowspan="6">Will be collected and disposed through TNPCB Authorized TSDF</td></tr>
<tr><td>5.</td><td>ETP sludge</td><td>35.3</td><td>3.60</td></tr>
<tr><td>6.</td><td>Process residue and waste</td><td>28.1</td><td>307</td></tr>
<tr><td>7.</td><td>Spent catalyst</td><td>28.2</td><td>1.20</td></tr>
<tr><td>8.</td><td>Spent carbon</td><td>28.3</td><td>3.62</td></tr>
<tr><td>9.</td><td>Spent solvents</td><td>28.6</td><td>5</td></tr>
</table>

</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
STANDARD TERMS OF REFERENCE FOR (SYNTHETIC ORGANIC CHEMICALS INDUSTRY)		
1.	**Executive Summary**	
1.1	Executive Summary	The Executive Summary is mentioned before the Chapter 1 of this EIA report in compliance with the Structure of EIA as per the EIA Notification, 2006 and its subsequent amendments.
2.	**Introduction**	
2.1	Details of the EIA Consultant including NABET accreditation	M/s. Eco Services India Private Limited, Chennai. NABET Accreditation Certificate No: NABET / EIA / 24-27 / RA 0332, dated 24.05.2024, Valid upto 03.04.2027.
2.2	Information about the project proponent	**M/s. Juvenus Drugs** Plot No. 38, Survey nos, 16 & 17, TANSIDCO Industrial Estates at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District. **Project Proponent**: Mr. P. Kannan Designation: Managing Partner Registered Address: No: 55, Raj Flat, Near Ring Road, Devakai Nagar, Ponniamman Medu, Chennai – 600 100.
2.3	Importance and benefits of the project	TANSIDCO has setup a Mega Pharma Cluster at Tindivanam to reduce individual capital investment for MSMEs and large pharma firms by encouraging them to develop API and Intermediate Manufacturing Units**.** The proposed project will contribute towards strengthening the Tamil Nadu's pharmaceutical manufacturing base. The benefits through this proposed project are as follows: • Generation of direct and indirect employment. • Improves of economic growth of the region.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>• The company will contribute towards quality education, sanitation facilities in the government schools of the surrounding villages under Corporate Environmental Responsibility (CER) funds.</td></tr>
<tr><td>3.</td><td colspan="2">Project Description</td></tr>
<tr><td>3.1</td><td>Cost of project and time of completion.</td><td>Total Project Cost – 4.52 Crores

Timeline of completion:
<table>
<tr><th>S.No.</th><th>Activities</th><th>Timeline</th></tr>
<tr><td>1.</td><td>Environmental Clearance</td><td>January 2026</td></tr>
<tr><td>2.</td><td>Consent to Establish (CTE)</td><td>February 2026</td></tr>
<tr><td>3.</td><td>Finalization of Process (Instrumentation, Electrical and Mechanical)</td><td rowspan="2">March 2026</td></tr>
<tr><td>4.</td><td>Procurement and Delivery</td></tr>
<tr><td>5.</td><td>Construction at Site (Buildings, MEP works etc.)</td><td>April 2026</td></tr>
<tr><td>6.</td><td>Mechanical Commissioning</td><td>May 2026</td></tr>
<tr><td>7.</td><td>Pre Commissioning</td><td>June 2026</td></tr>
<tr><td>8.</td><td>CTO from TNPCB</td><td>September 2026</td></tr>
<tr><td>9.</td><td>Process Commissioning and Stabilization</td><td>October 2026</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>3.2</td><td>Products with capacities for the proposed project.</td><td>List of Product:
<table>
<tr><th>S. No.</th><th>Proposed Products</th><th>Quantity (T/Month)</th><th>Quantity (T/Annum)</th></tr>
<tr><td>1.</td><td>Valproic acid</td><td>3.000</td><td>36.00</td></tr>
<tr><td>2.</td><td>Sodium valproate</td><td>3.000</td><td>36.00</td></tr>
<tr><td>3.</td><td>Divalproex sodium</td><td>3.000</td><td>36.00</td></tr>
<tr><td>4.</td><td>Magnesium valproate</td><td>1.000</td><td>12.00</td></tr>
<tr><td>5.</td><td>Gabapentin</td><td>1.000</td><td>12.00</td></tr>
<tr><td>6.</td><td>Pregabalin</td><td>1.000</td><td>12.00</td></tr>
<tr><td>7.</td><td>Leflunomide</td><td>0.050</td><td>0.60</td></tr>
<tr><td>8.</td><td>Iguratimod</td><td>0.100</td><td>1.20</td></tr>
<tr><td>9.</td><td>Rivaroxaban</td><td>0.050</td><td>0.60</td></tr>
<tr><td>10.</td><td>Itopride Hydrochloride</td><td>0.200</td><td>2.40</td></tr>
<tr><td>11.</td><td>Permethol Sodium</td><td>0.025</td><td>0.30</td></tr>
<tr><td>12.</td><td>Amitriptyline Hydrochloride</td><td>0.500</td><td>6.00</td></tr>
<tr><td>13.</td><td>Duloxetine Hydrochloride</td><td>0.500</td><td>6.00</td></tr>
<tr><td>14.</td><td>Sumatriptan</td><td>0.060</td><td>0.72</td></tr>
<tr><td>15.</td><td>Clidinium Bromide</td><td>0.080</td><td>0.96</td></tr>
<tr><td>16.</td><td>Montelukast Sodium</td><td>0.500</td><td>6.00</td></tr>
<tr><td>17.</td><td>Ataluren</td><td>0.050</td><td>0.600</td></tr>
<tr><td>18.</td><td>Linezolid</td><td>1.000</td><td>12.00</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>19.</td><td>Valethamate bromide</td><td>0.050</td><td>0.600</td></tr>
<tr><td>20.</td><td>R & D
(Pre-Production)</td><td>0.495</td><td>5.94</td></tr>
<tr><td colspan="2">Grand Total</td><td>15.66 (T/Month)</td><td>187.92 (T/Annum)</td></tr>
</table>
</td></tr>
<tr><td>3.3</td><td>If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.</td><td>Not Applicable, since it is a proposed project.

The board of State Industries Promotion Corporation of Tamil Nadu (SIPCOT) in its meeting held on 24.08.2022 has approved a bulk allotment of 113 acres of underdevelopment land to M/s. Tamil Nadu Small Industries Development Corporations Limited, Tindivanam on outright sale basis. TANSIDCO, Tindivanam is keen in developing Mega Pharma Cluster in Tindivanam. Subsequently, TANSIDCO, Tindivanam has allotted a plot covering total land area of 5,867.95 Sq.m to M/s. Juvenus Drugs through the allotment letter dated 01.09.2023.

The Plot Allotment letter and the payment made to the plot allotment is enclosed as Annexure – V.</td></tr>
<tr><td>3.4</td><td>Details of existing products and production, if any, along with present product/production details in tabular format, to verify the compliance of the EIA Notifications.</td><td>Not Applicable, since it is a proposed project. Hence there will be no existing product.

List of Product:
<table>
<tr><th>S. No.</th><th>Proposed Products</th><th>Quantity (T/Month)</th><th>Quantity (T/Annum)</th></tr>
<tr><td>1.</td><td>Valproic acid</td><td>3.000</td><td>36.00</td></tr>
<tr><td>2.</td><td>Sodium valproate</td><td>3.000</td><td>36.00</td></tr>
<tr><td>3.</td><td>Divalproex sodium</td><td>3.000</td><td>36.00</td></tr>
<tr><td>4.</td><td>Magnesium valproate</td><td>1.000</td><td>12.00</td></tr>
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<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>5.</td><td>Gabapentin</td><td>1.000</td><td>12.00</td></tr>
<tr><td>6.</td><td>Pregabalin</td><td>1.000</td><td>12.00</td></tr>
<tr><td>7.</td><td>Leflunomide</td><td>0.050</td><td>0.60</td></tr>
<tr><td>8.</td><td>Iguratimod</td><td>0.100</td><td>1.20</td></tr>
<tr><td>9.</td><td>Rivaroxaban</td><td>0.050</td><td>0.60</td></tr>
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<tr><td>11.</td><td>Permethol Sodium</td><td>0.025</td><td>0.30</td></tr>
<tr><td>12.</td><td>Amitriptyline Hydrochloride</td><td>0.500</td><td>6.00</td></tr>
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<tr><td>15.</td><td>Clidinium Bromide</td><td>0.080</td><td>0.96</td></tr>
<tr><td>16.</td><td>Montelukast Sodium</td><td>0.500</td><td>6.00</td></tr>
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<tr><td>18.</td><td>Linezolid</td><td>1.000</td><td>12.00</td></tr>
<tr><td>19.</td><td>Valethamate bromide</td><td>0.050</td><td>0.600</td></tr>
<tr><td>20.</td><td>R & D
(Pre-Production)</td><td>0.495</td><td>5.94</td></tr>
<tr><td colspan="2">Grand Total</td><td>15.66 (T/Month)</td><td>187.92 (T/Annum)</td></tr>
</table>
</td></tr>
<tr><td>3.5</td><td>Details of existing products and production, if any, along with present product/production details</td><td>Not Applicable, since it is a proposed project. Hence there will be no existing product.

List of Product:</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE

in tabular format, to verify the compliance of the EIA Notifications.

S. No.	Proposed Products	Quantity (T/Month)	Quantity (T/Annum)
1.	Valproic acid	3.000	36.00
2.	Sodium valproate	3.000	36.00
3.	Divalproex sodium	3.000	36.00
4.	Magnesium valproate	1.000	12.00
5.	Gabapentin	1.000	12.00
6.	Pregabalin	1.000	12.00
7.	Leflunomide	0.050	0.60
8.	Iguratimod	0.100	1.20
9.	Rivaroxaban	0.050	0.60
10.	Itopride Hydrochloride	0.200	2.40
11.	Permethol Sodium	0.025	0.30
12.	Amitriptyline Hydrochloride	0.500	6.00
13.	Duloxetine Hydrochloride	0.500	6.00
14.	Sumatriptan	0.060	0.72
15.	Clidinium Bromide	0.080	0.96
16.	Montelukast Sodium	0.500	6.00
17.	Ataluren	0.050	0.600
18.	Linezolid	1.000	12.00
19.	Valethamate bromide	0.050	0.600

S.No.	TERMS OF REFERENCE	COMPLIANCE

20.	R & D (Pre-Production)	0.495	5.94
Grand Total		**15.66 (T/Month)**	**187.92 (T/Annum)**

3.6 List of raw materials required and their source along with mode of transportation.

List of Major Raw Materials:

S. No.	Raw Material	CAS*/ MSDS* Number	Formula	Physical State	Odour	Mol. Wt.* (g/mole)	Flash Point(ºC)	Melting Point (ºC)	Boiling Point
1.	Diethyl malonate	105-53-3	C7H12O4	Liquid	Sweet	160.17	93	-50	199
2.	2-Propyl pentanoic acid	99-66-1	C8H16O2	Liquid	Characteristic	144.21	111	26	220
3.	Cyclohexane-1,1-diacetic acid monoamide	99189-60-3	C10H17NO2	Solid	Odourless	183.25	NA	NA	NA
4.	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	590-86-3	C8H15NO3	Solid	Slight	173.21	NA	93	NA
5.	5-methyl-1,2-oxazole-4-carboxylic acid	42831-50-5	C5H5NO3	Solid	Odourless	127.10	NA	190	NA
6.	4-(trifluoromethyl)aniline	455-14-1	C7H6F3N	Liquid	Characteristic	161.12	86	3-8	83
7.	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	149457-03-4	C16H16N206S	Solid	NA	380.37	NA	NA	NA
8.	4 (4-amino phenyl) morpholin-3-one	350-46-9	C10H12N2O2	Solid	Slight aromatic odor	192.22	>93	-5	-213
9.	4-Hydroxy benzaldehyde	123-08-0	C7H602	Solid	Characteristic	122.12	NA	112-116	197
10.	Para benzoquinone	106-51-4	C6H4O2	Solid	Pungent	108.09	77	115	160
11.	Dibenzosuberone	1210-35-1	C15H12O	Solid	Mild Characteristic	208.26	NA	74	360

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>12.</td><td>(S)-3-(Methylamino)-1-(thiophen-2 yl)propane-1-ol</td><td>86408-72-2</td><td>C8H13NOS</td><td>Liquid</td><td>Amine</td><td>171.26</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>13.</td><td>3-(2-Hydroxyethyl)-N-methyl-1H--indole-5 methanesulphonamide</td><td>Not available</td><td>C12H16N2O3S</td><td>Solid</td><td>NA</td><td>268.33</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>14.</td><td>Methyl 2-hydroxy-2,2 diphenyl acetate</td><td>3260-28-8</td><td>C15H14O3</td><td>Liquid</td><td>Odourless</td><td>242.27</td><td>NA</td><td>NA</td><td>152</td></tr>
<tr><td>15.</td><td>(S)-1-(3-(2-(7-chloroquinolin-2-yl) vinyl) phenyl)-3-(2- (2-hydroxypropan -2-yl)phenyl) propan-1-ol</td><td>142569-70-8</td><td>C29H28ClNO2</td><td>Solid</td><td>NA</td><td>458</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>16.</td><td>3-cyanobenzoic acid</td><td>1877-72-1</td><td>C8H5NO2</td><td>Solid</td><td>Odourless</td><td>147.13</td><td>NA</td><td>222</td><td>NA</td></tr>
<tr><td>17.</td><td>1,2-difluoro-4 nitrobenzene</td><td>446-35-5</td><td>C6H3F2NO2</td><td>Liquid</td><td>Odourless</td><td>159.09</td><td>80</td><td>NA</td><td>81</td></tr>
<tr><td>18.</td><td>2-bromo butane</td><td>78-76-2</td><td>C4H9Br</td><td>Liquid</td><td>Ether-like</td><td>137.02</td><td>21</td><td>-112</td><td>91</td></tr>
<tr><td>19.</td><td>Choline chloride</td><td>67-48-1</td><td>C5H14ClNO</td><td>Solid</td><td>Amine Compounds</td><td>139.62</td><td>NA</td><td>302</td><td>NA</td></tr>
<tr><td>20.</td><td>Isopropyl alcohol</td><td>67-63-0</td><td>C3H8O</td><td>Liquid</td><td>Alcohol-like</td><td>60.10</td><td>12</td><td>-89</td><td>82.40</td></tr>
<tr><td>21.</td><td>Acetone</td><td>67-64-1</td><td>C3H6O</td><td>Liquid</td><td>Sweet mint-like</td><td>58.08</td><td>-20</td><td>-94.7</td><td>56.1</td></tr>
<tr><td>22.</td><td>N-Hexane</td><td>110-54-3</td><td>C6H14</td><td>Liquid</td><td>Characteristic</td><td>86.18</td><td>-22</td><td>-95</td><td>68.3</td></tr>
<tr><td>23.</td><td>Toluene</td><td>108-88-3</td><td>C7H8</td><td>Liquid</td><td>Aromatic</td><td>92.14</td><td>4</td><td>-95</td><td>111</td></tr>
</table>
</td></tr>
<tr><td>3.7</td><td>Other chemicals and materials required with quantities and storage capacities</td><td>There will be no other chemicals and materials required to this project.</td></tr>
<tr><td>3.8</td><td>Details of Emission, effluents, hazardous waste</td><td>Emission Details:</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>generation and their management.</td><td>Air quality modelling has been carried out using AERMOD software to assess the ground-level concentrations resulting from the operation of the proposed industries. Details regarding the type of fuel proposed and the corresponding emission characteristics are provided in Chapter 4 of the EIA report. Based on the modelling results, the combined ground-level concentrations from both point sources and line sources are presented below.

Ground Level Concentration from Stack Emission
<table><tr><th>Description</th><th>PM (µg/m^3)</th><th>NO_x (µg/m^3)</th><th>SO_2 (µg/m^3)</th><th>CO (mg/m^3)</th></tr><tr><td>Baseline Scenario</td><td>84.80</td><td>23.70</td><td>6.70</td><td>1,140</td></tr><tr><td>Predicted incremental GLC through AERMOD</td><td>0.071</td><td>0.936</td><td>0.061</td><td>1.986</td></tr><tr><td>Overall Scenario</td><td>84.871</td><td>24.636</td><td>6.761</td><td>1,141.986</td></tr><tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>80</td><td>4000</td></tr></table>
Ground Level Concentration from Vehicular Emission
<table><tr><th>Description</th><th>PM (µg/m^3)</th><th>NO_x (µg/m^3)</th><th>CO (mg/m^3)</th></tr><tr><td>Baseline Scenario</td><td>84.80</td><td>23.70</td><td>1,140</td></tr><tr><td>Predicted incremental GLC through AERMOD</td><td>0.11</td><td>1.21</td><td>39.76</td></tr><tr><td>Overall Scenario</td><td>84.91</td><td>24.91</td><td>1,179.76</td></tr><tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>4000</td></tr></table>
Ground Level Concentration from Cumulative Emission</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE

Description	PM (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)	CO (mg/m³)
Baseline Scenario	84.80	23.70	6.70	1,140
Predicted incremental GLC through AERMOD	0.09	0.996	0.061	39.76
Overall Scenario	84.89	24.696	6.761	1,179.76
NAAQ Standards	100	80	80	4000

Effluent Details:

S. No	Description	Proposed Quantity (KLD)	Disposal Point
Construction Phase			
1.	Sewage	2.20	Will be disposed through temporary septic tank and soak pit arrangements
Operation Phase			
1.	Sewage	1.64	Will be disposed through Bio Septic Tank with Soak Pit arrangement
2.	Effluent 1	4.48	Effluent generated from the wet scrubber and the process will have high TDS, once it is neutralized, the effluent will be sent to solar pan / heating pan for evaporation and the solid waste will be sent to TSDF.
3.	Effluent 2	3.23	Effluent from the process washing, boiler blowdown and cooling tower blowdown and sent to ETP (5 KLD Capacity) for treatment followed

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>by RO. The treated water will be utilized for gardening and the RO reject will be sent to solar pan / heating pan for evaporation.

Zero Liquid Discharge (ZLD) will be adopted.</td></tr>
</table>

Hazardous Waste:
<table>
<tr><th>S. No.</th><th>Description of Waste</th><th>Category as per HWM Rules 2016</th><th>Quantity T/Annum</th><th>Storage Method</th><th>Method of disposal</th></tr>
<tr><td>1.</td><td>Used oil</td><td>5.1</td><td>0.2</td><td rowspan="5">Hazardous waste generated will be stored inside a hazardous waste storage shed having impervious floor</td><td rowspan="4">Will be collected and disposed through TNPCB Authorized recycler</td></tr>
<tr><td>2.</td><td>Waste or residue containing oil</td><td>5.2</td><td>0.1</td></tr>
<tr><td>3.</td><td>Contaminated cotton rags or other cleaning materials</td><td>33.2</td><td>0.1</td></tr>
<tr><td>4.</td><td>Concentration and evaporation residue</td><td>37.3</td><td>36</td></tr>
<tr><td>5.</td><td>ETP sludge</td><td>35.3</td><td>3.60</td><td>Will be collected and disposed</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>6.</td><td>Process residue and waste</td><td>28.1</td><td>307</td><td></td><td rowspan="4">through TNPCB Authorized TSDF</td></tr>
<tr><td>7.</td><td>Spent catalyst</td><td>28.2</td><td>1.20</td><td></td></tr>
<tr><td>8.</td><td>Spent carbon</td><td>28.3</td><td>3.62</td><td></td></tr>
<tr><td>9.</td><td>Spent solvents</td><td>28.6</td><td>5</td><td></td></tr>
</table>
</td></tr>
<tr><td>3.9</td><td>Requirement of water, power, with source of supply, status of approval, water balance diagram,man-power requirement (regular and contract)</td><td>Requirement of Water:
Construction Phase: The water requirement during construction phase will be 25 KLD. The fresh water requirement will be 2.7 KLD where the sewage generation 2.2 KLD will be treated in septic with soak pit arrangements.

Operation Phase:
The estimated fresh water requirement is about 16.24 KLD will be sourced from the TANSIDCO water supply distribution system. The fresh water requirement for the project activity is 16.24 KLD (Domestic purpose: 1.84 KLD, R.O Process: 10.00 KLD, Cooling Tower: 2.00 KLD and Gardening: 2.20 KLD). 3.00 KLD of R.O rejection (<600 PPM) will be sent to Gardening.

The sewage generation from the domestic activity is estimated to be 1.64 KLD which is treated in bio septic tank and soak pit arrangements. The effluent from wet scrubber 0.20 KLD and 3.37 KLD from the process and 0.90 KLD RO reject after ETP treatment will be sent straightaway to Solar pan / Heating pan since it will have high TDS.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
The total quantity of the effluent generated from the other activity is 3.23 KLD (Process washing: 2.63 KLD, Boiler blow down: 0.50 KLD and Cooling tower blow down: 0.10 KLD) which will be treated in an Effluent Treatment Plant of 5 KLD capacity.

The treated effluent of 2.00 KLD after the RO process will be utilized for gardening and landscape development within the premises. The detailed water requirement and the water balance chart is provided in Chapter 2-2.11 of this EIA report.

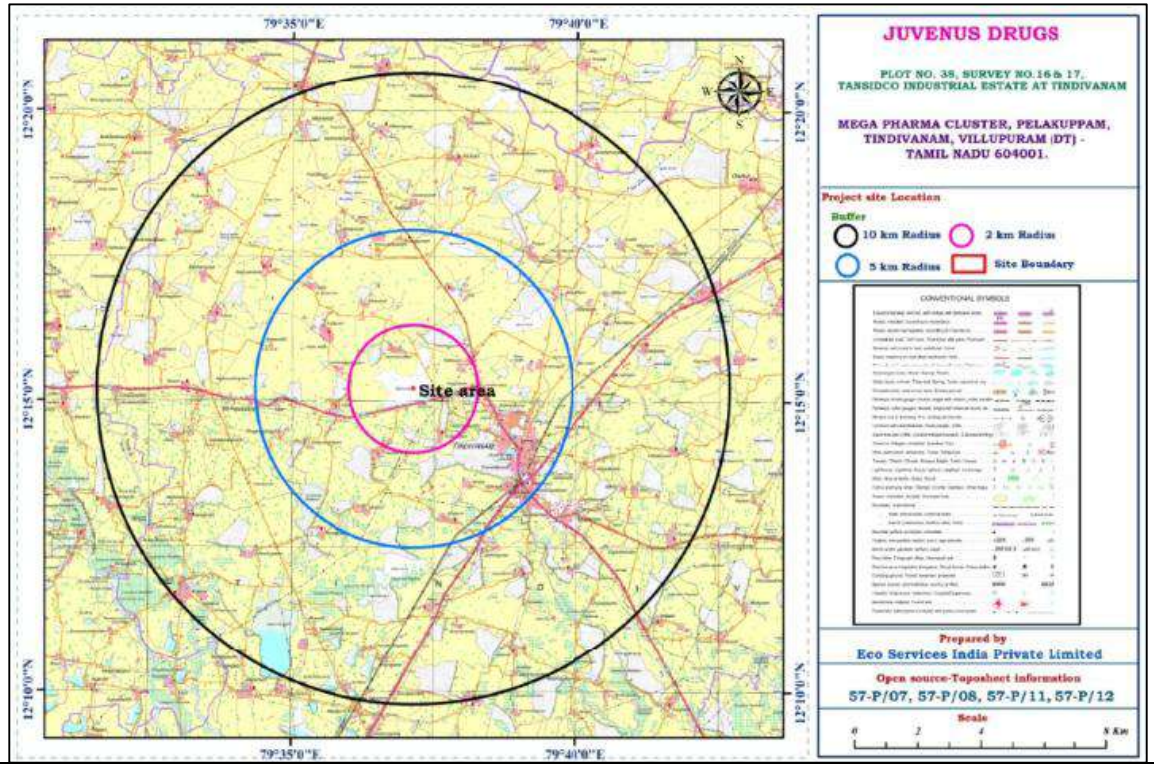
Requirement of Power and Fuel:
<table>
<tr><th>S. No.</th><th>Description</th><th>Capacity</th><th>Type of Fuel</th><th>Quantity of Fuel</th></tr>
<tr><td>1.</td><td>DG Set</td><td>125 kVA</td><td>HSD</td><td>480 Lts/day</td></tr>
<tr><td>2.</td><td>Pulverizer</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>3.</td><td>Process Reactor Stack</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>4.</td><td>Boiler</td><td>800 kg/day</td><td>PNG</td><td>1700 SCM/day</td></tr>
</table>
</td></tr>
<tr><td>3.10</td><td>Details of boiler/gensets (including stacks/exhausts) and fuels to be used</td><td>
List of Boiler and Gensets:
<table>
<tr><th>S. No.</th><th>Description</th><th>Capacity</th><th>Type of Fuel</th><th>Quantity of Fuel</th><th>Stack Height</th><th>Material of Construction</th><th>Mitigation Measures</th></tr>
<tr><td>1.</td><td>DG Set</td><td>125 kVA</td><td>HSD</td><td>480 Lts/day</td><td>10</td><td>Mild Steel</td><td>Stack height with acoustic enclosure</td></tr>
<tr><td>2.</td><td>Pulverizer</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Stainless Steel</td><td>Dust collector with stack</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>3.</td><td>Process Reactor Stack</td><td>-</td><td>-</td><td>-</td><td>11</td><td>Stainless Steel</td><td>Wet Scrubber</td></tr>
<tr><td>4.</td><td>Boiler</td><td>800 kg/day</td><td>PNG</td><td>1700 SCM/day</td><td>11</td><td>Stainless Steel</td><td>Common Stack with monitoring facility to have a check and control the Particulate Matter (PM) emissions</td></tr>
</table>
</td></tr>
<tr><td>3.11</td><td>Process description along with major equipment’s and machineries, process flow sheet(quantitative) from raw materials to products to be provided</td><td>The raw material sourced is checked for quality prior to chemical reaction process. The raw materials will undergo one or more chemical reactions such as hydrolysis, neutralization, condensation, purification, dehydration, heating, cooling and crystallization to obtain the final product. The end use of the products is provided in Table 2.5. The products will be stored in containers/bags and will be placed in the warehouses temporarily and dispatched to customers. The process description with flow chat, route of synthesis and material balance for each product is enclosed as Annexure XI. The overall material balance is provided in Table 2.10. The general flow diagram of the manufacturing process of the products is presented in figure 2.2 of Chapter 2 of this EIA report.</td></tr>
<tr><td>3.12</td><td>Hazard identification and details of proposed safety systems.</td><td>The details of Hazard identification and details of proposed safety systems is provided in Chapter 7-7.3 of this EIA report.</td></tr>
<tr><td>3.13</td><td>Expansion/modernization proposals:
a. Copy of all the Environmental</td><td>Not applicable, since it is a greenfield project.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
	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 Integrated Regional Office of the Ministry of Environment, Forest and Climate Change 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, copy of the latest CTO and status of compliance of Consent to Operate for the	

S.No.	TERMS OF REFERENCE	COMPLIANCE
	ongoing/existing operation of the project from SPCB shall be attached with the EIA-EMP report. 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,	

S.No.	TERMS OF REFERENCE	COMPLIANCE
	compliance report to the conditions ofconsents from the SPCB shall be submitted.	
4.	**Site Details**	
4.1	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	The proposed project site is located at Plot No. 38, Survey No. 16 & 17, TANSIDCO, Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The geo-graphical co-ordinates at center of the project site are 12°15'12.58"N, 79°37'9.87"E. No alternative site has been considered based on the followings: **Land ownership:** TANSIDCO, Tindivanam has allotted a plot on outright sale basis to the proponent towards development of the proposed project. **Land use:** The proposed project site is located within the TANSIDCO Industrial Estate. **Accessibility:** The site is surrounded by institutional, commercial and industrial establishments making it an ideal for industrial development. The site is located near the Thiruvannamalai – Tindivanam national highway. **Infrastructure:** The TANSIDCO, Tindivanam Industrial Estate proposes to house several industries with fresh water supply from the 3 MLD Tertiary Treatment Reverse Osmosis (TTRO) and provides access to major roads.

S.No.	TERMS OF REFERENCE	COMPLIANCE
4.2	A topo-sheet of the study area of radius of 10 km 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)	**Topo Map of the Study Area - 10km** 
4.3	Details w.r.t. option analysis for selection of site	The proposed project site is located at Plot No. 38, Survey No. 16 & 17, TANSIDCO, Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The geo-graphical co-ordinates at center of the project site are 12°15'12.58"N, 79°37'9.87"E. No alternative site has been considered based on the followings:

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>Land ownership: TANSIDCO, Tindivanam has allotted a plot on outright sale basis to the proponent towards development of the proposed project.

Land use: The proposed project site is located within the TANSIDCO Industrial Estate.

Accessibility: The site is surrounded by institutional, commercial and industrial establishments making it an ideal for industrial development. The site is located near the Thiruvannamalai – Tindivanam national highway.
Infrastructure: The TANSIDCO, Tindivanam Industrial Estate proposes to house several industries with fresh water supply from the 3 MLD Tertiary Treatment Reverse Osmosis (TTRO) and provides access to major roads.</td></tr>
<tr><td>4.4</td><td>Co-ordinates (lat-long) of all four corners of the site.</td><td>
<table>
<tr><th>S.No.</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>1</td><td>12°15'13.42"N</td><td>79°37'8.42"E</td></tr>
<tr><td>2</td><td>12°15'13.55"N</td><td>79°37'11.30"E</td></tr>
<tr><td>3</td><td>12°15'11.56"N</td><td>79°37'11.30"E</td></tr>
<tr><td>4</td><td>12°15'11.56"N</td><td>79°37'8.35"E</td></tr>
</table>
</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
4.5	Google map-Earth download of the project site.	
4.6	Layout maps indicating existing unit as well as proposed unit indicating	The master plan layout of the proposed project is enclosed as **Annexure – I**. The TANSIDCO layout map is enclosed **Annexure-II**.

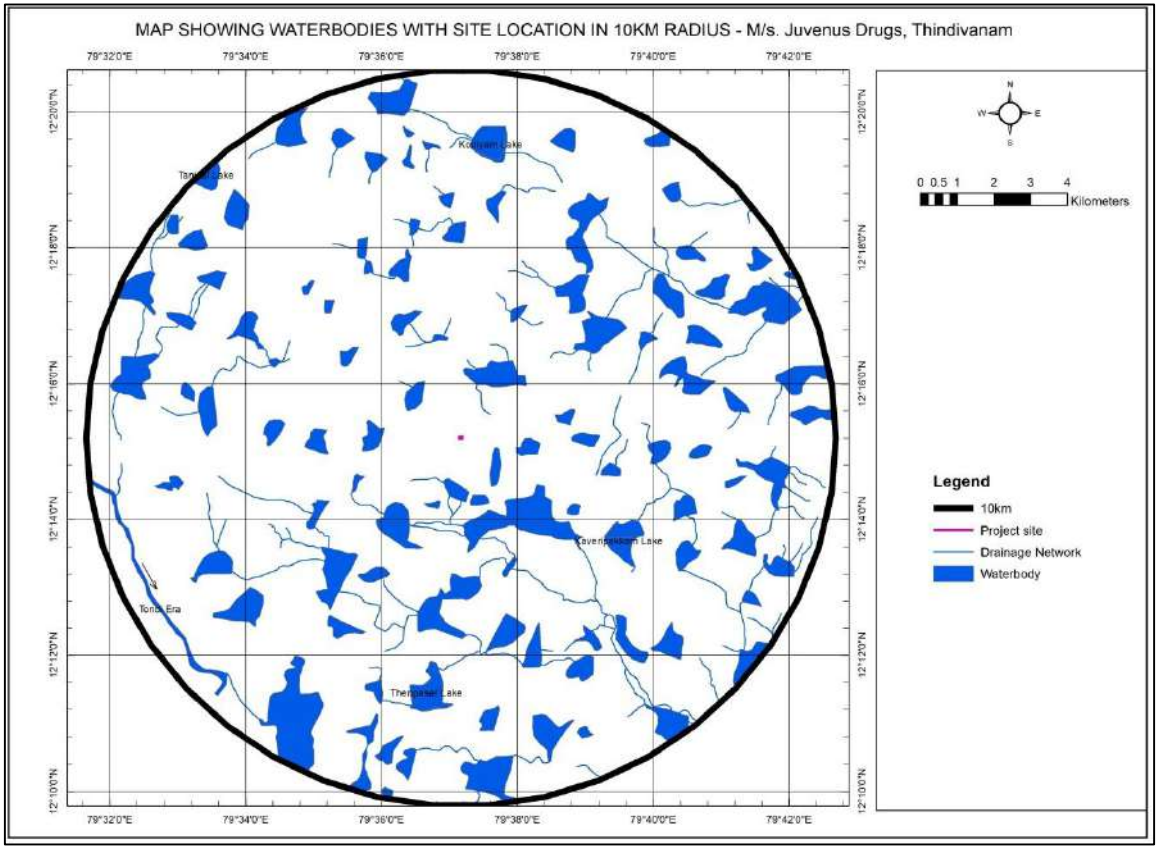
S.No.	TERMS OF REFERENCE	COMPLIANCE
	storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	
4.7	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	The project is a greenfield project.  

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>   </td></tr>
<tr><td>4.8</td><td>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 forindustrial area)</td><td>Land use – Industrial Use

Land Area Breakup details:

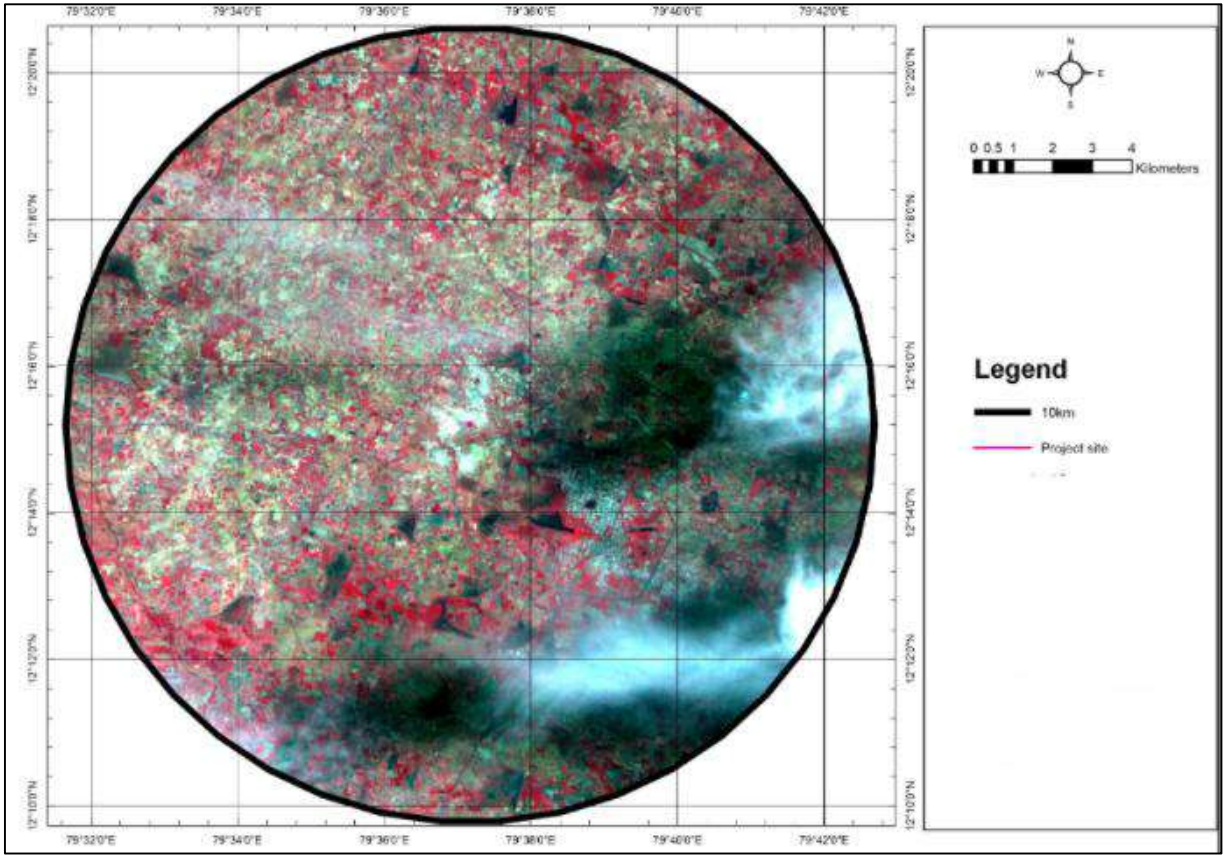
<table>
<tr><th>S. No.</th><th>Description</th><th>Area (Sq.m.)</th><th>Percentage (%)</th></tr>
<tr><td>1</td><td>Total Area</td><td>5867.95</td><td>100</td></tr>
<tr><td>2</td><td>Process Building Area (Production and R&D)</td><td>930</td><td>16</td></tr>
<tr><td>3</td><td>Non Process Building Area (Ware house, Office Building, Canteen Block a Toilets)</td><td>744</td><td>13</td></tr>
<tr><td>4</td><td>Internal Road Area and Pavement</td><td>533</td><td>9</td></tr>
<tr><td>5</td><td>Surface Parking Area</td><td>80</td><td>1</td></tr>
<tr><td>6</td><td>Green Belt</td><td>2054</td><td>35</td></tr>
<tr><td>7</td><td>Vacant Land Area</td><td>1446</td><td>25</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>8</td><td>Other Utilities (Boiler Room, E.B. Panel Room, UG Sump, RWH, Septic Tank and Soak Pit, ETP area, Solid waste handling area, Hazardous waste storage area, Security room)</td><td>80.95</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>4.9</td><td>A list of major industries with name and type within study area (10 km radius) shall be incorporated. Land use details of the study area</td><td>
Existing Industries within 10km radius:
<table>
<tr><th>Industries</th><th>~Distance (km)</th><th>Direction</th></tr>
<tr><td>Cheyyar SEZ Developers Private Limited</td><td>0.36</td><td>SSE</td></tr>
<tr><td>Pioneer Cold Store & Cladding Pvt Ltd</td><td>0.52</td><td>NE</td></tr>
<tr><td>Sri Ram Enterprises</td><td>0.59</td><td>NNE</td></tr>
<tr><td>JRMB Auto Technologies Private Limited</td><td>0.71</td><td>N</td></tr>
<tr><td>Dharshini Engineering Private Limited</td><td>0.78</td><td>N</td></tr>
<tr><td>Stellar Pipes</td><td>1.11</td><td>NNE</td></tr>
<tr><td>SAF Petroleum</td><td>1.45</td><td>NNE</td></tr>
<tr><td>Kals Rises India Private Limited</td><td>1.76</td><td>NNE</td></tr>
<tr><td>Shree Kubera Vinayagar Modern Rice Mill</td><td>5.67</td><td>E</td></tr>
<tr><td>Kanishka Granites</td><td>6.19</td><td>E</td></tr>
<tr><td>Horizon Packs Private Limited</td><td>6.81</td><td>E</td></tr>
<tr><td>Mini Star Engineering Private Limited</td><td>7.02</td><td>E</td></tr>
<tr><td>Jayanthi Agro Industries</td><td>8.18</td><td>SE</td></tr>
</table>
</td></tr>
<tr><td>4.10</td><td>Geological features and Geo-hydrological status of the study area shall be included.</td><td>The details of Geological features and Geo-hydrological are provided in Chapter 3 of this EIA report.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
4.11	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 Map – 10km radius: 

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>Waterbodies within 10km radius:
<table>
<tr><th>S. No.</th><th>Name of watercourse / water bodies</th><th>Direction</th><th>Distance (Km)</th></tr>
<tr><td>1.</td><td>Pattanam Lake</td><td>NE</td><td>1.86</td></tr>
<tr><td>2.</td><td>Buderi Lake</td><td>SE</td><td>2.47</td></tr>
<tr><td>3.</td><td>Vempundi Lake</td><td>SW</td><td>2.63</td></tr>
<tr><td>4.</td><td>Melpakkam Lake</td><td>NE</td><td>4.47</td></tr>
<tr><td>5.</td><td>Avaiyurkuppam Lake</td><td>SW</td><td>7.51</td></tr>
<tr><td>6.</td><td>Kodiyam Lake</td><td>N</td><td>7.83</td></tr>
<tr><td>7.</td><td>Saram Lake</td><td>NE</td><td>8.16</td></tr>
<tr><td>8.</td><td>Vilukkam Lake</td><td>W</td><td>8.45</td></tr>
<tr><td>9.</td><td>Elamangalam Lake</td><td>NW</td><td>8.92</td></tr>
<tr><td>10.</td><td>Tondi eri</td><td>SW</td><td>9.08</td></tr>
<tr><td>11.</td><td>Saram eri</td><td>NE</td><td>9.37</td></tr>
<tr><td>12.</td><td>Kondamur eri</td><td>SE</td><td>10.12</td></tr>
<tr><td>13.</td><td>Olakkkur Lake</td><td>NE</td><td>10.92</td></tr>
<tr><td>14.</td><td>Sankaraparani River</td><td>SW</td><td>11.07</td></tr>
<tr><td>15.</td><td>Etanemali Lake</td><td>NW</td><td>11.22</td></tr>
<tr><td>16</td><td>Ongur Channel / Stream</td><td>NE</td><td>14.05</td></tr>
</table></td></tr>
<tr><td>4.12</td><td>Status of acquisition of land. If acquisition is not</td><td>The proposed site is already allocated to the project proponent (M/s. Juvenus Drugs) by TANSIDCO through a land allotment order for the plot no. 38, Survey No. 16 & 17, TANSIDCO, Tindivanam Mega</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
	complete, stage of the acquisition process and expected time of complete possession of the land. Documents related to conversion of land for Industrial purpose.	Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The plot allotment order is enclosed as Annexure – V.
4.13	R&R details in respect of land in line with state Government policy.	Rehabilitation and Resettlement is not applicable, since the project site is located within the TANSIDCO industrial area.
5.	**Forest, Wildlife and Crz Related Issues (If Applicable):**	
5.1	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	Not applicable, since the site is within the TANSIDCO Industrial Park.
5.2	Land-use map based on High resolution satellite imagery of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha)	**Land Use / Land Cover Map:**

S.No.	TERMS OF REFERENCE	COMPLIANCE
		
5.3	Status of Application submitted for obtaining the stage I forestry clearance	Not applicable, the project site is located within the TANSIDCO industrial park and no forest land is involved in the project.

S.No.	TERMS OF REFERENCE	COMPLIANCE
	along with latest status shall be submitted.	
5.4	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 Wardenthereon	Nil, there is no National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors within 10 km radius.
5.5	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, there is no Schedule-I species within the study area as per the primary survey.

S.No.	TERMS OF REFERENCE	COMPLIANCE
5.6	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife	Not applicable.
5.7	Recommendations and NOC from the concerned State/UT Coastal Zone Management Authority on CRZ angle	Not applicable.
6.	**Environmental Status**	
6.1	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.P • AAQ data (except monsoon) at 8 locations for	The details of the micrometeorological data, AAQ location and the result and interpretation is given in Chapter 3-3.5 of this EIA report.

S.No.	TERMS OF REFERENCE	COMPLIANCE
	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. Study should indicate minimum, maximum value of different parameters for the period (3 months) collected. Collected data should be supported by the reference data of either CPCB or SPCB. AAQ data & GLC of pollutants from stack emissions should suggest technology/ measures- Best Practiced Technology (BPT)	

S.No.	TERMS OF REFERENCE	COMPLIANCE
	indicating best achieved results.	
6.2	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.	The raw data of all the AAQ for 12 weeks of all stations as per frequency is enclosed as Annexure - XV.
6.3	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.	The details of surface water monitoring location and the results with interpretation is given in Chapter 3-3.7 in this EIA report.
6.4	Whether the site falls near to polluted stretch of river identified by the	No, the site is not located near to any polluted stretch of river which is identified by CPCB/MoEF&CC.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>CPCB/MoEF&CC, if yes give details.</td><td></td></tr>
<tr><td>6.5</td><td>Ground water monitoring at minimum at 8 locations shall be included.</td><td>The details of ground water monitoring location and the results with interpretation is given in Chapter 3-3.7 in this EIA report.</td></tr>
<tr><td>6.6</td><td>Noise levels monitoring at 8 locations within the study area.</td><td>The details of ANL location and the results with interpretation is given in Chapter 3-3.6 in this EIA report.</td></tr>
<tr><td>6.7</td><td>Soil Characteristic as per CPCB guidelines.</td><td>The details of Soil monitoring location and the results with interpretation is given in Chapter 3-3.8 in this EIA report.</td></tr>
<tr><td>6.8</td><td>Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.</td><td>A Traffic Study was carried out in the Thiruvannamalai – Tindivanam Highway which is the nearest highway which connects the project site on March 13, 2025 to assess the existing traffic during the morning and evening peak hours.

Traffic observed during Morning Peak Hours
<table><tr><th colspan="7">Type of Carriageway: Two Lane – Two way</th></tr><tr><th>Time</th><th>Two Wheelers (Motor cycle, Scooter etc.)</th><th>Three Wheelers (Auto rickshaws, motorised carts etc.)</th><th>Four Wheelers (Passenger cars, Pickup vans etc.)</th><th>Six Wheelers (Light commercial vehicles, Trucks & Buses etc.)</th><th>Bicycles</th><th>Others (Carts etc)</th></tr><tr><td>07.00 - 07.30 Hrs</td><td>45</td><td>15</td><td>32</td><td>15</td><td>5</td><td>2</td></tr><tr><td>07.30 - 08.00 Hrs</td><td>75</td><td>48</td><td>61</td><td>18</td><td>11</td><td>5</td></tr><tr><td>08.00 - 08.30 Hrs</td><td>85</td><td>57</td><td>83</td><td>25</td><td>15</td><td>5</td></tr></table></td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE

08.30 - 09.00 Hrs	99	85	98	32	21	9
09.00 - 09.30 Hrs	120	91	105	38	15	6
09.30 - 10.00 Hrs	90	45	86	19	12	5
10.00 - 10.30 Hrs	78	45	74	12	10	2
10.30 - 11.00 Hrs	56	21	43	10	8	3
Item Total	648	407	582	169	97	37
						1940
Percentage Composition	33	21	30	9	5	2
M. Factor	0.75	1.2	1	3.7	0.5	2
PCU	**486**	**488**	**582**	**625**	**49**	**74**
Total No. of PCUs (For 4 Hrs)						**2304**
Total No. of PCUs/Hr (Avg.)						**576**

Traffic observed during Evening Peak Hours

Type of Carriageway: Two Lane – Two way						
Time	**Two Wheelers (Motor cycle, Scooter etc.)**	**Three Wheelers (Auto rickshaws, motorised carts etc.)**	**Four Wheelers (Passenger cars, Pickup vans etc.)**	**Six Wheelers (Light commercial vehicles, Trucks & Buses etc.)**	**Bicycles**	**Others (Carts etc)**
04.00 - 04.30 Hrs	54	21	41	8	5	1
04.30 - 05.00 Hrs	75	52	53	10	8	8
05.00 - 05.30 Hrs	90	63	60	12	17	5
05.30 - 06.00 Hrs	112	75	85	22	22	6
06.00 - 06.30 Hrs	96	85	92	30	16	7
06.30 - 07.00 Hrs	102	65	88	23	12	5

S.No.	TERMS OF REFERENCE	COMPLIANCE

07.00 - 07.30 Hrs	75	60	66	18	11	5	
07.30 - 08.00 Hrs	101	66	52	8	13	3	
Item Total	**705**	**487**	**537**	**131**	**104**	**40**	
						2004	
Percentage Composition	35	24	27	7	5	2	
M. Factor	0.75	1.2	1	3.7	0.5	2	
PCU	**529**	**584**	**537**	**485**	**52**	**80**	
Total No. of PCUs (For 4 Hrs)						**2267**	
Total No. of PCUs/Hr (Avg.)						**567**	

Traffic Summary

Existing Traffic Load in PCUs/Hr	Increase in Vehicular Population due to Proposed Development	Estimated Future Traffic Volume in PCUs/Hr (V)	Capacity of Existing Road in PCUs per Hour as per IRC 106-1990 (C)	V/C Ratio
MP- 576	PCUs/Hr-200	MP -776	1500 PCU	0.52
EP- 567		EP - 767		

Interpretation of V/C Ratio

The Volume to Capacity (V/C) ratio at the assessed location is 0.52. As per the Indian Roads Congress (IRC) guidelines, IRC:106-1990 and IRC:64-1990, V/C ratio below 0.85 indicates that the road operates under acceptable service conditions with no serious congestion or delay.

S.No.	TERMS OF REFERENCE	COMPLIANCE
		• **V/C ≤ 0.75** – Excellent Level of Service: Free flow conditions. • **0.75 < V/C ≤ 0.85** – Good Level of Service: Stable flow, acceptable delays. • **0.85 < V/C ≤ 1.0** – Approaching capacity; increasing delays. • **V/C > 1.0** –Oversaturated; unstable flow with frequent stoppages. Therefore, a V/C ratio of 0.52 implies that the roadway is operating within its design capacity, and no significant adverse impact is anticipated from the projected increase in traffic volume.
6.9	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.	The flora and fauna study had been carried out within the 10 km radius of the project site and the details of the same is provided in the Chapter 3-3.9 of this EIA report.
6.10	Socio-economic status of the study area.	The Socio-economic study had been carried out within the 10 km radius of the project site and the details of the same is provided in the Chapter 3-3.10 of this EIA report.
7.	**Environment Impact and Environment Management Plan**	
7.1	Assessment of ground level concentration of pollutants from the stack emission	Air quality modelling has been carried out using AERMOD software to assess the ground-level concentrations resulting from the operation of the proposed industries. Details regarding the type of fuel proposed and the corresponding emission characteristics are provided in Chapter 4 of the EIA report.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>based on sitespecific 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 62odeling 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.</td><td>Based on the modelling results, the combined ground-level concentrations from both point sources and line sources are presented below.

Table 4.1 – Ground Level Concentration from Stack Emission
<table><tr><th>Description</th><th>PM ($\mu g/m^3$)</th><th>NO_x ($\mu g/m^3$)</th><th>SO_2 ($\mu g/m^3$)</th><th>CO (mg/m^3)</th></tr><tr><td>Baseline Scenario</td><td>84.80</td><td>23.70</td><td>6.70</td><td>1,140</td></tr><tr><td>Predicted incremental GLC through AERMOD</td><td>0.071</td><td>0.936</td><td>0.061</td><td>1.986</td></tr><tr><td>Overall Scenario</td><td>84.871</td><td>24.636</td><td>6.761</td><td>1,141.986</td></tr><tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>80</td><td>4000</td></tr></table>
Table 4.2 – Ground Level Concentration from Vehicular Emission
<table><tr><th>Description</th><th>PM ($\mu g/m^3$)</th><th>NO_x ($\mu g/m^3$)</th><th>CO (mg/m^3)</th></tr><tr><td>Baseline Scenario</td><td>84.80</td><td>23.70</td><td>1,140</td></tr><tr><td>Predicted incremental GLC through AERMOD</td><td>0.11</td><td>1.21</td><td>39.76</td></tr><tr><td>Overall Scenario</td><td>84.91</td><td>24.91</td><td>1,179.76</td></tr><tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>4000</td></tr></table></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>Table 4.3 – Ground Level Concentration from Cumulative Emission
<table>
<tr><th>Description</th><th>PM (µg/m^3)</th><th>NO_x (µg/m^3)</th><th>SO_2 (µg/m^3)</th><th>CO (mg/m^3)</th></tr>
<tr><td>Baseline Scenario</td><td>84.80</td><td>23.70</td><td>6.70</td><td>1,140</td></tr>
<tr><td>Predicted incremental GLC through AERMOD</td><td>0.09</td><td>0.996</td><td>0.061</td><td>39.76</td></tr>
<tr><td>Overall Scenario</td><td>84.89</td><td>24.696</td><td>6.761</td><td>1,179.76</td></tr>
<tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>80</td><td>4000</td></tr>
</table></td></tr>
<tr><td>7.2</td><td>Water Quality Modelling – in case of discharge in water body</td><td>Nil, there will be no discharge of wastewater or treated water. ZLD is adopted</td></tr>
<tr><td>7.3</td><td>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</td><td>The impact of the transportation of raw material and end product on the surrounding environment is provided in chapter 4 – 4.3 of this EIA report.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>transport shall be examined.</td><td></td></tr>
<tr><td>7.4</td><td>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 1986.</td><td>Sewage and the Effluent Generated and its Disposal Point
<table>
<tr><th>S.No</th><th>Description</th><th>Proposed Quantity (KLD)</th><th>Disposal Point</th></tr>
<tr><td colspan="4">Construction Phase</td></tr>
<tr><td>1.</td><td>Sewage</td><td>2.20</td><td>Will be disposed through temporary septic tank and soak pit arrangements</td></tr>
<tr><td colspan="4">Operation Phase</td></tr>
<tr><td>1.</td><td>Sewage</td><td>1.64</td><td>Will be disposed through Bio Septic Tank with Soak Pit arrangement</td></tr>
<tr><td>2.</td><td>Effluent 1</td><td>4.48</td><td>Effluent generated from the wet scrubber and the process will have high TDS, once it is neutralized, the effluent will be sent to solar pan / heating pan for evaporation and the solid waste will be sent to TSDF.</td></tr>
<tr><td>3.</td><td>Effluent 2</td><td>3.23</td><td>Effluent from the process washing, boiler blowdown and cooling tower blowdown and sent to ETP (5 KLD Capacity) for treatment followed by RO. The treated water will be utilized for gardening and the RO reject will be sent to solar pan / heating pan for evaporation.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>Zero Liquid Discharge (ZLD) will be adopted.</td></tr>
</table>

The effluent characteristic will be within the limit of TNPCB / CPCB standards.</td></tr>
<tr><td>7.5</td><td>Details of stack emission and action plan for control of emissions to meet standards</td><td>The major stack emission from the project activity will be DG set, Process stack and Boiler. The control measures are given below:

• Wet scrubber with a stack height of 11 m (AGL) will be provided for Process Stack.
• Common Stack with monitoring facility to control the Particulate Matter (PM) emissions will be installed for Boiler stack with a height of 11 m (AGL).
• DG stack with a height of 10 m (AGL) will be provided.
• Adequate Greenbelt area will be provided within the project premises.</td></tr>
<tr><td>7.6</td><td>Measures for fugitive emission control</td><td>The details of the fugitive emission are given in Chapter 4 of this EIA report.</td></tr>
<tr><td>7.7</td><td>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,</td><td>Hazardous Waste Generation and Management:

<table>
<tr><th>S. No.</th><th>Description of Waste</th><th>Category as per HWM Rules 2016</th><th>Quantity T/Annum</th><th>Storage Method</th><th>Method of disposal</th></tr>
<tr><td>1.</td><td>Used oil</td><td>5.1</td><td>0.2</td><td rowspan="2">Hazardous waste generated will be stored inside a</td><td rowspan="2">Will be collected and disposed</td></tr>
<tr><td>2.</td><td>Waste or residue containing oil</td><td>5.2</td><td>0.1</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th colspan="6">COMPLIANCE</th></tr>
<tr><td></td><td>recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.</td><td colspan="6">
<table>
<tr><td>3.</td><td>Contaminated cotton rags or other cleaning materials</td><td>33.2</td><td>0.1</td><td>hazardous waste storage shed having impervious floor</td><td>through TNPCB Authorized recycler</td></tr>
<tr><td>4.</td><td>Concentration and evaporation residue</td><td>37.3</td><td>36</td><td rowspan="6"></td><td rowspan="6">Will be collected and disposed through TNPCB Authorized TSDF</td></tr>
<tr><td>5.</td><td>ETP sludge</td><td>35.3</td><td>3.60</td></tr>
<tr><td>6.</td><td>Process residue and waste</td><td>28.1</td><td>307</td></tr>
<tr><td>7.</td><td>Spent catalyst</td><td>28.2</td><td>1.20</td></tr>
<tr><td>8.</td><td>Spent carbon</td><td>28.3</td><td>3.62</td></tr>
<tr><td>9.</td><td>Spent solvents</td><td>28.6</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>7.8</td><td>Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.</td><td colspan="6">Not applicable, since the HSD will be used as fuel for DG set and PNG will be used as fuel for Boiler.</td></tr>
<tr><td>7.9</td><td>Action plan for the green belt development plan in 33 % area i.e. land with not less than 2,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt</td><td colspan="6">The area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in the below table.

List of Species Proposed to be Planted within the Project Premises
<table>
<tr><th>S.No.</th><th>Common Name (Trees)</th><th>Botanical Name (Tree)</th></tr>
<tr><td>10.</td><td>Pongamia glabra</td><td>Pungan</td></tr>
<tr><td>11.</td><td>Michelia champaca</td><td>Shenbagam</td></tr>
<tr><td>12.</td><td>Ficus religiosa</td><td>Arasu</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated</td><td>
<table>
<tr><td>13.</td><td>Azadirachta indica</td><td>Vembu</td></tr>
<tr><td>14.</td><td>Terminalia arjuna</td><td>Neermardhu</td></tr>
<tr><td>15.</td><td>Calophyllum inophyllum</td><td>Punnai</td></tr>
<tr><td>16.</td><td>Syzygium cumini</td><td>Naval</td></tr>
<tr><td>17.</td><td>Madhuca longifolia</td><td>IIipai</td></tr>
<tr><td>18.</td><td>Mimusops elengi</td><td>Magilam</td></tr>
</table>
</td></tr>
<tr><td>7.10</td><td>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.</td><td>Storm water drains will be provided all along the periphery. Separate line for sewage and storm water will be provided to avoid run off contamination. The drains will be adequately sized to prevent over flooding of the site. The rain water and storm water design is as per Rain Water Harvesting and Conservation Manual, CPWD, GOI.
Design of Rain Water Harvesting (RWH) sump:
Surface area of roof top catchment (A) : 1,674 m^2
Peak rainfall in 15 min (r) : 5.75 mm
(In Villupuram region, peak hourly rainfall is mm)
Runoff co-efficient : 0.85
Capacity of the tank : 1,674 m^2 x 0.00575 m x 0.85 m
: 8.18 m
Capacity of the storage tank required : 9.00 m^3
Capacity of the storage tank proposed : 100 m^3 (1 no.)
(Ref.: Chapter 4 – Design of Storage/ Settlement Tanks, page no. 20–21, Rain Water Harvesting and Conservation Manual, 2019, CPWD, Government of India)

Estimation of Runoff:
The estimation of runoff is given in below table.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
Average annual rainfall for Villupuram Region : 1013.4 mm
https://www.annauniv.edu/cccdm/districtprofiles/villupuram.htmlmm/annum
Based on the annual rainfall days, average daily rainfall : 23 mm/day

Estimation of Runoff
<table>
<tr><th>S. No.</th><th>Description</th><th>Area (Sq.m)</th><th>Runoff Coefficient</th><th>Rainfall Intensity (m/day)</th><th>Runoff (Cum/day)</th></tr>
<tr><td>1</td><td>Rooftop Area</td><td>1,674</td><td>0.95</td><td>0.023</td><td>37</td></tr>
<tr><td>2</td><td>Roads, Pavement and Services Area</td><td>693.95</td><td>0.80</td><td>0.023</td><td>13</td></tr>
<tr><td>3</td><td>Greenbelt Area</td><td>3500</td><td>0.30</td><td>0.023</td><td>24</td></tr>
<tr><td colspan="5">Total</td><td>74 Cu.m</td></tr>
</table>
<u>Internal Storm Water Drains</u>
100 % of total quantum of rainfall in catchment area is considered
Estimated runoff from project site : 74 m^3 /d = 0.0008 Cu.m/sec
Cross section of storm drains
: 1 m^2 (B: 1m; D: 1m)
Carrying capacity of the open flow channel is based on Manning's equation as follows:
Q = A * V,
where, Q = Discharge in Cu.m/sec ; A = Area in Sq.m
V = Velocity in m/sec
$V = 1/n * R^{2/3} * S^{1/2}$
where, n = Manning's Coefficient (For concrete = 0.016)
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
R = Hydraulic Radius in m (R = D/4, where D = Diameter in m)
S = Channel slope in m/m
For the Industry,
n = 0.016
A = LxW = 1 m^2
P = 2 x (1) + 1 = 3 m
R = A/P = 1/3 = 0.33 m
S = 1/300 = 0.0033
V = 1.78 m/sec
Q = A x V = 1 x 1.78 = 1.78 m^3 /sec
Thus, the proposed internal storm water drains is adequate to handle the runoff from the project site. The excess storm water after recharge and storage will be conveyed into the external storm water drain maintained by TANSIDCO which has its outfall into the nearby natural drainage course (Pattanam Eri).

The cost estimate of the proposed Rain Water Harvesting Plan prepared for our project is given in below table.

Cost Estimation for Rain Water Harvesting Structures
<table>
<tr><th>S.No.</th><th>Name of the component</th><th>Specifications proposed</th><th>Cost in Lakhs</th></tr>
<tr><td>1.</td><td>Storm Water Drain</td><td>1 m (length) x 1 m (Width)</td><td>1.5</td></tr>
<tr><td>2.</td><td>Recharge Sump</td><td>100 m^3</td><td>1</td></tr>
<tr><td colspan="3">Total</td><td>2.5</td></tr>
</table>
</td></tr>
<tr><td>7.11</td><td>Total capital cost and recurring cost/annum for</td><td>The EMP cost for both the construction phase and the operation phase are given below:</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>environmental pollution control measures shall be included.</td><td>

EMP - Budgetary Allocation for Construction Phase

<table>
<tr><th rowspan="3">Description</th><th colspan="2">Budgetary Allocation</th></tr>
<tr><th colspan="2">(Rs. In Lakhs)</th></tr>
<tr><th>Capital Expenses</th><th>Operational Expenses
(Per Annum)</th></tr>
<tr><td>Drinking Water & Sanitation (Temporary Toilet) Facilities</td><td>2</td><td>2</td></tr>
<tr><td>Storm Water Management</td><td>2</td><td>0.5</td></tr>
<tr><td>Solid Waste/Debris Management</td><td>1</td><td>1</td></tr>
<tr><td>Environmental Monitoring</td><td>-</td><td>1</td></tr>
<tr><td>Dust Suppression Measures</td><td>1.5</td><td>0.5</td></tr>
<tr><td>Occupational Health & Safety</td><td>1</td><td>0.5</td></tr>
<tr><td>Total</td><td>7.5</td><td>5.5</td></tr>
</table>

Table 9.4 – EMP - Budgetary Allocation for Operation Phase

<table>
<tr><th rowspan="2">S.No.</th><th rowspan="2">Description</th><th colspan="2">Budgetary Allocation (Rs. In Lakhs)</th></tr>
<tr><th>Capital Expenses</th><th>Operational Expenses (Per Annum)</th></tr>
<tr><td>1.</td><td>Effluent Treatment Plant</td><td>5</td><td>2.5</td></tr>
<tr><td>2.</td><td>Rain Water Harvesting System</td><td>30</td><td>1</td></tr>
<tr><td>3.</td><td>Air Pollution Control Measures</td><td>9</td><td>1.5</td></tr>
<tr><td>4.</td><td>Solid Waste Management</td><td>1.5</td><td>0.5</td></tr>
<tr><td>5.</td><td>Environmental Monitoring</td><td>-</td><td>5.08</td></tr>
</table>

</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>6.</td><td>Energy Conservation</td><td>25</td><td>0.5</td></tr>
<tr><td>7.</td><td>Greenbelt Development</td><td>5</td><td>2</td></tr>
<tr><td></td><td>Total</td><td>75.5</td><td>13.08</td></tr>
</table>
</td></tr>
<tr><td>7.12</td><td>Action plan for post-project environmental monitoring shall be submitted.</td><td>The details of environmental monitoring program are given in Chapter 6 of this EIA report.</td></tr>
<tr><td>7.13</td><td>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</td><td>The details of Risk assessment are given in Chapter 7 of this EIA report and the QRA is enclosed as Annexure – XIII.</td></tr>
<tr><td>8.</td><td colspan="2">Occupational Health</td></tr>
<tr><td>8.1</td><td>Plan and fund allocation to ensure the occupational health & safety of all contract and casual Workers</td><td>The project proponent has allocated 1 lakh for Occupational Health and Safety of employees. The plan and the fund allotment is given in Chapter 10 of this EIA report.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
8.2	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 preplacement 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.	The details of health and safety management for the worker is given in Chapter 10-10.6.5 of this EIA report.
8.3	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are	Not applicable, since it a greenfield project

S.No.	TERMS OF REFERENCE	COMPLIANCE
	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.	
8.4	Annual report of health status of workers with special reference to Occupational Health and Safety.	Not applicable, since it a greenfield project
9.	**Corporate Environment Policy**	
9.1	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.	The Project Proponent (M/s. Juvenus Drugs) has their own Environmental Policy approved by its board of directors.
9.2	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement /	An EHS Policy has been formulated, and comprehensive Standard Operating Procedures (SOPs) along with detailed EHS checklists will be developed and implemented during the project's operational phase. Periodic Environmental Audits will be carried out, and the findings will be properly documented.

S.No.	TERMS OF REFERENCE	COMPLIANCE
	deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	
9.3	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.	Any employee who observes or becomes aware of any non-compliance or violation of environmental norms shall immediately report the same to the EHS In-Charge. The reported issue will be addressed and, if necessary, escalated to the next level until it is fully resolved. A hierarchical system will be followed to manage environmental issues, and an Environmental Management Cell (EMC) will be established to oversee and ensure effective implementation.
9.4	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	M/s. Juvenus Drugs will have their own reporting system for the non-compliance of the Environmental Clearance.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>9.5</td><td>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.</td><td>• Adequate sanitation facilities and restrooms will be provided for the labour force during the construction phase.
• During the operation phase, necessary amenities such as sanitary facilities, restrooms, Occupational Health and Safety (OHS) provisions and a canteen will be provided for employees and drivers.</td></tr>
<tr><td>10.</td><td colspan="2">Corporate Environmental Responsibility (CER)</td></tr>
<tr><td>10.1</td><td>Adequate funds, as per the Ministry’s OM/Guidelines, shall be earmarked towards the Corporate Environmental Responsibility based on Public Hearing issues/socioeconomic issues and item-wise details along with time bound action plan shall be included (CER activities shall be related to environment). Socio-</td><td>1.0% of the total project cost (i.e., INR 4.52 lakhs) has been earmarked towards Corporate Environment Responsibility (CER) activities. The allocated amount will be utilized for the infrastructure development for nearby government schools, in line with the observations made during the public hearing.
<table>
<tr><th>Beneficiary</th><th>Type of CER Activity</th><th>Budgetary Allocation (Rs. In Lakhs)</th></tr>
<tr><td>Government Higher Secondary School, Vellimedupettai Village, Tindivanam Taluk, Villupuram District</td><td>• Construction of New Toilet Facility (4 Toilets – 2 Male + 2 Female)
• Carrying out electrical maintenance activities, including replacement of electrical fixtures.
• Conducting life skill training program</td><td>4.52</td></tr>
<tr><td colspan="2">Total</td><td>4.52</td></tr>
</table>
</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
	economic development activities need to be elaborated upon. For the projects where public hearing is not conducted, CER plan shall be provided based on socio-economic study of the area.	
11.	**Additional Studies/measures to be considered**	
11.1	Provide latest and ecofriendly technology for product manufacturing.	API (Active Pharmaceutical Ingredient) manufacturing, adopting eco-friendly and sustainable technologies can significantly reduce emissions, waste and resource consumption. The latest trends include shifting from traditional batch processes to continuous flow manufacturing, which ensures better energy efficiency, reduced solvent use and consistent product quality. Biocatalysis using immobilized enzymes or engineered microbes is increasingly applied for complex reactions, offering higher selectivity, lower temperatures and minimal chemical waste.
11.2	Emphasize on Green chemistry/Clean Manufacturing	The chemicals used in the process are selected to minimize or eliminate the use and generation of substances that may be hazardous to humans, animals, plants or the environment. Clean manufacturing practices will be implemented in accordance with Good Manufacturing Practices (GMP) requirements, which include: • **Personal Protective Equipment (PPE):** Use of coveralls/gowns, head coverings, gloves, and protective eyewear. • **Personal and Material Movement:** Provision of dedicated entry and exit points for personnel, materials, and waste to prevent cross-contamination. • **HVAC System:** Installation of an efficient system to maintain controlled environmental conditions.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>

- **Clean Room Areas:** Maintenance of Grade A/B/C/D clean room environments as per GMP standards.
- **Clean Utilities:** Utilization of purified water and Water for Injection (WFI) for process operations to ensure product quality and hygiene.

</td></tr>
<tr><td>11.3</td><td>Provide CAS No. of products along with product list.</td><td>

List of Major Raw Materials:

<table>
<tr><th>S. No.</th><th>Raw Material</th><th>CAS*/ MSDS* Number</th><th>Formula</th><th>Physical State</th><th>Odour</th><th>Mol. Wt.* (g/mole)</th><th>Flash Point(ºC)</th><th>Melting Point (ºC)</th><th>Boiling Point</th></tr>
<tr><td>1.</td><td>Diethyl malonate</td><td>105-53-3</td><td>C7H12O4</td><td>Liquid</td><td>Sweet</td><td>160.17</td><td>93</td><td>-50</td><td>199</td></tr>
<tr><td>2.</td><td>2-Propyl pentanoic acid</td><td>99-66-1</td><td>C8H16O2</td><td>Liquid</td><td>Characteristic</td><td>144.21</td><td>111</td><td>26</td><td>220</td></tr>
<tr><td>3.</td><td>Cyclohexane-1,1-diacetic acid monoamide</td><td>99189-60-3</td><td>C10H17NO2</td><td>Solid</td><td>Odourless</td><td>183.25</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>4.</td><td>(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid</td><td>590-86-3</td><td>C8H15NO3</td><td>Solid</td><td>Slight</td><td>173.21</td><td>NA</td><td>93</td><td>NA</td></tr>
<tr><td>5.</td><td>5-methyl-1,2-oxazole-4-carboxylic acid</td><td>42831-50-5</td><td>C5H5NO3</td><td>Solid</td><td>Odourless</td><td>127.10</td><td>NA</td><td>190</td><td>NA</td></tr>
<tr><td>6.</td><td>4-(trifluoromethyl)aniline</td><td>455-14-1</td><td>C7H6F3N</td><td>Liquid</td><td>Characteristic</td><td>161.12</td><td>86</td><td>3-8</td><td>83</td></tr>
<tr><td>7.</td><td>N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide</td><td>149457-03-4</td><td>C16H16N206S</td><td>Solid</td><td>NA</td><td>380.37</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>8.</td><td>4 (4-amino phenyl) morpholin-3-one</td><td>350-46-9</td><td>C10H12N2O2</td><td>Solid</td><td>Slight aromatic odor</td><td>192.22</td><td>>93</td><td>-5</td><td>-213</td></tr>
</table>

</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE

9.	4-Hydroxy benzaldehyde	123-08-0	C7H602	Solid	Characteristic	122.12	NA	112-116	197
10.	Para benzoquinone	106-51-4	C6H4O2	Solid	Pungent	108.09	77	115	160
11.	Dibenzosuberone	1210-35-1	C15H12O	Solid	Mild Characteristic	208.26	NA	74	360
12.	(S)-3-(Methylamino)-1-(thiophen-2 yl)propane-1-ol	86408-72-2	C8H13NOS	Liquid	Amine	171.26	NA	NA	NA
13.	3-(2-Hydroxyethyl)-N-methyl-1H--indole-5 methanesulphonamide	Not available	C12H16N2O3S	Solid	NA	268.33	NA	NA	NA
14.	Methyl 2-hydroxy-2,2 diphenyl acetate	3260-28-8	C15H14O3	Liquid	Odourless	242.27	NA	NA	152
15.	(S)-1-(3-(2-(7-chloroquinolin-2-yl) vinyl) phenyl)-3-(2- (2-hydroxypropan -2-yl)phenyl) propan-1-ol	142569-70-8	C29H28ClNO2	Solid	NA	458	NA	NA	NA
16.	3-cyanobenzoic acid	1877-72-1	C8H5NO2	Solid	Odourless	147.13	NA	222	NA
17.	1,2-difluoro-4 nitrobenzene	446-35-5	C6H3F2NO2	Liquid	Odourless	159.09	80	NA	81
18.	2-bromo butane	78-76-2	C4H9Br	Liquid	Ether-like	137.02	21	-112	91
19.	Choline chloride	67-48-1	C5H14ClNO	Solid	Amine Compounds	139.62	NA	302	NA
20.	Isopropyl alcohol	67-63-0	C3H8O	Liquid	Alcohol-like	60.10	12	-89	82.40
21.	Acetone	67-64-1	C3H6O	Liquid	Sweet mint-like	58.08	-20	-94.7	56.1
22.	N-Hexane	110-54-3	C6H14	Liquid	Characteristic	86.18	-22	-95	68.3
23.	Toluene	108-88-3	C7H8	Liquid	Aromatic	92.14	4	-95	111

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>11.4</td><td>Provide details of amount of carbon sequestered in their unit through greenbelt/other modes, in case of expansion project.</td><td>Not applicable, since it is a greenfield project.</td></tr>
<tr><td>11.5</td><td>Life structure and sustainability for carbon and water foot print.</td><td>This detail will be provided in the final EIA report.</td></tr>
<tr><td>11.6</td><td>Detailed pollution Load estimation.</td><td>The details of the pollution load are given Chapter 2-2.8 of this EIA report.</td></tr>
<tr><td>11.7</td><td>Transportation of Hazardous substance, effluents etc shall be carriedout through authorized and GPS enable vehicles/Trucks only.</td><td>There will be no effluent discharge outside the facility as a Zero Liquid Discharge (ZLD) system is proposed.

Hazardous waste generated will be collected, stored and disposed of through TNPCB-authorized recyclers and the Treatment, Storage, and Disposal Facility (TSDF) as per regulatory norms.</td></tr>
<tr><td>11.8</td><td>Category of Hazardous Wastes shall be mentioned in the EIA/EMP report and in presentation.</td><td>
<table>
<tr><th>S. No.</th><th>Description of Waste</th><th>Category as per HWM Rules 2016</th><th>Quantity T/Annum</th><th>Storage Method</th><th>Method of disposal</th></tr>
<tr><td>1.</td><td>Used oil</td><td>5.1</td><td>0.2</td><td rowspan="2">Hazardous waste generated will be stored inside a</td><td rowspan="2">Will be collected and disposed</td></tr>
<tr><td>2.</td><td>Waste or residue containing oil</td><td>5.2</td><td>0.1</td></tr>
</table>
</td></tr>
</table>

<table>
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<tr><td></td><td></td><td>
<table>
<tr><td>3.</td><td>Contaminated cotton rags or other cleaning materials</td><td>33.2</td><td>0.1</td><td rowspan="7">hazardous waste storage shed having impervious floor</td><td>through TNPCB Authorized recycler</td></tr>
<tr><td>4.</td><td>Concentration and evaporation residue</td><td>37.3</td><td>36</td><td rowspan="6">Will be collected and disposed through TNPCB Authorized TSDF</td></tr>
<tr><td>5.</td><td>ETP sludge</td><td>35.3</td><td>3.60</td></tr>
<tr><td>6.</td><td>Process residue and waste</td><td>28.1</td><td>307</td></tr>
<tr><td>7.</td><td>Spent catalyst</td><td>28.2</td><td>1.20</td></tr>
<tr><td>8.</td><td>Spent carbon</td><td>28.3</td><td>3.62</td></tr>
<tr><td>9.</td><td>Spent solvents</td><td>28.6</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>11.9</td><td>Details of greenhouse gases and emissions shall be provided.</td><td>Air Emission:
Air quality modelling has been carried out using AERMOD software to assess the ground-level concentrations resulting from the operation of the proposed industries. Details regarding the type of fuel proposed and the corresponding emission characteristics are provided in Chapter 4 of the EIA report. Based on the modelling results, the combined ground-level concentrations from both point sources and line sources are presented below.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE

Ground Level Concentration from Stack Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	6.70	1,140
Predicted incremental GLC through AERMOD	0.071	0.936	0.061	1.986
Overall Scenario	84.871	24.636	6.761	1,141.986
NAAQ Standards	100	80	80	4000

Ground Level Concentration from Vehicular Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	1,140
Predicted incremental GLC through AERMOD	0.11	1.21	39.76
Overall Scenario	84.91	24.91	1,179.76
NAAQ Standards	100	80	4000

Ground Level Concentration from Cumulative Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	6.70	1,140

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Predicted incremental GLC through AERMOD</td><td>0.09</td><td>0.996</td><td>0.061</td><td>39.76</td></tr>
<tr><td>Overall Scenario</td><td>84.89</td><td>24.696</td><td>6.761</td><td>1,179.76</td></tr>
<tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>80</td><td>4000</td></tr>
</table>
</td></tr>
<tr><td>11.10</td><td>Greenbelt shall be developed in the first year of the project and wind breaks shall be erected.</td><td>The area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in below Table.

List of Species Proposed to be Planted within the Project Premises
<table>
<tr><th>S.No.</th><th>Common Name (Trees)</th><th>Botanical Name (Tree)</th></tr>
<tr><td>1.</td><td>Pongamia glabra</td><td>Pungan</td></tr>
<tr><td>2.</td><td>Michelia champaca</td><td>Shenbagam</td></tr>
<tr><td>3.</td><td>Ficus religiosa</td><td>Arasu</td></tr>
<tr><td>4.</td><td>Azadirachta indica</td><td>Vembu</td></tr>
<tr><td>5.</td><td>Terminalia arjuna</td><td>Neermardhu</td></tr>
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<tr><td>8.</td><td>Madhuca longifolia</td><td>IIipai</td></tr>
<tr><td>9.</td><td>Mimusops elengi</td><td>Magilam</td></tr>
</table>
</td></tr>
<tr><td>11.11</td><td>Study area map shall be overlapped with all the associated features.</td><td>The Study area map is shown in the Chapter 3 of this EIA report.</td></tr>
<tr><td>11.12</td><td>Emphasize on green fuels.</td><td>only HSD and PNG will be the source of fuel for DG set and the boiler.</td></tr>
<tr><td>11.13</td><td>The project from NCR shall not use Coal as fuel.</td><td>Not applicable, since there is no usage of coal as fuel for the project activity.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>Further, PP shall avoid use of Coal in the
CPAs and elsewhere also if alternatives are available</td><td></td></tr>
<tr><td>11.14</td><td>Provide the Cost-Benefit analysis with respect to the environment due to the project.</td><td>Not applicable, as the proposed site is located within TANSIDCO (a part of SIPCOT, which already holds a valid Environmental Clearance) and the land is already in possession of the project proponent.</td></tr>
<tr><td>11.15</td><td>Details of carbon foot prints and carbon sequestration study w.r.t. proposed project needs to spelled out. Proposed mitigation measures also needs to be analyzed and submitted for further appraisal of the EAC</td><td>The area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in below Table.

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<tr><td>11.16</td><td>Any litigation pending against the project and/or</td><td>There is no litigation pending against the proposed project activity.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
	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.	
11.17	A tabular chart with index for point wise compliance of above TORs and its details needs to be submitted in the EIA/EMP Report.	Will be followed as per the condition stated.
12.	**Specific Condition**	
12.1	Details on solvents to be used, measures for solvent recovery and for emissions control.	The details of solvents are given in Chapter 2-2.7 and the emission and control measures are given below:

S.No.	TERMS OF REFERENCE	COMPLIANCE

Ground Level Concentration from Stack Emission

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Ground Level Concentration from Cumulative Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)

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<tr><td>Overall Scenario</td><td>84.89</td><td>24.696</td><td>6.761</td><td>1,179.76</td></tr>
<tr><td>NAAQ Standards</td><td>100</td><td>80</td><td>80</td><td>4000</td></tr>
</table>
Air Pollution Control Measures:
• Wet scrubber with a stack height of 11 m (AGL) will be provided for Process Stack.
• Common Stack with monitoring facility to control the Particulate Matter (PM) emissions will be installed for Boiler stack with a height of 11 m (AGL)
• DG stack with a height of 10 m (AGL) will be provided
• Adequate Greenbelt area will be provided within the project premises.
</td></tr>
<tr><td>12.2</td><td>Details of process emissions from the proposed unit and its arrangement to control.</td><td>• Wet scrubber with a stack height of 11 m (AGL) will be provided for Process Stack.
• Common Stack with monitoring facility to control the Particulate Matter (PM) emissions will be installed for Boiler stack with a height of 11 m (AGL)</td></tr>
<tr><td>12.3</td><td>Ambient air quality data should include VOC, other process-specific pollutants* like NH3*,Chlorine*, HCl*, HBr*, H2S*, HF*, etc.,(*-as applicable)</td><td>The details of the AAQ data which included with VOC is given in Chapter 3-3.5 of this EIA report.</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td>12.4</td><td>Work zone monitoring arrangements for hazardous chemicals.</td><td>

All containers shall be properly labelled and suitable level indicators shall be installed.
Appropriate safety signage shall be displayed at all relevant locations.
Material Safety Data Sheets (MSDS) shall be readily available at the work area.
Chemical safety training shall be provided to all personnel and an updated inventory of hazardous chemicals shall be maintained. Preventive measures against electrostatic hazards shall be implemented.
Regular inspections and checks shall be conducted to ensure effective risk control measures, including proper earthing, functioning of safety interlocks, bonding, closed-system transfers and prevention of spillages.
Periodical health check-ups shall be mandatory for workers handling hazardous chemicals, in accordance with the provisions of the Factory Act.
All containers and liners shall be detoxified and certified by the Production In-charge prior to dispatch to the disposal area.

</td></tr>
<tr><td>12.5</td><td>Detailed effluent treatment scheme including segregation of effluent streams for units adopting ‘Zero’ liquid discharge.</td><td>
Sewage and Effluent Details:
<table>
<tr><th>S.No</th><th>Description</th><th>Proposed Quantity (KLD)</th><th>Disposal Point</th></tr>
<tr><td colspan="4">Construction Phase</td></tr>
<tr><td>1.</td><td>Sewage</td><td>2.20</td><td>Will be disposed through temporary septic tank and soak pit arrangements</td></tr>
<tr><td colspan="4">Operation Phase</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th colspan="4">COMPLIANCE</th></tr>
<tr><td></td><td></td><td colspan="4"><table>
<tr><td>1.</td><td>Sewage</td><td>1.64</td><td>Will be disposed through Bio Septic Tank with Soak Pit arrangement</td></tr>
<tr><td>2.</td><td>Effluent 1</td><td>4.48</td><td>Effluent generated from the wet scrubber and the process will have high TDS, once it is neutralized, the effluent will be sent to solar pan / heating pan for evaporation and the solid waste will be sent to TSDF.</td></tr>
<tr><td>3.</td><td>Effluent 2</td><td>3.23</td><td>Effluent from the process washing, boiler blowdown and cooling tower blowdown and sent to ETP (5 KLD Capacity) for treatment followed by RO. The treated water will be utilized for gardening and the RO reject will be sent to solar pan / heating pan for evaporation.

Zero Liquid Discharge (ZLD) will be adopted.</td></tr>
</table></td></tr>
<tr><td>12.6</td><td>Action plan for odour control to be submitted.</td><td colspan="4">There will be no odour from the process, since the process will be in closed loop system. The odour will be generated only in the ETP. Periodic maintenance will be done at the ETP to keep the surrounding odour free.</td></tr>
<tr><td>12.7</td><td>A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic</td><td colspan="4">Not Applicable, since it is a greenfield Project.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
	solid/hazardous waste generated.	
12.8	Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF, if any.	Solid/Hazardous waste will be disposed through TSDF and Authorization will be obtained from TNPCB as per Norms.
12.9	Action plan for utilization of MEE/dryers salts.	Salt from ATFD will be collected periodically and Stored and disposed thorugh Authorized TSDF as per HW Norms.
12.10	Material Safety Data Sheet for all the Chemicals are being used/will be used.	MSDS of all checmical and solvent are enclosed as Annexure – X.
12.11	Authorization/Membership for the disposal of solid/hazardous waste in TSDF	Authorization/Membership for the disposal of solid/hazardous waste in TSDF will be done after obtaining necessary clearance.
12.12	Details of incinerator if to be installed.	Not applicable, since there is no incinerator is proposed in the project.
12.13	Risk assessment for storage and handling of hazardous chemicals/ solvents. Action plan for handling & safety system to be incorporated.	Risk Assessment report for the hazardous chemical / solvent is enclosed as Annexure – XIII.

S.No.	TERMS OF REFERENCE	COMPLIANCE
12.14	Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.	**M/s. Juvenus Drugs** ensures a safe and healthy work environment for all employees by implementing comprehensive occupational health and safety practices, including annual medical examinations. **The key objectives are:** • To maintain and promote workers health and overall working capacity. • To improve the workplace environment through employee well-being programs. • To monitor and maintain industrial hygiene standards at the workplace. • To foster a safety-oriented work culture that enhances health, safety and productivity through a positive social climate. • To ensure all employees undergo annual health check-ups. • To provide each employee with appropriate Personal Protective Equipment (PPE) as per job requirements. **During the operational phase, the Safety Committee will:** 1. Conduct routine workplace inspections to identify and mitigate hazards. 2. Ensure the provision and proper use of Personal Protective Equipment (PPE). 3. Develop, implement and monitor safe work procedures and operational rules. 4. Conduct regular safety training sessions and enforce safety policies through appropriate disciplinary measures. 5. Promote safety awareness among employees to minimize the risk of injury or loss. 6. Identify, assess and control workplace hazards through proactive measures. 7. Enforce safety rules, evaluate safety performance and implement measures to reduce the frequency and severity of workplace injuries.
12.15	Details of carbon foot prints and carbon sequestration study w.r.t.	Committement towards the environmental sustainability, the area allocated for greenbelt development is 2,054 (35% of total land area) around 469 nos. of trees will be planted within the premises. The list of native species proposed to be planted is given in below Table.

<table>
<tr><th>S.No.</th><th>TERMS OF REFERENCE</th><th>COMPLIANCE</th></tr>
<tr><td></td><td>proposed project needs tospelled out. Proposed mitigation measures also need to be analysed and submitted for further appraisal of the EAC.</td><td>List of Species Proposed to be Planted within the Project Premises
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</table></td></tr>
<tr><td colspan="3">SEIAA STANDARD CONDITIONS:</td></tr>
<tr><td>1.</td><td>Impacts on Energy requirement.</td><td>Impacts on Energy Requirement

The establishment and operation of the proposed industry will result in an increase in overall energy demand due to process operations, utilities, lighting and administrative facilities. The major energy requirement will be in the form of electric power for running production machinery, pumps, compressors and environmental control systems.

Potential Impacts:

• Increased Demand on Power Supply:

The project will contribute to additional load on the local/state power grid. This may require coordination with the State Electricity Board for adequate power allocation and infrastructure strengthening.</td></tr>
</table>

S.No.	TERMS OF REFERENCE	COMPLIANCE
		• **Air Emission from DG Sets:** During power failures, DG sets used as backup will emit pollutants such as NOx, CO, SO_2, and particulate matter, contributing marginally to local air pollution. **Operational Costs:** Higher energy consumption may increase operational costs and affect long-term sustainability if energy efficiency measures are not adopted. **Mitigation and Energy Conservation Measures** • Adoption of energy-efficient equipment and motors complying with BEE Star ratings. • Use of LED lighting and automation-based lighting controls within the premises. • Regular energy audits to identify and reduce avoidable losses. • Installation of solar panels on rooftops or open areas to supplement power supply from renewable sources. • Proper maintenance of DG sets and other energy equipment to ensure optimal fuel efficiency. • Heat recovery systems and insulation to minimize process heat losses. • Encouragement of employee awareness programs for energy conservation.
2.	Impacts on living System (air, water, soil & micro-organisms).	The details are given in Chapter 3 of this EIA Report.

S.No.	TERMS OF REFERENCE	COMPLIANCE
3.	Impacts on terrestrial & aquatic within and surrounding areas.	The details are given in Chapter 3 of this EIA Report.
4.	As per the MoEF& CC office memorandum F.No.22-65/2017-IA.III dated: 30.09.2020 and 20.10.2020 the proponent shall furnish the detailed EMP mentioning all the CER activities as committed with the action plan.	The details are given in Chapter 9 of this EIA Report.
5.	The proponent shall provide details on the adequate parking facility provided including vehicles of all the workers & visitors and a clean traffic plan.	Sufficient parking is provided for both the workers and visitors.
6.	The project proponent shall furnish the action taken to improve water usage efficiency in the building.	The details are provided in Chapter 2 of this EIA report.

S.No.	TERMS OF REFERENCE	COMPLIANCE
7.	The project proponent shall conduct detailed study of biodiversity flora & fauna including invasives /endemic vulnerable species.	The details are given in Chapter 3 of this EIA Report.
8.	The project proponent shall furnish NOC obtained from competent authority that there is no encroachment of water bodies (including canals).	Not applicable, since the proposed site is located within the TANSIDCO industrial park and there is no encroachment of waterbodies.
9.	The project proponent shall conduct detailed soil investigation including microflora/fauna.	The details are given in Chapter 3 of this EIA Report.
10.	The project proponent shall study impact on livelihoods of locals.	The details are given in Chapter 3 of this EIA Report.
11.	The project proponent shall furnish List of trees available in the project area.	Not applicable, the site is vacant. There are no existing nos. of trees.

S.No.	TERMS OF REFERENCE	COMPLIANCE
12.	The project proponent shall study impact of activities on water bodies/wetlands.	The details are given in Chapter 4 of this EIA Report.
13.	The proponent shall furnish details on the measures taken to make the Buildings energy efficient confirming to green building norms.	The details are given in Chapter 4 of this EIA Report.
14.	The disaster management and disaster mitigation plan shall be furnished and should be seriously adhered to avoid of calamities.	The details are given in Chapter 7 of this EIA Report.
15.	The project proponent shall conduct studies on the presence of invasive and alien species around the project the area and shall furnish mitigate measures to prevent their spread.	The details are given in Chapter 4 of this EIA Report. There is no invasive and alien species around the project site.
16.	The proponent shall furnish details on the actions taken to reduce anthropogenic	Not applicable, since it is an industrial activity.

S.No.	TERMS OF REFERENCE	COMPLIANCE
	GHGs such as CO2, CH4, nitrous oxide, etc., resulting from human activities.	
17.	The proponent shall furnish details on the strategies adopted to decarbonize the building.	Not applicable, since it is an industrial activity.
18.	The proponent shall furnish measures taken to mitigate the impact on critically endangered species, biodiversity, etc., due to the modification of the habitat.	The details are given in Chapter 3 of this EIA Report.
19.	The proponent shall develop emergency response plan in addition to the disaster management plan.	The details are given in Chapter 7 of this EIA Report.
20.	The proponent shall furnish details on building-friendly pest control strategies developed using non chemical measures so as to control the pest population	Not applicable, since it is an industrial activity.

S.No.	TERMS OF REFERENCE	COMPLIANCE
	thereby not losing beneficial organisms.	
21.	The proponent shall furnish details on strategies developed to ensure the buildings in blocks don't trap heat and become local urban heat islands.	Not applicable, since it is an industrial activity.
22.	The proponent shall develop detailed evacuation plan for disabled people and safety evacuation plan during emergencies.	A detailed evacuation plan during the construction phase is given in Chapter 4 of this EIA report.
23.	The proponent shall explain the methodology adopted to control thermal Environment and other shocks in the building.	Not applicable, since it is an industrial activity.
24.	The proponent shall provide details on the provisions for controlled ventilation and lighting systems.	Proper ventilation systems will be provided in the industrial building / warehouse / block.

1.5 REGULATORY / LEGAL SCOPING OF THE PROJECT

The project proponent will obtain and comply with the statutory approvals specific to the project activity. The list of applicable approvals for the proposed project is provided below in **Table 1.2**.

Table 1.1: Statutory Approvals for the project

Regulatory Norms	Regulatory Authority	Approvals to be Obtained	Status of Approval
Tamil Nadu Combined Development and Building Rules, 2019	Directorate and Town Country Planning	Building Plan Approval	To be obtained after the receipt of Environmental Clearance.
Environmental Protection (EP) Act – EIA Notification 2006	MoEF&CC/SEIAA	Environmental Clearance (EC)	ToR accorded by SEIAA and now Draft EIA submitted for conducting Public Hearing
Factories Act, 1948 and Tamil Nadu Factories Rules, 1950	Directorate of Industrial Safety and Health (DISH)	Factory License	To be obtained
Tamil Nadu Fire Service Act, 1985	Fire and Rescue Services	Fire NOC	Obtained
Water (Prevention and Control of Pollution) Act, 1974	Tamil Nadu Pollution Control Board	Consent to Establish and Consent to Operate	To be obtained after obtaining Environmental Clearance, Planning permission and Completion Certificate (in case of Consent to Operate)
Air (Prevention and Control of Pollution) Act, 1981	Tamil Nadu Pollution Control Board	Consent to Establish and Consent to Operate	
Environmental Protection (EP) Act – EIA Notification 2006	Tamil Nadu Pollution Control Board	Hazardous Waste Authorization	

CHAPTER 2
PROJECT DESCRIPTION

2.1 TYPE OF THE PROJECT

The proposed project is a green field project. It involves in the production of Active Pharmaceutical Ingredients & Intermediates of total production quantity 15.66 T/Month. The project falls under Category B (Schedule 5(f): Synthetic Organic Chemicals) as per the EIA Notification, 2006 and its amendments.

2.2 NEED OF THE PROJECT

The proposed project will address the demand supply gap for Active Pharmaceutical Ingredients (APIs) and intermediates. To reduce dependency on imports, enhance supply chain security, and support indigenous manufacturing of critical pharmaceutical products. By fostering advanced infrastructure and innovative technologies, the project will contribute to both state and national healthcare self-reliance while supporting export potential.

2.3 LOCATION OF THE PROJECT

The project site is located in TANSIDCO, Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The Figure 2.1 illustrates the location map, outlining the project boundary and geographical co-ordinates. The master plan layout is enclosed as **Annexure II**. The Environmental Setting of the project site is illustrated in **Table 2.1**.

Table 2.1 Environmental Setting of the Project Site

S. No.	Item	Details
1.	Geographical Co-ordinates	Centre of the site
	Latitude	12°15'12.58"N
	Longitude	79°37'9.87"E
2.	Project Site Elevation in MSL	72-79 m
3.	Topo Sheet Nos.	57-P/07, 57-P/08, 57-P/11, 57-P/12
4.	Land use at the Proposed project site	Industrial Use Zone
5.	Nearest Highway	NH 77 – Thiruvannamalai – Tindivanam Highway, 0.45 Km, Southern Direction
6.	Nearest Railway Station	Tindivanam Railway Station – 4.38 Km, South Eastern direction
7.	Nearest Airport	Puducherry Airport – 37.22 Km, South Eastern direction

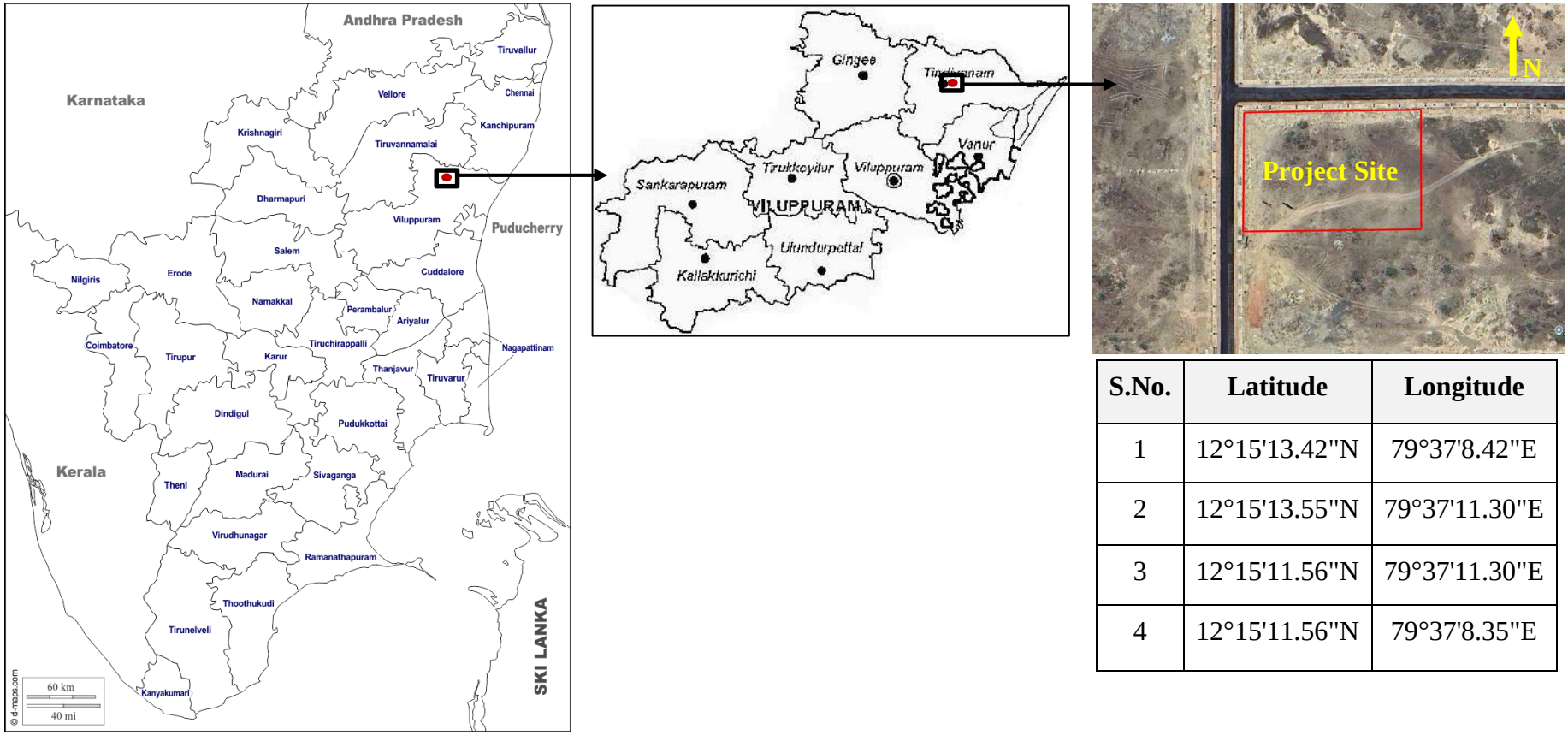
S. No.	Item	Details
		Chennai International Airport – 99.19 km, North Eastern direction
8.	Nearest Habitation/ Village	Pattanam – 1.55 Km, North Eastern direction
9.	Nearest Town/ City	Tindivanam – 4.55 Km, South Eastern direction
10.	Interstate boundary	Nil within 10 km radius
11.	Nearest River	Sankaraparani River – 21.10 Km, South Western direction
12.	Nearest Water Bodies	Pattanam lake – 1.86 Km, North Eastern direction Buderi Lake – 2.47 Km, South Eastern direction
14.	Ecologically sensitive zones or Protected areas as per Wildlife Protection Act, 1972	Nil within 10 km radius
15.	Reserved Forests (RF)	Kilsevur Reserved Forest – 9.84 Km, South Eastern direction
16.	Critically polluted areas as per CPCB Notification	Nil within 10 km radius
17.	Historical and cultural important places	Gingee Fort – 24.36 Km, South Western direction
18.	Seismic zone	Zone 2
19.	Defense installations	Nil within 10 km radius

The board of State Industries Promotion Corporation of Tamil Nadu (SIPCOT) in its meeting held on 24.08.2022 has approved a bulk allotment of 113 acres of underdevelopment land to M/s. Tamil Nadu Small Industries Development Corporations Limited, Tindivanam on outright sale basis. TANSIDCO, Tindivanam is keen in developing Mega Pharma Cluster in Tindivanam. Subsequently, TANSIDCO, Tindivanam has allotted a plot covering total land area of 5,867.95 Sq.m to M/s. Juvenus Drugs through the allotment letter dated 01.09.2023. Land area break-up is provided in **Table 2.2**.

Table 2.2: Land Area Break Up

S. No.	Description	Area (Sq.m.)	Percentage (%)
1	Total Area	5867.95	100
2	Process Building Area (Production and R&D)	930	16
3	Non Process Building Area (Ware house, Office Building, Canteen Block a Toilets)	744	13
4	Internal Road Area and Pavement	533	9
5	Surface Parking Area	80	1
6	Green Belt	2054	35

7	Vacant Land Area	1446	25
8	Other Utilities (Boiler Room, E.B. Panel Room, UG Sump, RWH, Septic Tank and Soak Pit, ETP area, Solid waste handling area, Hazardous waste storage area, Security room)	80.95	1



S.No.	Latitude	Longitude
1	12°15'13.42"N	79°37'8.42"E
2	12°15'13.55"N	79°37'11.30"E
3	12°15'11.56"N	79°37'11.30"E
4	12°15'11.56"N	79°37'8.35"E

Figure 2.1 Location of the Project Site with Geographical Co-ordinates

(Source: Google Earth 2023 (Online)Available at: http://www.google.com/earth/index.html [Accessed 20th October, 2025)

2.4 JUSTIFICATION OF SITE SELECTION

No alternative site was examined, as the proposed location is project-specific and has been earmarked by TANSIDCO for the development of a Mega Pharma Cluster. Also, project site is well connected by roads (NH 77, 0.45 Km, S) and railways (Tindivanam railway station, 4.38 Km, SE).

2.5 SIZE OR MAGNITUDE OF OPERATION

The proposed unit has a total production capacity of 15.66 T/Month. Earlier the Terms of Reference is granted for 20.635 T/Month. The details of the products with their respective quantities as per the Terms of Reference along with the revised products and quantities proposed for Environmental Clearance are presented in **Table 2.3.**

Table 2.3 Proposed Changes in Products and Quantities (TOR vs. Revised)

TOR obtained for the Product with quantity				EC Requested for the Product with quantity			
S. No.	**Proposed Products**	**Quantity (T/Month)**	**Quantity (T/Annum)**	**S. No.**	**Proposed Products**	**Quantity (T/Month)**	**Quantity (T/Annum)**
1.	Valproic acid	3.000	36.00	1.	Valproic acid	3.000	36.00
2.	Sodium valproate	3.000	36.00	2.	Sodium valproate	3.000	36.00
3.	Divalproex sodium	5.000	60.00	3.	Divalproex sodium	3.000	36.00
4.	Magnesium valproate	1.000	12.00	4.	Magnesium valproate	1.000	12.00
5.	Gabapentin	1.000	12.00	5.	Gabapentin	1.000	12.00
6.	Pregabalin	2.000	24.00	6.	Pregabalin	1.000	12.00
7.	Leflunomide	0.050	0.60	7.	Leflunomide	0.050	0.60
8.	Iguratimod	0.100	1.20	8.	Iguratimod	0.100	1.20
9.	Rivaroxaban	0.050	0.60	9.	Rivaroxaban	0.050	0.60
10.	Itopride Hydrochloride	0.100	1.20	10.	Itopride Hydrochloride	0.200	2.40
11.	Dothiepin Hydrochloride	0.500	6.00	11.	Permethol Sodium	0.025	0.30
12.	Amitriptyline Hydrochloride	0.500	6.00	12.	Amitriptyline Hydrochloride	0.500	6.00
13.	Duloxetine Hydrochloride	0.500	6.00	13.	Duloxetine Hydrochloride	0.500	6.00
14.	Sumatriptan	0.060	0.72	14.	Sumatriptan	0.060	0.72
15.	Acotiamide Hydrochloride hydrate	0.075	0.90	15.	Clidinium Bromide	0.080	0.96

16.	Labetalol Hydrochloride	0.500	6.00	16.	Montelukast Sodium	0.500	6.00
17.	Vildagliptin	0.200	2.40	17.	Ataluren	0.050	0.600
18.	Amisulpride	1.000	12.00	-	-	-	-
19.	Linezolid	1.000	12.00	18.	Linezolid	1.000	12.00
20.	Valethamate bromide	0.500	6.00	19.	Valethamate bromide	0.050	0.600
21.	R & D (Pre-Production)	0.500	6.00	20.	R & D (Pre-Production)	0.495	5.94
Grand Total		**20.635 (T/Month)**	**247.62 (T/Annum)**	**Grand Total**		**15.66 (T/Month)**	**187.92 (T/Annum)**

The Chemical Abstract Service (CAS) number/Harmonized System of Nomenclature (HSN) Code of the products involved in the process are provided in **Table 2.4**.

Table 2.4 CAS No. / HSN Code of Products

S. No.	Product	CAS No. / HSN Code	T/Month
1.	Valproic acid	99-66-1	3.000
2.	Sodium Valproate	1069-66-5	3.000
3.	Divalproex Sodium	76584-70-8	3.000
4.	Magnesium Valproate	62959-43-7	1.000
5.	Gabapentin	60142-96-3	1.000
6.	Pregabalin	148553-50-8	1.000
7.	Leflunomide	75706-12-6	0.050
8.	Iguratimod	610695-17-2	0.100
9.	Rivaroxaban	366789-02-8	0.050
10.	Itopride Hydrochloride	113871-53-6	0.200
11.	Permethol Sodium	95873-69-1	0.025
12.	Amitriptyline Hydrochloride	58-72-0	0.500
13.	Duloxetine Hydrochloride	136434-34-9	0.500

14.	Sumatriptan	103628-26-5	0.060
15.	Clidinium Bromide	33737-09-4	0.080
16.	Montelukast Sodium	158966-92-8	0.500
17.	Ataluren	374189-51-0	0.050
18.	Linezolid	165800-03-3	1.000
19.	Valethamate bromide	15617-94-4	0.050
20.	R & D (Pre-Production)	-	0.495
Total			**15.66 (T/Month)**

The products proposed to be manufactured will be utilized as Active Pharmaceutical Ingredients (APIs) in the formulation of end-products for pain relief, neurological disorders, psychiatric conditions, infections, and other therapeutic applications. The end use of products is provided in **Table 2.5.**

Table 2.5 End Use of Products

S. No	Product	End Use of Product
1.	Valproic acid	Anticonvulsant / Antiepileptic
2.	Sodium valproate	Anticonvulsant
3.	Divalproex sodium	Anticonvulsant
4.	Magnesium valproate	Anticonvulsant / Antiepileptic
5.	Gabapentin	Anticonvulsant / Neuropathic Pain Agent
6.	Pregabalin	Anticonvulsant / Neuropathic Pain Agent
7.	Leflunomide	Antirheumatic / Disease Modifying Antirheumatic Drug (DMARD)
8.	Iguratimod	Antirheumatic / DMARD
9.	Rivaroxaban	Anticoagulant
10.	Itopride Hydrochloride	Prokinetic / Gastroprokinetic Agent
11.	Permethol sodium	Anti-inflammatory and antioxidant
12.	Amitriptyline Hydrochloride	Anti-Depressant
13.	Duloxetine Hydrochloride	Anti-Depressant
14.	Sumatriptan	Antimigraine
15.	Clidinium bromide	Anticholinergic / Antispasmodic

16.	Montelukast sodium	Leukotriene receptor antagonists
17.	Ataluren	Duchenne muscular dystrophy agent
18.	Linezolid	Anti-Biotic
19.	Valethamate bromide	Anticholinergic / Antispasmodic

2.6 PROJECT SCHEDULE FOR APPROVAL AND IMPLEMENTATION

The estimation of cost breakup for the proposed activity is provided in **Table 2.6**. The project cost certificate is enclosed as Annexure XVI.

Table 2.6 Estimated cost of the project

S.No.	Description	Cost (Crores)
1.	Land Cost	1.52
2.	Building Cost	1.00
3.	Plant & Machinery Cost	1.00
4.	Utilities/Other Infrastructure Cost	1.00
Total		**4.52**

The tentative project schedule based on receiving the statutory approvals from the concerned authorities is presented in **Table 2.7.**

Table 2.7 Tentative project schedule towards obtaining statutory approvals

S.No.	Activities	Timeline
1.	Environmental Clearance	January 2026
2.	Consent to Establish (CTE)	February 2026
3.	Finalization of Process (Instrumentation, Electrical and Mechanical)	March 2026
4.	Procurement and Delivery	
5.	Construction at Site (Buildings, MEP works etc.)	April 2026
6.	Mechanical Commissioning	May 2026

S.No.	Activities	Timeline
7.	Pre Commissioning	June 2026
8.	CTO from TNPCB	September 2026
9.	Process Commissioning and Stabilization	October 2026

2.7 RAW MATERIAL AND ITS CHARACTERISTICS

The raw material required for the manufacturing process will be sourced from local markets/ imported from various countries and stored in the earmarked areas. The type of storage of the raw material and the products manufactured is illustrated in **Table 2.8** and **2.9**, respectively. Transportation of raw materials and the dispatch of finished goods will be carried out through a combination of modes which includes road, rail, air, and sea. The Material Safety Data Sheet (MSDS) for the raw materials is enclosed as Annexure X. The raw material and the characteristics for the proposed manufacturing of API and Intermediate are listed in **Table 2.10**.

Table 2.8 Major Raw Materials: Physical form and Storage

S. No.	Raw Materials	Commercial Name	Physical form	Storage
1.	Diethyl malonate	Malonic acid diethyl ester	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
2.	2-Propyl pentanoic acid	Valproic acid	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
3.	Cyclohexane-1,1-diacetic acid monoamide	Gabapentin Intermediate	Solid	Store in cool, dry place and tightly closed drums.
4.	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	Pregabalin intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.

S. No.	Raw Materials	Commercial Name	Physical form	Storage
5.	5-methyl-1,2-oxazole-4-carboxylic acid	Leflunomide Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
6.	4-(trifluoromethyl)aniline	p-Trifluoromethylaniline	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
7.	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	Rivaroxaban Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
8.	4(4-amino phenyl) morpholin-3-one	Itopride Intermediate	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
9.	4-Hydroxy benzaldehyde	p-Hydroxybenzaldehyde	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
10.	Para benzo quinone	p-Benzoquinone	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
11.	Dibenzosuberone	Dibenzocycloheptanone	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.

S. No.	Raw Materials	Commercial Name	Physical form	Storage
12.	(S)-3-(Methylamino)-1-(thiophen-2 yl)propane-1-ol	Duloxetine Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
13.	3-(2-Hydroxyethyl)-N-methyl-1H--indole-5 methanesulphonamide	Sumatriptan Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
14.	Methyl 2-hydroxy-2,2 diphenyl acetate	Amitriptyline Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
15.	(S)-1-(3-(2-(7-chloroquinolin-2-yl) vinyl) phenyl)-3-(2- (2-hydroxypropan -2-yl)phenyl) propan-1-ol	Hydroxychloroquine Intermediate	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
16.	3-cyanobenzoic acid	m-Cyanobenzoic acid	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
17.	1,2-difluoro-4 nitrobenzene	Difluoronitrobenzene	Solid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
18.	2-bromo butane	sec-Butyl bromide	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
19.	Choline chloride	Vitamin B4 / Choline salt	Solid	Store in tightly closed drums, in cool, dry, well-

S. No.	Raw Materials	Commercial Name	Physical form	Storage
				ventilated area away from heat and ignition sources.
20.	Iso propyl alcohol	IPA / Isopropanol	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
21.	Acetone	Dimethyl ketone	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
22.	N-Hexane	Hexane	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.
23.	Toluene	Methylbenzene	Liquid	Store in tightly closed drums, in cool, dry, well-ventilated area away from heat and ignition sources.

Table 2.8 Products: Physical form and Storage

S. No.	Products	Physical form	Storage
1.	Valproic acid	Liquid	HDPE Drums (acid-resistant)
2.	Sodium Valproate	Crystalline powder	HDPE Drums
3.	Divalproex Sodium	Crystalline powder	HDPE Drums
4.	Magnesium Valproate	Crystalline powder	HDPE Drums
5.	Gabapentin	Crystalline powder	HDPE Drums
6.	Pregabalin	Crystalline powder	HDPE Drums
7.	Leflunomide	Crystalline powder	HDPE Drums
8.	Iguratimod	Crystalline powder	HDPE Drums
9.	Rivaroxaban	Crystalline powder	HDPE Drums

S. No.	Products	Physical form	Storage
10.	Itopride Hydrochloride	Crystalline powder	HDPE Drums
11.	Permethol Sodium	Crystalline powder	HDPE Drums
12.	Amitriptyline Hydrochloride	Crystalline powder	HDPE Drums
13.	Duloxetine Hydrochloride	Crystalline powder	HDPE Drums
14.	Sumatriptan	Crystalline powder	HDPE Drums
15.	Clidinium Bromide	Crystalline powder	HDPE Drums
16.	Montelukast Sodium	Powder	HDPE Drums
17.	Ataluren	Crystalline powder	HDPE Drums
18.	Linezolid	Crystalline powder	HDPE Drums
19.	Valethamate Bromide	Crystalline powder	HDPE Drums

Table 2.9 Major Raw Material and its Characteristics

S. No.	Raw Material	CAS*/ MSDS* Number	Formula	Physical State	Odour	Mol. Wt.* (g/mole)	Flash Point(°C)	Melting Point (°C)	Boiling Point
1.	Diethyl malonate	105-53-3	C7H12O4	Liquid	Sweet	160.17	93	-50	199
2.	2-Propyl pentanoic acid	99-66-1	C8H16O2	Liquid	Characteristic	144.21	111	26	220
3.	Cyclohexane-1,1-diacetic acid monoamide	99189-60-3	C10H17NO2	Solid	Odourless	183.25	NA	NA	NA
4.	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	590-86-3	C8H15NO3	Solid	Slight	173.21	NA	93	NA
5.	5-methyl-1,2-oxazole-4-carboxylic acid	42831-50-5	C5H5NO3	Solid	Odourless	127.10	NA	190	NA
6.	4-(trifluoromethyl)aniline	455-14-1	C7H6F3N	Liquid	Characteristic	161.12	86	3-8	83
7.	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	149457-03-4	C16H16N206S	Solid	NA	380.37	NA	NA	NA

S. No.	Raw Material	CAS*/ MSDS* Number	Formula	Physical State	Odour	Mol. Wt.* (g/mole)	Flash Point(°C)	Melting Point (°C)	Boiling Point
8.	4 (4-amino phenyl) morpholin-3-one	350-46-9	C10H12N2O2	Solid	Slight aromatic odor	192.22	>93	-5	-213
9.	4-Hydroxy benzaldehyde	123-08-0	C7H602	Solid	Characteristic	122.12	NA	112-116	197
10.	Para benzoquinone	106-51-4	C6H4O2	Solid	Pungent	108.09	77	115	160
11.	Dibenzosuberone	1210-35-1	C15H12O	Solid	Mild Characteristic	208.26	NA	74	360
12.	(S)-3-(Methylamino)-1-(thiophen-2 yl)propane-1-ol	86408-72-2	C8H13NOS	Liquid	Amine	171.26	NA	NA	NA
13.	3-(2-Hydroxyethyl)-N-methyl-1H--indole-5 methanesulphonamide	Not available	C12H16N2O3S	Solid	NA	268.33	NA	NA	NA
14.	Methyl 2-hydroxy-2,2 diphenyl acetate	3260-28-8	C15H14O3	Liquid	Odourless	242.27	NA	NA	152
15.	(S)-1-(3-(2-(7-chloroquinolin-2-yl) vinyl) phenyl)-3-(2- (2-	142569-70-8	C29H28ClNO2	Solid	NA	458	NA	NA	NA

S. No.	Raw Material	CAS*/ MSDS* Number	Formula	Physical State	Odour	Mol. Wt.* (g/mole)	Flash Point(°C)	Melting Point (°C)	Boiling Point
	hydroxypropan -2-yl)phenyl) propan-1-ol								
16.	3-cyanobenzoic acid	1877-72-1	C8H5NO2	Solid	Odourless	147.13	NA	222	NA
17.	1,2-difluoro-4 nitrobenzene	446-35-5	C6H3F2NO2	Liquid	Odourless	159.09	80	NA	81
18.	2-bromo butane	78-76-2	C4H9Br	Liquid	Ether-like	137.02	21	-112	91
19.	Choline chloride	67-48-1	C5H14ClNO	Solid	Amine Compounds	139.62	NA	302	NA
20.	Isopropyl alcohol	67-63-0	C3H8O	Liquid	Alcohol-like	60.10	12	-89	82.40
21.	Acetone	67-64-1	C3H6O	Liquid	Sweet mint-like	58.08	-20	-94.7	56.1
22.	N-Hexane	110-54-3	C6H14	Liquid	Characteristic	86.18	-22	-95	68.3
23.	Toluene	108-88-3	C7H8	Liquid	Aromatic	92.14	4	-95	111

CAS - Chemical Abstracts Service, MSDS – Material Safety Data Sheet, Mol.Wt. – Molecular Weight

2.8 PROCESS DESCRIPTION

The raw material sourced is checked for quality prior to chemical reaction process. The raw materials will undergo one or more chemical reactions such as hydrolysis, neutralization, condensation, purification, dehydration, heating, cooling and crystallization to obtain the final product. The end use of the products is provided in Table 2.5. The products will be stored in containers/bags and will be placed in the warehouses temporarily and dispatched to customers. The process description with flow chat, route of synthesis and material balance for each product is enclosed as Annexure XI. The overall material balance is provided in Table 2.10. The general flow diagram of the manufacturing process of the products is presented in Figure 2.2

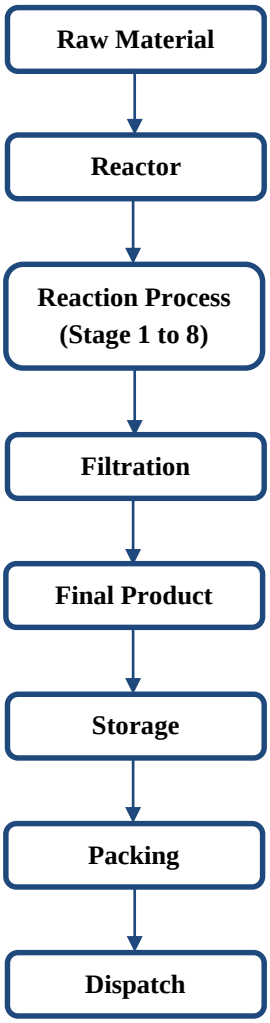


Figure 2.2 Overall Flow Diagram

Table 2.10: Overall Material Balance

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
1	Diethyl malonate	3.600	Valproic acid	3.000
2	Sodium Hydroxide	1.800	Sodium valproate	3.000
3	n-propyl bromide	5.550	Divalproex sodium	3.000
4	Water	12.000	Magnesium valproate	1.000

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
5	Stage-1	5.250	Gabapentin	1.000
6	Sodium Hydroxide	1.740	Pregabalin	1.000
7	Hydrochloric acid	5.250	Leflunomide	0.050
8	Water	15.000	Iguratimod	0.100
9	2-Propyl pentanoic acid	2.610	Rivaroxaban	0.050
10	Sodium hydroxide	0.724	Itopride Hydrochloride	0.200
11	Water	1.500	Permethol Sodium	0.025
12	2-propyl pentanoic acid	1.455	Amitriptyline Hydrochloride	0.500
13	Sodium-2-propyl pentanoate	1.605	Duloxetine Hydrochloride	0.500
14	Water	1.500	Sumatriptan	0.060
15	2-propyl pentanoic acid	0.935	Clidinium Bromide	0.080
16	Magnesium oxide	0.130	Montelukast Sodium	0.500
17	IPA	2.780	Ataluren	0.050
18	Acetone	2.000	Linezolid	1.000
19	Cyclohexane-1,1-diacetic acid monoamide	1.610	Valethamate bromide	0.050
20	Sodium Hydroxide	0.890	R&D	0.495
21	Sodium Hypochlorite 12%	5.200	**Total Product Output**	**15.660**
22	Hydrochloric acid	0.230		
23	Stage-1	1.100	Process emission	5.992
24	Hydrochloric acid	0.800	Organic Residue	25.564
25	Acetone	2.500	Solvent Rec & Loss	211.639
26	Sodium Hydroxide	0.280	Intermediates	19.993
27	Water	3.000	Effluent	101.063
28	Stage-2	1.400	Solid waste	23.772
29	Sodium Hydroxide	0.270	Spent carbon	0.302
30	Acetone	1.000	Spent Catalyst	0.100
31	n-propanol	1.000	**Total**	**404.085**
32	Water	1.500		
33	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	4.942		
34	Sulphuric acid	2.000		
35	Sodium Hydroxide	0.430		
36	Sodium Hypochlorite	5.010		
37	Activated carbon	0.082		
38	Celite	0.014		
39	Iso propyl alcohol	5.000		
40	5-methyl-1,2-oxazole-4-carboxylic acid	0.040		
41	4-(trifluoromethyl)aniline	0.046		
42	Thionyl chloride	0.038		
43	Toluene	0.056		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
44	Sodium bi carbonate	0.026		
45	Water	0.120		
46	Leflunomide Crude	0.066		
47	Ethyl acetate	0.330		
48	Toluene	0.082		
49	N, N-Dimethylformamide	0.089		
50	N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide	0.094		
51	N, N-Dimethylformamide dimethyl acetal	0.089		
52	Water	0.167		
53	Hydrochloric acid	0.051		
54	4-Hydroxy benzaldehyde	0.074		
55	(2-Chloroethyl)-dimethylamine - hydrochloride	0.087		
56	Triethyl amine	0.120		
57	Chloroform	1.000		
58	Water	1.200		
59	Stage-1	0.112		
60	Hydroxyl amine sulfate	0.074		
61	Raney Ni	0.010		
62	Iso Propyl alcohol	1.200		
63	Hydrogen gas	0.002		
64	Stage-2	0.108		
65	3, 4-Dimethoxy benzoyl chloride	0.110		
66	Toluene	0.800		
67	Water	0.400		
68	Stage-3	0.210		
69	Iso Propyl alcohol	2.000		
70	Activated carbon	0.007		
71	Water	0.400		
72	Para benzo quinone	0.040		
73	Acetyl chloride	0.130		
74	Sodium acetate	0.182		
75	Con.Sulphuric acid	0.008		
76	Water	0.600		
77	Stage-I	0.092		
78	Ethyl aceto acetate	0.047		
79	75% Sulphuric acid	0.363		
80	Water	0.438		
81	Toluene	0.063		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
82	Stage-II	0.055		
83	Dimethyl formamide	0.551		
84	Sodium carbonate	0.076		
85	Ethyl bromo acetate	0.056		
86	Stage-III	0.039		
87	Water	0.225		
88	Acetone	0.225		
89	Sodium hydroxide	0.005		
90	Dibenzosuberone	0.350		
91	3-Chloro-N,N-dimethyl propan-1-amine	0.205		
92	Ammonium Chloride	0.090		
93	Magnesium	0.041		
94	Tetra hydro furan	0.250		
95	Toluene	0.100		
96	Iso Propyl alcohol	0.200		
97	Water	0.500		
98	Stage-1	0.480		
99	Hydrochloric Acid	0.062		
100	Toluene	0.600		
101	Acetone	0.250		
102	Activated Carbon	0.020		
103	Water	0.400		
104	(s)-3-(Methylamino)-1-(thiophen -2-yl)propane-1-ol	0.675		
105	1-Fluoro naphthalene	1.000		
106	Sodium hydride (60%) in Paraffin oil	0.270		
107	Toluene	4.100		
108	DMSO	2.250		
109	Ethyl acetate	12.200		
110	Potassium acetate	0.035		
111	Ammonium chloride	0.250		
112	Sodium chloride	0.880		
113	Water	4.250		
114	Stage-1	1.000		
115	Ethyl acetate	5.800		
116	IPA HCl	0.825		
117	Activated carbon	0.025		
118	Acetone	5.800		
119	Iso Propyl alcohol	0.500		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
120	3-(2-Hydroxyethyl)-N-methyl-1H-indole-5 methanesulphonamide	0.125		
121	Dichloromethane	3.125		
122	Pyridine	0.019		
123	Thionyl chloride	0.063		
124	Hydrochloric acid	0.005		
125	Water	0.625		
126	Stage-1	0.100		
127	Iso Propyl alcoholic dimethyl amine	3.540		
128	Methyl 2-hydroxy-2,2 diphenyl acetate	0.110		
129	Cyclohexane	0.320		
130	Methyl benzilate	0.046		
131	Water	0.472		
132	Clidinium base	0.149		
133	Iso propyl alcohol	1.100		
134	Methyl bromide	0.312		
135	Activated Carbon	0.020		
136	Acetone	1.000		
137	(S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl) phenyl)propan1-ol	0.500		
138	Toluene	1.750		
139	Acetic acid	0.275		
140	Sodium hydroxide	0.075		
141	Methylene dichloride	2.500		
142	DIPEA	0.225		
143	Methane sulfonyl chloride	0.130		
144	DMSO	0.750		
145	2-(1-(mercaptomethyl) cyclopropyl)acetic acid	0.190		
146	Sodium methoxide solution	0.240		
147	Pet ether	1.250		
148	Water	1.500		
149	Stage-1	0.500		
150	Sodium Hydroxide	0.038		
151	Iso propyl alcohol	3.000		
152	3-cyanobenzoic acid	0.063		
153	Dimethyl formamide	0.750		
154	Potassium carbonate	0.067		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
155	Methyl iodide	0.049		
156	Hexane	0.650		
157	Water	0.600		
158	Stage-1	0.056		
159	Iso propyl alcohol	0.800		
160	50% hydroxylamine	0.070		
161	Hexane	0.237		
162	Stage-2	0.067		
163	Tetrahydrofuran	0.305		
164	Diisopropyl ethylamine	0.079		
165	2-fluoro benzoyl chloride	0.059		
166	Ethyl acetate	0.400		
167	Hexane	0.250		
168	Toluene	0.250		
169	Stage-III	0.055		
170	Toluene	0.650		
171	Stage-IV	0.053		
172	Tetrahydrofuran	0.259		
173	Sodium hydroxide	0.322		
174	Ethyl acetate	0.280		
175	Water	0.750		
176	1,2-difluoro-4 nitrobenzene	1.400		
177	Morpholine	2.270		
178	Isopropyl alcohol	9.800		
179	Water	3.820		
180	Stage-1	1.800		
181	Iron(III) chloride	0.190		
182	Activated charcoal	0.800		
183	Hydrazine hydrate	2.000		
184	Iso Propyl alcohol	19.500		
185	Ethyl acetate	6.000		
186	Water	2.070		
187	Stage-2	1.350		
188	Sodium bicarbonate	1.440		
189	Ethyl chloroformate	0.896		
190	Dichloromethane	7.760		
191	Water	22.275		
192	Stage-3	1.778		
193	2-(oxiran-2-ylmethyl)isoindoline-1,3-dione	1.990		
194	Triethylamine	0.075		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
195	Methyl isobutyl ketone	2.660		
196	Ethyl acetate	14.220		
197	Stage-4	2.340		
198	80% hydrazine hydrate	1.826		
199	Iso Propyl alcohol	12.000		
200	Water	9.200		
201	Dichloromethane	54.000		
202	Hexane	4.680		
203	Stage-5	1.400		
204	Acetic acid	1.490		
205	Toluene	8.420		
206	Benzy Cyanide	0.038		
207	2-bromo butane	0.111		
208	Choline chloride	0.099		
209	Sodium hydroxide	0.091		
210	Toluene	0.206		
211	water	0.190		
212	Stage-1	0.057		
213	Mono ethylene glycol	0.090		
214	Sodium Hydroxide	0.189		
215	Con. HCl	0.268		
216	water	0.440		
217	Stage-2	0.055		
218	Dimethyl formamide	1.548		
219	Thionyl chloride	0.035		
220	2-diethyl amino ethanol	0.035		
221	Triethyl amine	0.062		
222	Toluene	0.275		
223	Sodium hydroxide	0.025		
224	water	2.742		
225	Stage-3	0.050		
226	Methyl Bromide	0.030		
227	Ethyl acetate	0.250		
228	4(4-amino phenyl) morpholin-3-one	0.040		
229	N-(s)-glycidyl Pthalamide	0.055		
230	Isopropyl alcohol	0.440		
231	Stage-1	0.080		
232	Carbonyldiimidazole	0.050		
233	Potassium carbonate	0.039		
234	Dichloromethane	3.000		

S. No.	Name of the Raw material	Quantity (T/M)	Name of the output	Quantity (T/M)
235	water	2.000		
236	Stage-2	0.077		
237	Iso propyl alcohol	0.709		
238	40% Methyl amine	0.071		
239	Con. Hydrochloric acid	0.085		
240	Stage-3	0.058		
241	5-Chloro thiopene-2- -carbonylchloride	0.027		
242	Triethylamine	0.015		
243	Isopropyl alcohol	0.075		
244	water	0.125		
245	Stage-4	0.056		
246	Acetone	0.075		
247	Charcoal	0.001		
	Total	**404.085**	-	

2.9 LIST OF EQUIPMENT

The equipment proposed for the manufacturing of Active Pharmaceutical Ingredients and Intermediates unit is provided in **Table 2.11**.

Table 2.11: List of Equipment

S. No.	Equipment Name	No. of Equipments	Material of construction
1.	3 KL SS Reactor	2 Nos	Stainless Steel
2.	1 KL SS Reactor	1 Nos	Stainless Steel
3.	2KL GLR	2 Nos	Glass lined Carbon Steel
4.	36-inch centrifuge	1 No	Stainless Steel
5.	200 Lts AGR	1 No	All Glass Reactor
6.	100 Lts AGR	2 No	All Glass Reactor
7.	50 Lts AGR	2 No	All Glass Reactor
8.	24-inch Centrifuge	1 No	Stainless Steel
9.	Hot Air Oven	2 No	Stainless Steel
10.	Nutche Filter	1 No	Stainless Steel
11.	20 Lts Rotary Evaporator	1 No	All Glass Unit
12.	RCVD / ADR	1 No	Stainless Steel
13.	Multi Miller	1 No	Mild Steel
14.	Tray drier	1 No	Stainless Steel for trays, Mild Steel for structure
15.	Drum drier	1 No	Stainless Steel

16.	Open Pan drier	1 No	Stainless Steel
17.	Boiler 0.8 tone	1 No	Carbon Steel
18.	Chiller 30 TR	1 No	Stainless Steel
19.	Cooling Tower	1 No	Mild Steel
20.	Vacuum Pump	1 No	Cast Iron & Stainless steel for wetted parts
21.	Water System	1 No	Stainless Steel for purified water, MS for storage tanks
22.	Electrical	1 No	Copper (for wiring), Aluminum, Mild Steel (for panels & enclosures)
23.	Plumbing & Pipes	1 No	Stainless Steel for process lines, UPVC/GI for utility lines
24.	DG 125 KVA	1 No	Mild Steel / Cast Iron for engine body & Copper for windings
25.	ETP Plant	1 No	Mild Steel, FRP Coating & Stainless Steel

2.10 MANPOWER REQUIREMENT

The employment generation during the operation phase is expected to be 41 including maintenance staff and visitors. The working hours in the operation phase will be 8 hours per shift and there will be 3 shifts per day.

2.11 WATER AND WASTEWATER GENERATION AND MANAGEMENT

2.11.1 Construction Phase

Water requirement for the project during construction is primarily for preparation of mortar, PCC, RCC, curing, sprinkling and domestic uses (construction work force). It is estimated that 25 KLD of water will be required during peak construction period, which will be sourced from TANSIDCO, Tindivanam. The peak manpower strength during the construction phase will be 60 persons. Only local labourers will be hired for the construction phase. Hence, labour sheds are not provided. The estimation of fresh water requirement is given in **Table 2.12**.

Table 2.12: Estimation of Fresh Water Requirement as per CPHEEO norms – Construction Phase

Component	Total Occupancy (Nos.)	Water Consumption		Total Sewage Generation @ 80% of Total Water Requirement (Lts/Day)
		Water Consumption Rate (LPCD)	Total Water Requirement (Lts/Day)	
Employees	60	45	2700	2160
			2.7 KLD	2.2 KLD
Note: CPHEEO - Central Public Health and Environmental Engineering Organization				

During the construction phase, sewage generation is anticipated from temporary toilets and labour camps which will be disposed through temporary septic tank with soak pit arrangements.

2.11.2 Operation Phase

The estimated fresh water requirement is about 16.24 KLD will be sourced from the TANSIDCO water supply distribution system. The fresh water requirement for the project activity is 16.24 KLD (Domestic purpose: 1.84 KLD, R.O Process: 10.00 KLD, Cooling Tower: 2.00 KLD and Gardening: 2.20 KLD). 3.00 KLD of R.O rejection (<600 PPM) will be sent to Gardening.

The sewage generation from the domestic activity is estimated to be 1.64 KLD which is treated in bio septic tank and soak pit arrangements. The effluent from wet scrubber 0.20 KLD and 3.37 KLD from the process and 0.90 KLD RO reject after ETP treatment will be sent straightaway to Solar pan / Heating pan since it will have high TDS.

The total quantity of the effluent generated from the other activity is 3.23 KLD (Process washing: 2.63 KLD, Boiler blow down: 0.50 KLD and Cooling tower blow down: 0.10 KLD) which will be treated in an Effluent Treatment Plant of 5 KLD capacity.

The treated effluent of 2.00 KLD after the RO process will be utilized for gardening and landscape development within the premises. The other reject, evaporation, etc., are shown in the water balance chart.

The estimation of fresh water requirement and recycled water requirement for domestic and industrial process is given in Table 2.13. The overall water balance is presented in Figure 2.3. The detailed ETP design proposal and layouts are enclosed herewith as Annexure - XII.

Table 2.13 - Water Requirement for Domestic Purposes & Industrial

Component	Total Occupancy (Nos.)	Water Consumption			
		Water Consumption Rate (LPCD)	Total Water Requirement (L/day)		
			Fresh Water Requirement (L/day)	Recycled Water Requirement (L/day)	Total Water Requirement (L/day)
Working Population	41	45	1,845	-	1,845
Wet Scrubber	-	-	200	-	200
R.O for Process, Washing & Boiler Feed	-	-	10,000	1,000	11,000
Cooling Tower	-	-	2,000	-	2,000
Gardening & Landscaping	-	@ 3.5 L/Sq.m for 2,054 Sq.m of green area	2.200	5,000	7.200
Total	**41**	**-**	**16,245**	**6,000**	**22,245**
			16.24 KLD	**6.00 KLD**	**22.24 KLD**
(Reference: National Building Code of India, 2016, Volume 2, Part IV, Clause 4.1.2 Table 1 Water Requirements for Buildings other than Residences, page 11)					

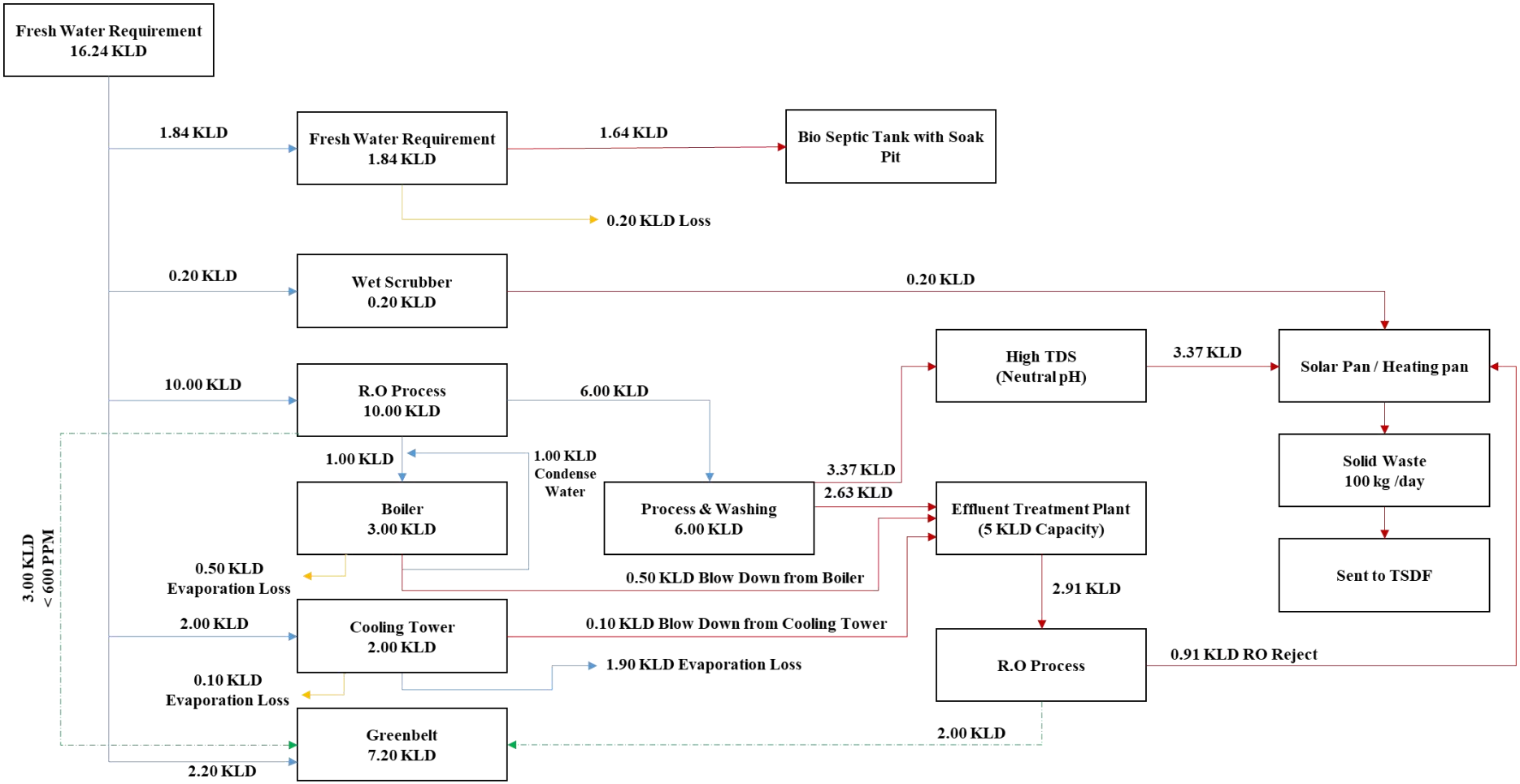


Figure 2.3: Water Balance Chart

2.12 SOLID WASTE GENERATION AND MANAGEMENT

2.12.1 Construction and Demolition Waste

The construction waste generation in the project is estimated at the rate 20 – 30 kg/ Sq. m. of the construction area. (Source: Central Pollution Control Board, 2017 – Guidelines on Environmental Management of Construction & Demolition (C&D) Wastes, Section 2.2). The construction waste generated shall be used in the construction of internal driveways within the project site.

2.12.2 Municipal solid waste

The municipal solid waste from the proposed project activity will comprise of biodegradable waste and non-biodegradable waste. The solid waste will be handed over to TANSIDCO daily waste collection system. It is estimated (**Table 2.14**) based on CPHEEO norms.

Table 2.14: Estimation of Municipal Solid Waste from Occupants

S.No.	Component	Occupancy	Per Capita waste generation (kg/day)	Total waste generation (kg/day)	Biodegradable Waste	Non-Biodegradable waste
					@ 60% of total waste generation (kg/day)	@ 40% of total waste generation (kg/day)
1.	Maintenance Staff	41	0.3	12.3	7.38	4.92
2.	Canteen	41	0.3	12.3	7.38	4.92
Total				**24.6**	**14.76**	**9.84**

2.12.3 Hazardous waste management

The details of hazardous waste to be generated from the project activity are listed in **Table 2.15.**

Table 2.15 Details of Hazardous Waste

S. No.	Description of Waste	Category as per HWM Rules 2016	Quantity T/Annum	Storage Method	Method of disposal
10.	Used oil	5.1	**0.2**		

S. No.	Description of Waste	Category as per HWM Rules 2016	Quantity T/Annum	Storage Method	Method of disposal
11.	Waste or residue containing oil	5.2	**0.1**	Hazardous waste generated will be stored inside a hazardous waste storage shed having impervious floor	Will be collected and disposed through TNPCB Authorized recycler
12.	Contaminated cotton rags or other cleaning materials	33.2	**0.1**		
13.	Concentration and evaporation residue	37.3	**36**		Will be collected and disposed through TNPCB Authorized TSDF
14.	ETP sludge	35.3	**3.60**		
15.	Process residue and waste	28.1	**307**		
16.	Spent catalyst	28.2	**1.20**		
17.	Spent carbon	28.3	**3.62**		
18.	Spent solvents	28.6	**5**		

2.12.4 E-Waste

The details of the E-waste generated from the project activity is given in Table 2.16.

Table 2.16 E-waste Estimation

S.No	Category	Quantity TPA	Method of Disposal
1.	ITEW2: Personal Computers	0.5	Handed over to E- waste recyclers
2.	ITEW6: Printers including cartridges		
3.	ITEW12: Telephones		

4.	CEE4: Air-conditioners excluding centralized air conditioning plants CEE5 : Lamps		

2.12.5 Bio-medical waste

No Health Care Facilities will be provided within the premises as the occupancy is less than 50. First aid kits will be provided at earmarked areas.

2.13 POWER REQUIREMENT

The power requirement for the plant is about 110 kVA, which will be sourced from TNEB. For backup, 1 no. of 125 kVA capacity DG set capacity will be installed to meet the emergency power requirements of the plant. Low-sulphur HSD, or HSD available at the nearby fuel station, will be used.

2.13.1 Air Pollution Control

The sources of air pollution from the proposed plant are the DG set, pulverizer, process reactor stack and boiler. The details of the emission sources and the proposed mitigation measures are provided in **Table 2.17**. The estimation of the air pollution control measures are as follows:

Stack height design calculation:

i) DG set

where h=7.5m; DG set= 125 kVA (1no.);

$H = h + (0.2)(kVA)$

$= 7.5 + (0.2)(125)^{0.5}$

$= 7.5 + 2.23$

$= 9.73$ m

where, H = Total height of stack in meters from ground level

h = height of the building in meters

The stack height required as per CPCB norms is 9.73 m. The stack height of 10m will be provided.

ii) Process Reactor Stack

Q =SO_2 emission rate in kg/hr;

SO_2 concentration = 400 mg/Nm^3; Gas flow rate = 550 Nm^3/hr

$Q = 400 \times 550/10^6 = 0.22$ kg/hr

$H = 14Q^{0.3}$

$=14(0.22)^{0.3}$

$= 8.8$

The stack height required as per CPCB norms is 8.8 m. The stack height of 11 m will be provided.

iii) Boiler

Q = SO_2 emission rate in kg/hr

SO_2 concentration = 200 mg/Nm^3; Gas flow rate = 3000 Nm^3/hr

Q = 150 x 3000/10^6 = xx kg/hr

H $=14Q^{0.3}$

$=14(0.45)^{0.3}$

= 11

The stack height required as per CPCB norms is 11 m. The stack height of 11 m will be provided.

Table 2.17 Air Pollution Control Measures

S. No.	Description	Capacity	Type of Fuel	Quantity of Fuel	Stack Height	Material of Construction	Mitigation Measures
5.	DG Set	125 kVA	HSD*	480 Lts/day	10	Mild Steel	Stack height with acoustic enclosure
6.	Pulverizer	-	-	-	-	Stainless Steel	Dust collector with stack
7.	Process Reactor Stack	-	-	-	11	Stainless Steel	Wet Scrubber
8.	Boiler	800 kg/day	PNG*	1700 SCM/day	11	Stainless Steel	Common Stack with monitoring facility to have a check and control the Particulate Matter (PM) emissions

**HSD-High Sulphur Diesel; PNG-Piped Natural Gas*

2.14 STORM WATER MANAGEMENT

Storm water drains will be provided all along the periphery. Separate line for sewage and storm water will be provided to avoid run off contamination. The drains will be adequately sized to prevent over flooding of the site. The rain water and storm water design is as per Rain Water Harvesting and Conservation Manual, CPWD, GOI.

Design of Rain Water Harvesting (RWH) sump:

Surface area of roof top catchment (A) : 1,674 m^2

Peak rainfall in 15 min (r) : 5.75 mm

(In Villupuram region, peak hourly rainfall is mm)

Runoff co-efficient : 0.85

Capacity of the tank : 1,674 m^2 x 0.00575 m x 0.85 m

: 8.18 m

Capacity of the storage tank required : 9.00 m^3

Capacity of the storage tank proposed : 100 m^3 (1 no.)

(Ref.: Chapter 4 – Design of Storage/ Settlement Tanks, page no. 20–21, Rain Water Harvesting and Conservation Manual, 2019, CPWD, Government of India)

Estimation of Runoff:

The estimation of runoff is given in **Table 2.18.**

Average annual rainfall for Villupuram Region : 1013.4 mm

https://www.annauniv.edu/cccdm/districtprofiles/villupuram.htmlmm/annum

Based on the annual rainfall days, average daily rainfall : 23 mm/day

Table 2.18: Estimation of Runoff

S. No.	Description	Area (Sq.m)	Runoff Coefficient	Rainfall Intensity (m/day)	Runoff (Cum/day)
1	Rooftop Area	1,674	0.95	0.023	37
2	Roads, Pavement and Services Area	693.95	0.80	0.023	13
3	Greenbelt Area	3500	0.30	0.023	24
Total					**74 Cu.m**

<u>Internal Storm Water Drains</u>

100 % of total quantum of rainfall in catchment area is considered

Estimated runoff from project site : 74 m^3/d = 0.0008 Cu.m/sec

Cross section of storm drains

: 1 m^2 (B: 1m; D: 1m)

Carrying capacity of the open flow channel is based on Manning's equation as follows:

$Q = A * V$,

where, Q = Discharge in Cu.m/sec ; A = Area in Sq.m

V = Velocity in m/sec

$V = 1/n * R^{2/3} * S^{1/2}$

where, n = Manning's Coefficient (For concrete = 0.016)

R = Hydraulic Radius in m (R = D/4, where D = Diameter in m)

S = Channel slope in m/m

For the Industry,

n = 0.016
A = LxW = 1 m^2
P = 2 x (1) + 1 = 3 m
R = A/P = 1/3 = 0.33 m
S = 1/300 = 0.0033
V = 1.78 m/sec
Q = A x V = 1 x 1.78 = 1.78 m^3/sec

Thus, the proposed internal storm water drains is adequate to handle the runoff from the project site. The excess storm water after recharge and storage will be conveyed into the external storm water drain maintained by TANSIDCO which has its outfall into the nearby natural drainage course (Pattanam Eri).

The cost estimate of the proposed Rain Water Harvesting Plan prepared for our project is given in **Table 2.19**.

Table 2.19: Cost Estimation for Rain Water Harvesting Structures

S.No.	Name of the component	Specifications proposed	Cost in Lakhs
1.	Storm Water Drain	1 m (length) x 1 m (Width)	1.5
2.	Recharge Sump	100 m^3	1
Total			**2.5**

2.15 LANDSCAPE AND ECOLOGICAL MANAGEMENT

The green belt area of 2,054 m^2 will be developed with 120 trees (native species). Some of the proposed species to be planted at the site are listed in **Table 2.20**.

Table 2.20: List of proposed tree species

S.No.	Botanical Name	Common name
1.	*Pongamia glabra*	Pungan
2.	*Michelia champaca*	Shenbagam
3.	*Ficus religiosa*	Arasu
4.	*Azadirachta indica*	Vembu
5.	*Terminalia arjuna*	Neermarudhu
6.	*Calophyllum inophyllum*	Punnai
7.	*Madhuca longifolia*	Ilippai
8.	*Mimusops elengi*	Magilam

2.16 SOLAR ENERGY UTILIZATION

We will be installing solar panels in the available roof top area of the plant of capacity 70 kWH.

CHAPTER 3
DESCRIPTION OF THE ENVIRONMENT

Baseline studies were carried out to provide a detailed description of the existing environment in the project site and its study area. The study area encompasses different radii from the project site depending on the project component. For Ecology and Biodiversity, Socioeconomics and Land Use studies, the radius was 10 km, for Air quality and Noise level assessment it was 2 km radius and for Water and Soil quality analyses it was 5 km radius from the project site.

The baseline study was conducted from March 2025 to May 2025. Monitoring locations were fixed following a reconnaissance survey of the site and its study area. The study involved the collection of both primary and secondary data pertinent to the project.

3.1 METHODOLOGY – BASELINE ENVIRONMENTAL MONITORING

The references for the baseline study includes:

- MoEF&CC Technical Guidance (Guidelines: Synthetic Organic Chemicals)
- ToR issued by SEIAA-TN for the project
- Sector and functional area regulations and directives

The baseline study was conducted with the following considerations:

Primary attributes such as ambient air quality, Micrometeorological data, noise levels, ground water and surface water quality, soil quality, land use pattern, biodiversity and socio-economic aspects were assessed through field studies.

Secondary attributes include Meteorological data from IMD, Pondicherry, land use data, geology and hydrogeological conditions, flora and fauna of the study area and sensitive areas such as forests, sanctuaries etc. and the socio-economic condition were evaluated using published literature and government publications and was validated against ground conditions.

3.2 LAND ENVIRONMENT

3.2.1Objectives of the Study

- To assess the existing land use patterns within the core and buffer zones of the study area.
- To analyze the potential impacts of land use changes resulting from the proposed project activities.
- To identify critically vulnerable zones and recommend appropriate long-term management and mitigation measures along with an implementation timeline.

3.2.2 Methodology of the Study

The following steps were undertaken to analyze the land use pattern of the project site, with the assessment based on image characteristics such as color, texture, tone, and other visual attributes.

Source Data

- Survey of India (SOI) toposheets were collected, scanned, and geo-referenced using available ground control points.
- IRS LISS-III satellite data (Spatial Resolution: 23.5 m; Bands: Green, Red, NIR, SWIR; Revisit Period: ~24 days) was procured and used as the primary dataset.

Pre-processing of Satellite Data

- Geometric correction and image enhancement were carried out using Principal Component Analysis (PCA) and nearest neighbourhood resampling techniques.
- Fusion and blending of LISS-III data were performed using Image interpreter-Utilities and Layer stack option available in ERDAS to obtain optimum colour combinations.

Map Preparation

- Base maps such as layout, transport, settlement, contour, and drainage maps were prepared from SOI topo sheets.
- These were updated through visual interpretation of satellite imagery based on image characteristics such as tone, texture, shape, size, pattern, and association.

Land Use Analysis

- Area of Interest (AOI) was delineated with a 10 km buffer around the project site.
- Enhanced LISS-III imagery was rectified and subset to UTM coordinates system.
- Unsupervised classification was initially carried out, followed by generation of signature files.
- A hybrid approach combining supervised classification with recoding and visual interpretation was adopted for improved accuracy.

Finalization and Quantification

- All maps were digitized, mosaicked, labelled, and integrated into GIS format.
- Quality Control (QC) and Quality Assurance (QA) checks were undertaken to ensure reliability of datasets.
- Land use/land cover categories were finalized and quantified in square kilometres.
- The flow chart showing methodology adopted for land use mapping is shown in **Figure 3.1**.

3.2.3 Topography

The project site is primarily open land with slight undulations. The Topographical maps of the study area (Annexure VII) prepared using Survey of India (SOI) toposheets (57-P/07, 57-P/08, 57-P/11, 57-P/12) shows the project site along with surrounding reserve forests, rivers, lakes, drains and other water bodies. *(Source: Survey of India (SOI). (n.d.). Topographical Sheets – 57-P/07, 57-P/08, 57-P/11 and 57-P/12 Department of Science & Technology, Government of India.).* As observed study area is predominantly covered by Agriculture Land (31%). The maps also illustrate including the hydrological connectivity of these features to major water bodies located in the North eastern side of the study area. The aerial distance of the water bodies and reserve forests from the project site in the study area are listed below:

- ✓ Sankaraparani River – 21.10 Km, South Western direction
- ✓ Pattanam lake – 1.86 Km, North Eastern direction
- ✓ Buderi Lake – 2.47 Km, South Eastern direction
- ✓ Kilsevur Reserved Forest– 9.84 Km, South Eastern direction

- There is no major river located in 1.0 km radius from the site location.
- The project site is well connected by roads
- There is no reserved forest, heritage structures within 10 km radius of the project site
- The terrain comprises red and brown soils with a stony texture and undulating topography. A drainage network exists around the site, ensuring no possibility of flooding.

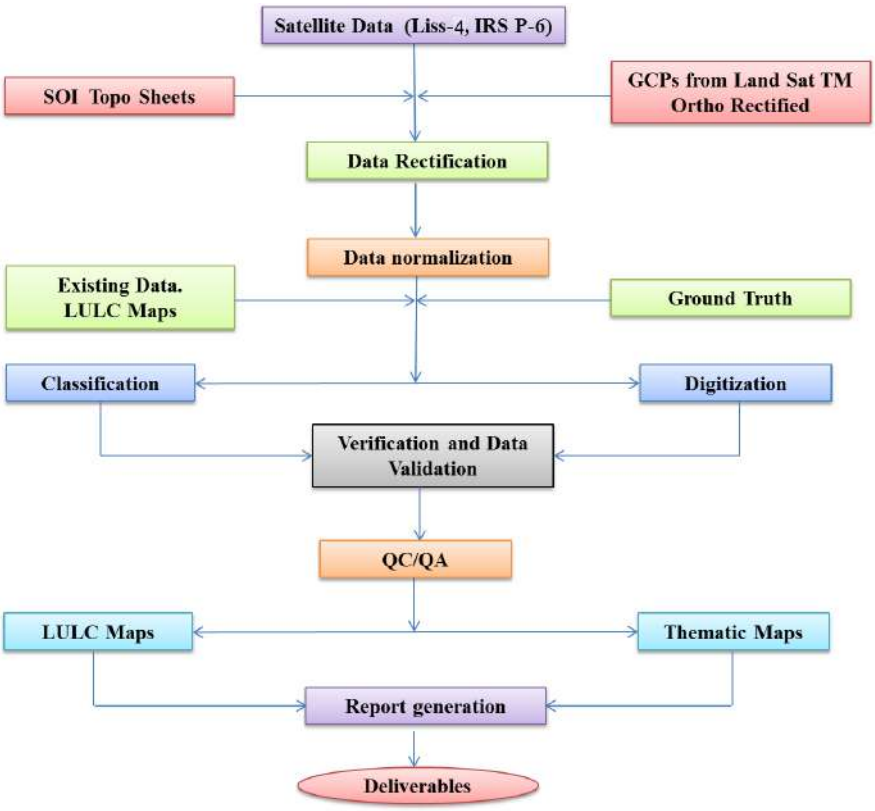


Figure 3.1: Flow Chart Showing Methodology of Land Use Mapping

3.2.4 Contour Map and Elevation of Study Area

The contour lines from the Survey of India (SOI) toposheet were digitized within a GIS environment and assigned elevation values in meters, referenced to Mean Sea Level (MSL). To enhance accuracy, these values were verified using elevation data from the Shuttle Radar Topography Mission (SRTM). *(Source: United States Geological Survey (USGS). (2000), Shuttle Radar Topography Mission (SRTM) Global Elevation Data. NASA and NGA.)* The contour map (Figure 3.2) was prepared by integrating both the toposheet and SRTM data, with a contour interval of 10 meters.

The elevation at the project site ranges from 71 m to 77 m above MSL, while the study area exhibits elevation variations from 30 m to 90 m above MSL. . The high range contour levels were observed from NW direction and the lowest contour level were observed in SE direction. The remaining areas showed a gradual variation in elevation across the site. Figure 3.2 shows the Contour profile of the study area.

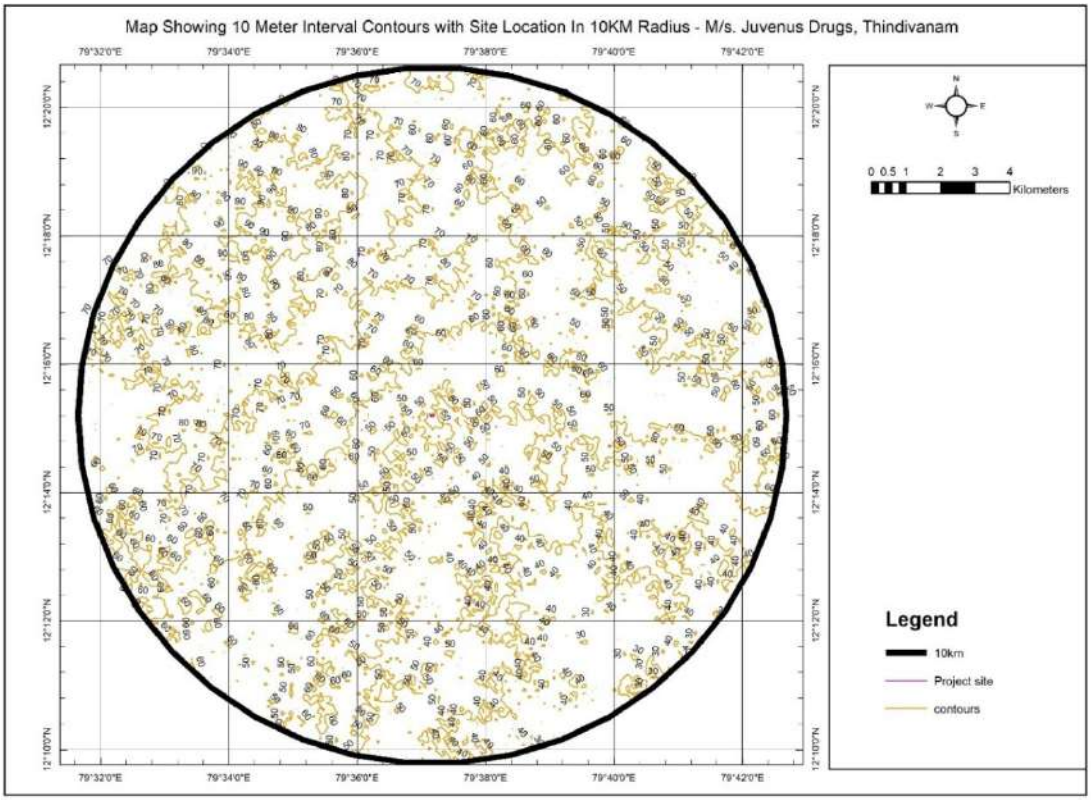


Figure 3.2: Contour Profile of the Study Area

3.2.5 Drainage

The study area is drained by the Tondi river, which flows in a NW–SE direction along the South Western (SW) boundary of the buffer zone. The Tondi river is a tributary of the Sankaraparani River, also known as the Varahi River. All the streams ultimately join the Varahi River beyond the South Eastern part of the study area. The drainage system exhibits a dendritic pattern.

It is pertinent to note that numerous first and second order streams are distributed throughout the study area. Local tanks have been constructed across almost every stream, taking advantage of the natural drainage. As a result, the area contains a large number of local tanks. The drainage pattern is illustrated in Figure 3.3.

3.2.6 Soil

Major parts of the study area comprised of red soil, Black cotton soil, Sandy loam and Forest loam. This soil has moderate to good infiltration characteristics.

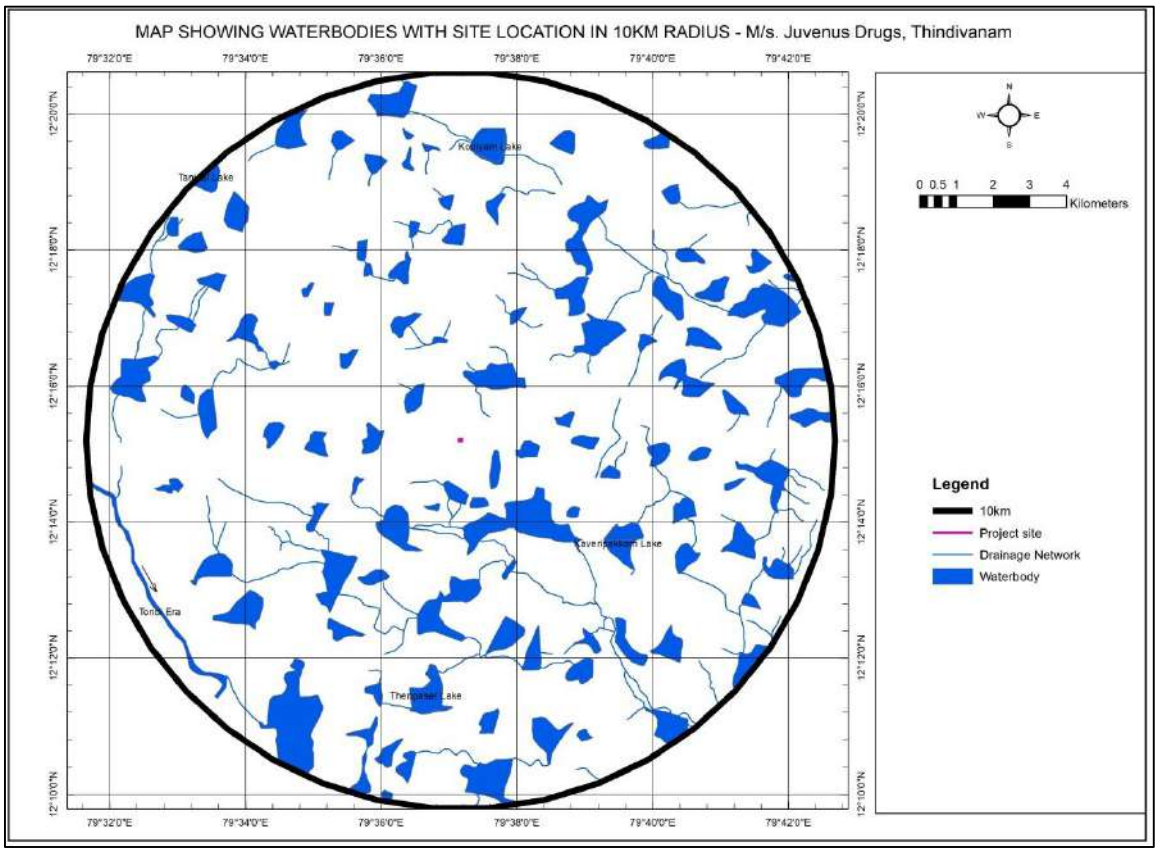


Figure 3.3: Drainage Pattern of the Study Area

3.2.7 Land Use Pattern

The present study envisaged different Land Use and Land Cover (LU and LC) around the project site and its study area. The methodology adopted is summarized below.

The Satellite IRS P-6 LISS-IV images are obtained. *(Source: National Remote Sensing Centre (NRSC). IRS-P6 LISS-IV Satellite Imagery, Indian Space Research Organisation (ISRO), Hyderabad.)* The co-ordinate of the site is at the Latitude of 12°15'12.31"N, and Longitude of 79°37'9.81"E. The satellite image of the site is shown in Figure 3.4.

Based on the data analysis the study area is predominantly covered by Agricultural Fallow Land which accounts for approximately 31%, while plantation area covers 16% of the total buffer zone. Water bodies including the Tondi Eri, Botheri Lake, Taniyal Lake etc cover 11% of the total area. The built-up area covers 13%, while industrial areas make up roughly 2%.

Road and railway networks occupy around 10%. The waste lands including open scrub, rocky nob, vegetation, stony waste is around 19%. The land use classes of the study area is graphically represented in Figure 3.5 and provided in Table 3.1.

To ensure the reliability of the satellite-based interpretation, ground-truthing and field verification were carried out at key locations across various land use classes. Observations confirmed the accuracy of classification with visual characteristics of fallow lands, water bodies, forest, roads, railway, settlement and industrial areas aligning well with on-ground conditions. Corrections and adjustments where necessary were incorporated into the final LULC map during the Quality Control/Quality Assurance (QC/QA) stage.

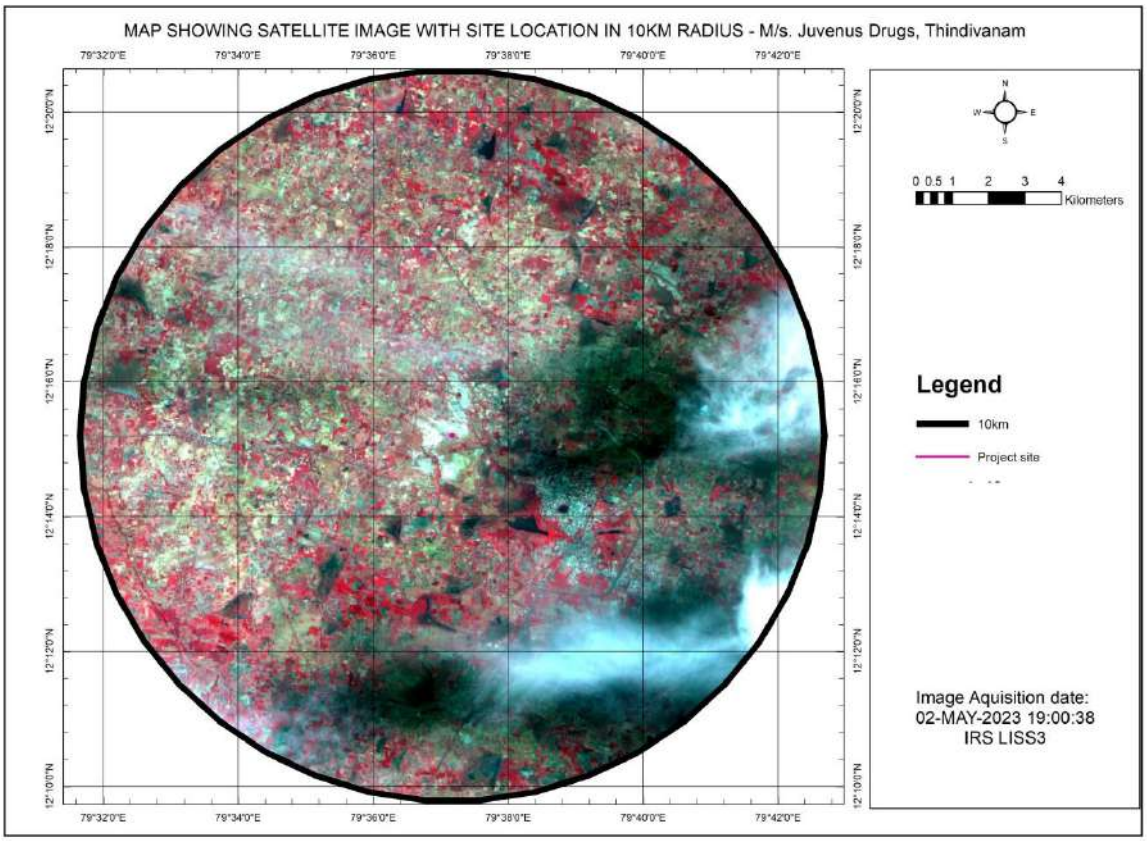


Figure 3.4: Satellite image showing Land Use of the Study Area

Table 3.1: Land Use Land Cover Statistics of 10 KM Buffer Zone

SL No	LULC Classifications		Area (Ha)	Area (%)
	Level 1	Level 2		
1	Water Bodies	River / Streams	3468.31	11%
2	Agriculture Land	Fallow Land	9880.44	31%
3	Built-up	Urban/Rural	4166.75	13%
5	Wastelands	Open Scrub	1312.00	4%
6	Wastelands	Rocky nob	810.00	3%
7	Wastelands	Vegetation	2210.00	7%

SL No	LULC Classifications		Area (Ha)	Area (%)
	Level 1	Level 2		
8	Wastelands	Stony waste	602.00	2%
10	Agriculture Land	Plantation	5112.00	16%
11	Built-up	Industrial area	712.00	2%
12	Built-up	Roads/Railways	3110.00	10%
Total			**31383.50**	**100%**

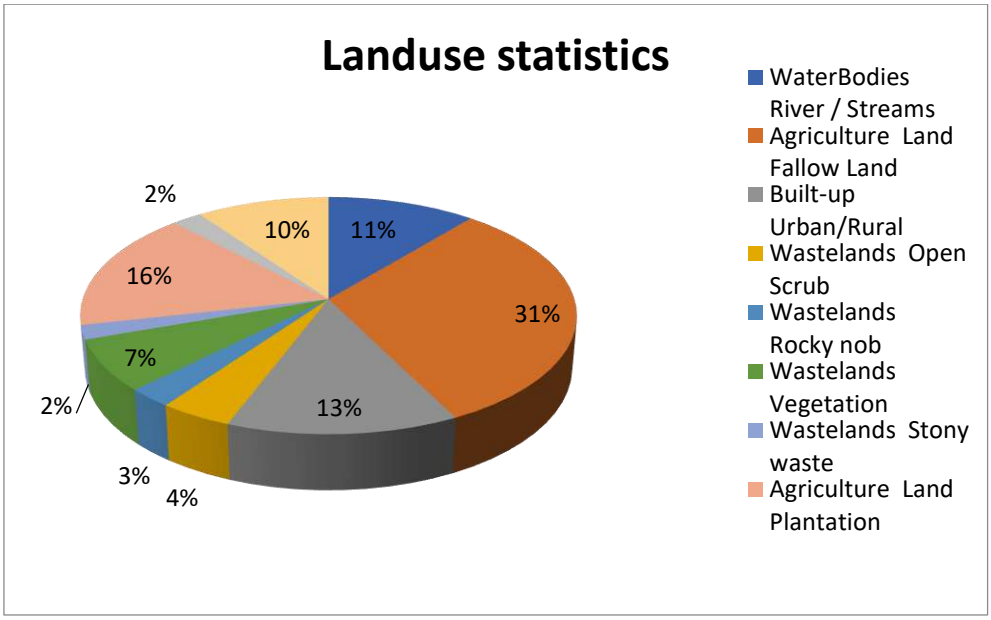


Figure 3.5: Graphical Representation of Land Use Statistics

3.2.8 Summary on the Land Use of the Study Area:

Dominance of Agricultural and Waste Land use: The study area is predominantly utilized for agricultural activity (31%), plantation (16%) together accounting for 47% of the land use. This dominance is due to the availability of fertile soil, adequate irrigation from nearby rivers and lakes, and the traditional dependence of the local population on farming for livelihood. The area also includes wasteland comprising of open shrub (4%), rocky nob (3%), vegetation (7%) and stony waste (2%).

Significant Water Sources: Tondi Eri, Botheri Lake, Taniyal Lake etc cover 11% of the total area. These water sources are vital hydrological features that support agriculture, maintain groundwater recharge and contribute to the ecological balance of the region. They play a critical role in sustaining local biodiversity and providing irrigation water for nearby agricultural lands.

Limited Settlement and Industrial activity: Built-up land constitutes about 12% of the study area, indicating limited settlements. This is primarily due to the dominance of agricultural and ecological land use, and the area not being part of a major urban agglomeration. Industrial area

contributes only 2%, as the industrial activity is limited to a few designated zones near the TANSIDCO industrial estate, while the rest of the region remains primarily rural.

3.3 GEOLOGY AND HYDROGEOLOGY

3.3.1 Objectives of the Study

- To evaluate the geological and hydrogeological characteristics of the project site and its surrounding area including rock types, soil profile, aquifer systems and groundwater conditions.
- To assess the potential impacts of the proposed project on geological stability and groundwater resources, including changes in recharge, withdrawal and contamination risks.
- To recommend appropriate mitigation and management measures for conserving groundwater and ensuring geotechnical stability.

3.3.2 Methodology of the Study

The following methodology was adopted for the assessment of geomorphology, geology, and hydrogeology of the study area:

- Collection of Secondary Data: Relevant data on geomorphology, geology, and hydrogeology were obtained from various State and Central agencies, including the Central Ground Water Authority (CGWA), District Handbooks, and the Indian Meteorological Department (IMD).
- Assessment of Terrain Characteristics: The physiography, slope, terrain, and geomorphic features of the buffer zone were analyzed to understand their influence on groundwater conditions.

Field Investigation:

a) Rock types and aquifer characteristics were identified
b) Existing open wells/bore wells and tube wells were monitored for water levels and conditions.

- Data Correlation: Field observations were collated and compared with secondary data to validate and enhance the understanding of site-specific conditions.
- Interpretation: Geomorphological, geological and hydrogeological characteristics were interpreted in the context of the study area.
- Impact Assessment and Mitigation: Potential project-related impacts on geological and groundwater conditions were identified, and appropriate mitigation measures were proposed.
- Environmental Management Recommendations: Site-specific environmental management strategies were suggested, particularly focusing on the utilization of available rainwater potential

3.3.3 Geomorphology

Geomorphologically, the area has been delineated into residual hills, pediments, pediplain, flood plains and coastal plains. The regional slope is towards East and South East. The residual hills in the Western and North Western parts of the area comprise charnockite group of rocks, The pediments and pediplain in the Western part and Central part overlie the Migmatite and Charnockite domain. The rocks of Mio-Pliocene age *i.e.* Cuddalore sandstone and laterite form low plateaus in the area. The southern part is marked by depositional regime of Varahanadi river, manifested in the form of flood plains occurring at the lowest elevation in the area.

3.3.4 Geology

Geologically, the area is underlain by upper Cretaceous, Palaeogene and Neogene sediments of marine, estuarine and fluvial alluvium over the by Precambrian rocks of Granitic gneiss as a basement. Hornblende Biotite Gneiss and Charnockites. The Charnockites occur in the Northern and Central parts, and Hornblende Biotite Gneiss occurs in the Eastern part of the area. *(Source: Geological Survey of India (GSI) (n.d.). Geological and Mineral Maps of Tamil Nadu, Ministry of Mines, Government of India)*

The study area is underlain by the Charnockite rocks and migmatite complex made up of Hornblende biotite gneiss, pink Augen gneiss and pink Migmatite, occurring in the eastern part intruded by the bands of granite and pegmatite, with quartz veins. The younger intrusions of Tindivanam and Gingee granite and basic dykes occur in the magmatic complex. Along the Varaha River thin layer alluvium is observed.

3.3.5 Seismic zones

The Geological Survey of India (G.S.I.) first published the seismic zoning map of the country in the year 1935. With numerous modifications made afterward, this map was initially based on the amount of damage suffered by the different regions of India because of earthquakes. Previously, earthquake zones were divided into five zones with respect to the severity of the earthquakes but the BIS grouped the country into four seismic zones by unifying the first two zones i.e Zone I and II. BIS is the official agency for publishing seismic hazard maps and codes. There are four seismic zones (II, III, IV, and V) in India based on scientific inputs relating to seismicity, earthquakes that occurred in the past, and the tectonic setup of the region. Zone-5 is the highest seismic zone whereas Zone II is said to be the least active seismic zone. Based on the GSI map, similar map has been prepared for Tamil Nadu State. From the map, it is seen that the Villupuram district of Tamil Nadu State, as such falls in Zone -II which is said to be the least seismic active zone/low damage risk zone. The possibilities of occurring earthquakes in the study area are remote. Seismic Zones of Tamil Nadu State are shown in Figure 3.6.

3.3.6 Climate and Rainfall

The study area experiences a humid to hot climate, with average temperatures ranging from 26°C to 41°C. During summer, the temperature rises up to 41°C, while winters are moderate, with temperatures between 30°C and 35°C. The humidity remains high, around 80%. Wind

speeds are relatively high during July and August, ranging from 7.4 to 12.6 km/hr, and increase to 100–120 km/hr during cyclonic periods.

The district receives rainfall from the South West Monsoon (June–September), North East Monsoon (October–December), and during non-monsoon periods (January–May). Rainfall is generally heavy during low-pressure depressions and cyclones in the North East Monsoon season. The normal annual rainfall is about 1046 mm, with higher amounts recorded along the coast.

3.4 HYDROGEOLOGY

Villupuram district is underlain by Crystalline Metamorphic Complex in the Western part of the district and sedimentary tract in Eastern side (Plate-II). The thickness of sediments exceeds 600m near Southern part of the district. Groundwater occurs under phreatic and semi–confined conditions in consolidated formations, which comprises weathered and fractured granites, gneisses and charnockites, whereas in unconsolidated sedimentary rocks the groundwater occurs in phreatic, semi-confined conditions in Vanur sandstone, Kadapperi Kuppam formation and Turuvai limestone. The gneisses and charnockite rocks together form the Hard Rock aquifer system in the study area. Generally, the area consists of two aquifer system.

Aquifer Unit I – Weathered: The weathered aquifer unit occurs from the ground level and has a minimum thickness of 6 m and maximum thickness of 18 m with average thickness of 9 m. The yield of this weathered aquifer unit ranges from 1.6 to 20.3 m^3/hr. During monsoon period the wells tapping this aquifer unit sustains pumping for 2 to 4 hours/day while during non-monsoon period (April to June), it sustains pumping for less than 1 hour/day ground water occurs in unconfined condition. The aquifer parameter such as transmissivity in this aquifer unit ranges from 2.2 to 24.34 m^2/day. The Specific yield of this aquifer unit ranges from 1 to 1.5% with potable groundwater quality. The general Electrical Conductivity (EC) of this aquifer unit ranges from 750 to 3000 µS/cm and is suitable for within the drinking water standards

Aquifer Unit II (Fractured/Jointed) – This aquifer unit comprises of fractured and jointed Gneissic and Charnockites formed due to tectonic activity. Top of this aquifer unit occurs from 6 to 18 m bgl. At some places it is nil. Based on the analysis of the 78 wells (CGWB) it is observed that there is a possibility of occurrence of 1 to 3 fractures/joints existing up to 132 m bgl in the gneissic region.

The average/decadal ground water levels vary from 5.0 to 10.0m bgl during pre-monsoon period where as it varies from 2.0 to 5.0 m bgl during the post monsoon period (January in this case due to NE monsoon).

In Charnockite region 1 to 3 fractures are likely to be encountered and they exist up to 120 m bgl. The yield of this aquifer unit II ranges from 4 to 10.8 m^3/hr. During monsoon period the

wells tapping this aquifer unit sustains pumping for 4 to 6 hrs /day while during non-monsoon period (April to June) sustains pumping for 1 to 3 hour/day. Transmissivity of this aquifer unit ranges from 1.0 to 51.5 m^2/day. The general EC of Aquifer I and II aquifer units range from 750 to 3000 and 340 to 2100 µs /cm respectively and are potable.

3.4.1 Ground water Resource

As per Ground Water Estimation Committee Methodology (GEC- 2015), for the year 2024, the Annual Recharge in Deevanur Firka in which the study area falls is 2272.7 Ham and the Net Annual Extractable Ground Water availability is 2045.43 Ham, whereas Extraction of ground water for irrigation, industry and domestic use is 752.32 Ham. Net Ground water availability for future use is 1293.11 Ham. Stage of Ground Water Extraction is 36.78% indicating that the Deevanur Firka as a whole is classified as "Safe Category".

Similarly, annual recharge in of Villupuram District is 104448.92 Ham and the Net Annual Extractable Ground Water availability is 94473.26 Ham, whereas Extraction of ground water for irrigation, industry and domestic use is 80616.18 Ham. Net Ground water availability for future use is 13857.0 Ham. Stage of Ground Water Extraction of the district is 85.33% indicating that the Villupuram District as a whole is categorized as Semi Critical Category.

Any extraction of ground water has to be viewed critically and necessary recharge measured to be taken as per the stipulation of Regulatory Authority, in general around the area, specifically in the Plant Premises to comply with.

Table 3.2: Ground Water Resources of the Deevanur Firka & Villupuram District, Tamil Nadu (CGWB-2024)

Resource	Deevanur Firka of Villupuram District, Tamil Nadu State	Villupuram District, Tamil Nadu State
Total Annual Recharge (Ham)	2272.70	104448.92
Annual Extractable Ground Water Resources (Ham)	2045.43	94473.26
Annual Ground Water Extraction (Ham)	752.32	80616.18
Net Annual Ground Water Availability (Ham)	1293.11	13857.0
Stage of Groundwater Extraction (%)	36.78	85.33
Category	**Safe**	**Safe**

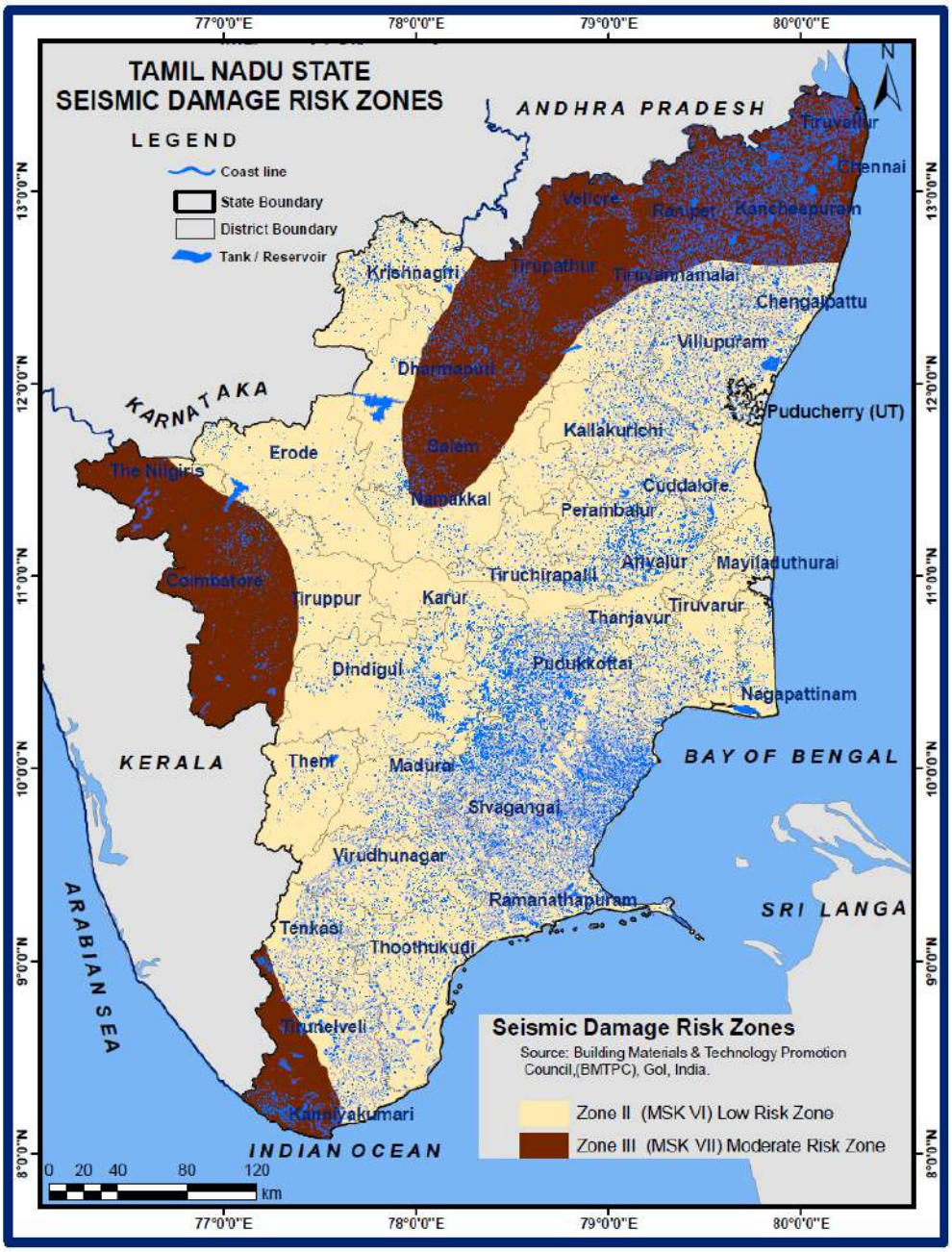


Figure 3.6. Seismic zones of Tamil Nadu

3.5 AIR ENVIRONMENT

Air quality is influenced by both micrometeorological conditions and the presence of pollutants from natural and anthropogenic sources. The meteorological data for the study has been obtained from Indian Meteorological Department (IMD) station at Pondicherry due to the non-availability of a nearby station at Tindivanam while a micrometeorological study has been concurrently conducted at the project site to capture site-specific atmospheric conditions.

3.5.1 Meteorological Characteristics

The meteorological data from IMD station at Pondicheery was collected for the period from March to May 2025 and historical data for the period 2012-2024 was obtained from

worldweatheronline.com. The data compiled for the study area is presented in Table 3.3. The important parameters considered are temperature, humidity, wind speed, wind direction and rainfall.

Table 3.3 Meteorological Data – (2012-2024)

Month	Temperature ^{0}C		Humidity (%)	Predominant Wind Direction ^{0}N	Wind Speed	Rainfall (mm)
	Max	Min			Max	Max
January	29	20	73	40-60	12.5	24.3
February	32	21	73	50-70	10.4	6.2
March	35	23	63	90-120	13.1	20.1
April	37	26	61	120-160	12.4	28.5
May	38	29	52	180-250	12.3	69.1
June	37	28	48	220-270	13.3	96.4
July	35	27	56	230-280	14.7	107.1
August	35	26	62	240-280	13.2	164.7
September	34	26	69	220-270	13.4	145.5
October	32	25	78	250-270	10.5	200
November	30	23	80	20-70	12.3	251.5
December	29	21	81	20-70	15.2	123

(Source: www.worldweatheronline.com)

3.5.2 Site specific micro meteorological characteristics

The micro-meteorological station was installed at the site and the details on the monitoring parameters, equipment and its detection limit and the monitoring frequency are given in Table 3.4.

Table 3.4: Details on Micro Meteorological parameters monitored

S.No	Parameters Monitored	Sampling collection		Monitoring period	Monitoring Frequency	Methodology
		Equipment	Sensitivity/ Detection Limit			
1	Wind Speed	Anemometer cup counter (0 to 65 m/s)	0.25 m/s	One season (March to May 2025)	Hourly	As per Manufacture's manual (IS 8892-1978)
2	Wind Direction	Wind vane (0^0 to 357^0)	1^0			
3	Temperature	Thermometer (-40^0 C to 60^0 C)	0.1^0C			
4	Humidity	Relative Humidity meter (0-99%)	3%			
5	Rainfall	Rain gauge	0.5 mm		-	-
6	Cloud cover	-	-		4 Hourly	Visual Inspection by the observer

3.5.3 Micro Metrological Study-Results and Interpretation

The micro meteorological data were processed to obtain average values of Temperature, Wind Speed, Wind direction, Cloud Cover, Rainfall and Relative Humidity and presented in Table 3.5. The combined wind rose diagram for the season March to May 2025 is given in Figure 3.6.

Inference from the study:

- Temperature ranged between 23.3°C and 40°C, showing a typical diurnal variation with warm afternoons and cooler early mornings.
- Relative humidity was highest in the early morning (100%) and lowest around noon (48%) indicating normal evaporation-condensation cycles.
- Wind speed was calm at night and peaked at 10 kmph in the afternoon with predominant southeasterly winds during daytime.

- Clear skies and negligible rainfall were indicative of dry season conditions favorable for field studies

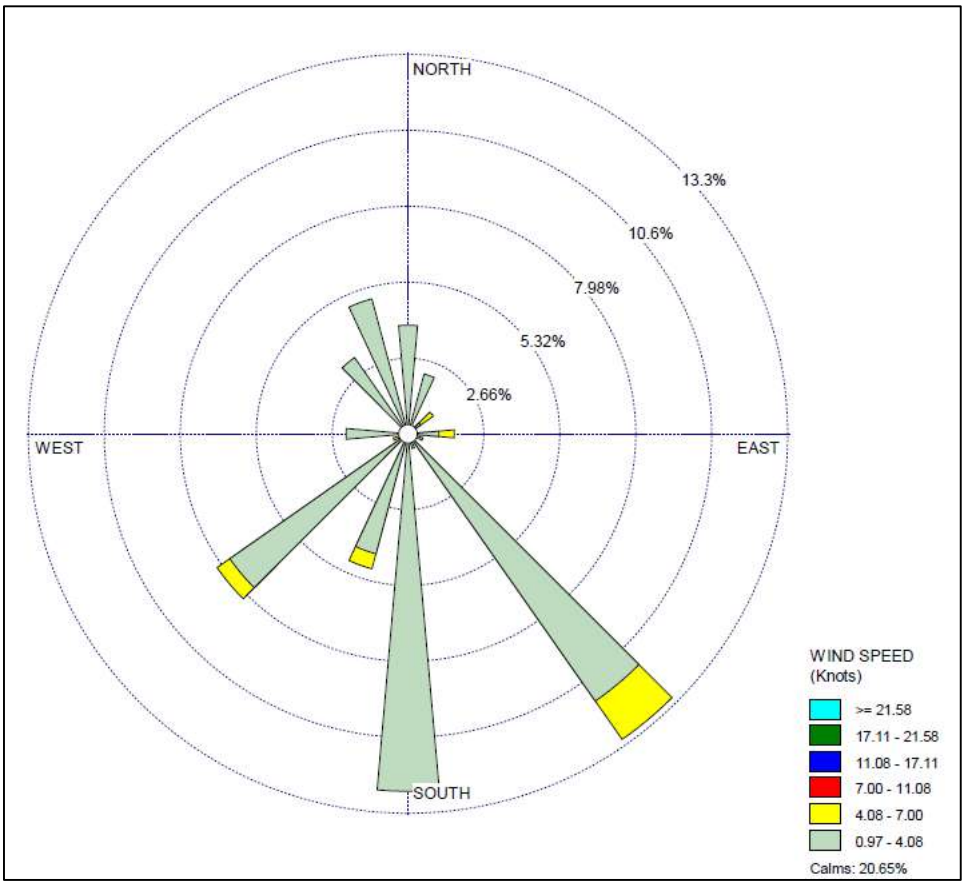


Figure 3.7 Combined wind rose diagram for March to May 2025

3.5.4 Ambient Air Quality Monitoring

Sampling locations were finalized in accordance with IS 5182 (P-14) 2000 and the norms prescribed by the Central Pollution Control Board (CPCB) considering factors such as regional climatology, predominant wind direction (NE to SW), ease of site accessibility and availability of essential infrastructure such as adequate power supply.

Accordingly, six sampling stations were established at the project site (Core zone), and in Venmaniyathur, Ural, Pattanam, Tindivanam, Vempundi, Kollar, Kudisipalayam (Buffer zone) as presented in Figure 3.8 and Table 3.6. At each station, PM_{10}, $PM_{2.5}$, SO_2, NO_2 and VOCs were measured over a 24-hour period at uniform intervals and CO concentration was measured every 1 hour twice every week for a period of 3 months. The photographs taken during ambient air quality monitoring are given in Figure 3.8.

3.5.5 Ambient Air Quality Monitoring – Sampling Procedure

Respirable Dust Samplers and Fine Particulate Samplers were used to collect samples for PM_{10} and $PM_{2.5}$ in ambient air at a flow rate of 1.2 m^3/min and 17.6 LPM, respectively. The ambient air was sucked through the cyclone and filter paper by a blower. Samples of gases were drawn

at a flow rate of 0.5 litres per minute and were analysed in the laboratory. Measurements were made in respect of the following parameters:

- Particulate Matter (PM_{10})
- Particulate Matter ($PM_{2.5}$)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_2)
- Carbon Monoxide (CO)

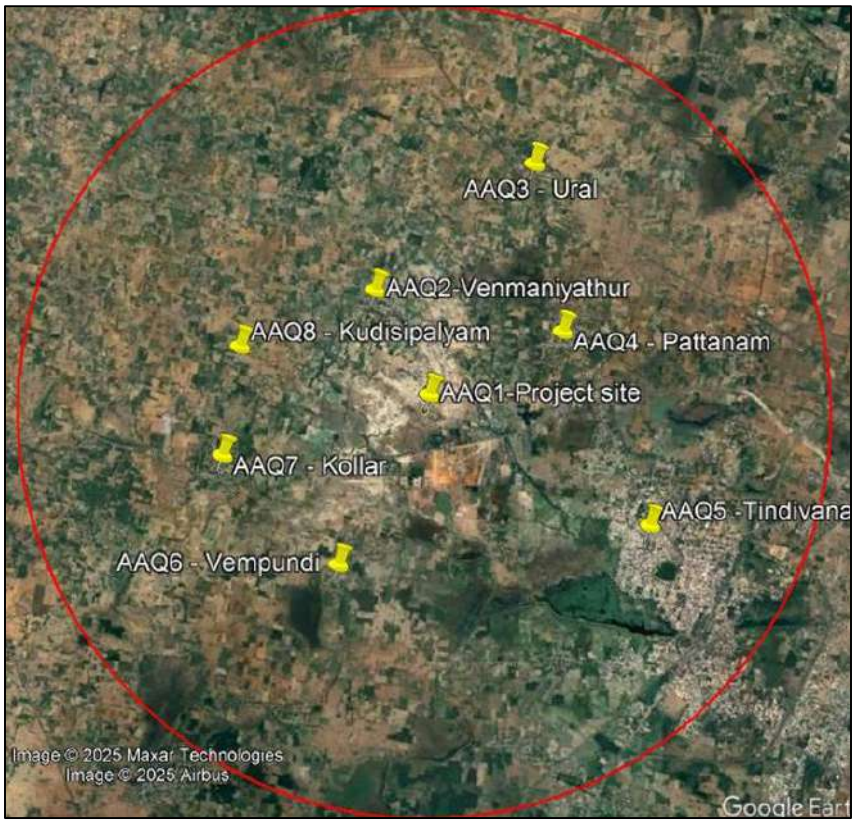


Figure 3.8: Ambient Air Quality Monitoring Stations

Imagery source: Google Earth (2024)

[Online] available at: http://www.google.com/earth/index.html[Accessed January, 2024]

Table 3.6: Details of Ambient Air Quality Monitoring Stations

Location code	Name of the Location	Direction and Distance from Project Site	Area/ Sources	Environmental Significance	Latitude and Longitude	Justification or Selection of station
AAQ1	Project Site (Core Zone)	Base	Core zone	Existing ambient air quality in upwind and downwind at core zone	12°253753”N 79°619647”E	Selected as Base Station

Location code	Name of the Location	Direction and Distance from Project Site	Area/ Sources	Environmental Significance	Latitude and Longitude	Justification or Selection of station
AAQ2	Venmaniyathur	NNW 1.4 km	Residential	Existing air quality at Buffer zone3	12°264769"N 79°614287"E	2nd Crosswind direction
AAQ3	Ural	NNE 3.2 km	Residential		12°279654"N 79°630104"E	1st Crosswind direction
AAQ4	Pattanam	NE 1.8 km	Residential		12°261409"N 79°633462"E	Upwind direction.
AAQ5	Tindivanam	SE 3.0 km	Commercial		12°226765"N 79°647704"E	2nd Crosswind direction
AAQ6	Vempundi	SW 2.3 Km	Residential		12°234588"N 79°608245"E	Downwind direction
AAQ7	Kollar	WSW 2.7 Km	Residential		12°21844"N 79°603747"E	Downwind direction
AAQ8	Kudisipalyam	NW 2.5 Km	Residential		12°258741"N 79°596734"E	Downwind direction





Figure 3.9. Photographs of Ambient Air Sampling

The methodology adapted for the analysis is given in Table 3.7.

Table 3.7 Method of analysis of Ambient Air Quality parameters

Sampling Parameters	Sampling Equipment	Analytical Equipment	Sensitivity/ Detection Limit	Methodology
PM_{10}	Respirable dust sampler with cyclone and flow measurement – APM 460	Electronic Balance	5 µg/m^3	Gravimetric IS:5182 (Part 23) 2006
$PM_{2.5}$	Fine particulate sampler – APM 550 mini	Electronic Balance	8 µg/m^3	ESIPL/SOP/C-AA/03 Refer CPCB Guidelines
SO_2	Gaseous flow (Impinger with TCM) with RDS	Spectrophotometer	4.5 µg/m^3	Colorimetric IS:5182 (Part 2) 2001
NO_2	Gaseous Flow (Impinger with Sodium Hydroxide (0.1N)) with RDS	Spectrophotometer	6 µg/m^3	Colorimetric IS:5182 (Part 6) 2006
CO	CO Sensor	CO Analyser	1.14 mg/m^3	Sensor/GC Method
VOCs	Bladder and Pump (Charcoal adsorption/analyser)	GC	0.5 µg/m^3	IS:5182 (Part 2)

- Particulate Matter ($PM_{2.5}$): (NAAQS Monitoring & Analysis Guidelines Volume-I: Particulate Matter ($PM_{2.5}$) was analyzed by Gravimetric Method. Particulate matter was collected on the 37 mm dia glass microfiber Filter Paper. $PM_{2.5}$ value was determined from the values of volume of air passed through Ambient Fine Dust Sampler.
- Particulate Matter (PM_{10}) (IS: 5182 Part 23:2006): Particulate Matter (PM_{10}) was carried out by Respirable Dust sampler as per IS: 5182(Part 23):2006. Particulate matter was collected on the GF/A Filter Paper. Particles with aerodynamics diameter less than the cut-point of the inlet were collected by the filter. The mass of these particles was determined by the difference in filter paper weight prior to and after sampling.
- Sulphur dioxide (SO_2) (IS: 5182; Part – 2 – 2001): Sulphur dioxide was absorbed by aspirating a measured air sample through a solution of Potassium or sodium tetrachloromercurate, TCM. This procedure results in the formation of a dichloro sulphite mercurate complex. The Sulphite ion produced during sampling reacts with sulphamic acid, formaldehyde and pararosaniline to form an azo dye which was determined colorimetrically.
- Nitrogen Oxides (IS: 5182; Part – 6 – 2006): Nitrogen dioxide was collected by bubbling air through a sodium hydroxide- sodium arsenite solution to form a stable solution of sodium Nitrite. The Nitrite ion produced during sampling reacts with hydrogen peroxide, Sulphanilamide and NEDA to form an azodye which was determined colorimetrically.
- Carbon monoxide (CO) (IS:5182; Part -10-1999): Samples containing Carbon monoxide in the range of 0 to 100 mg/m3 were analysed using an Electro chemical sensor.

3.5.6 AMBIENT AIR QUALITY MONITORING – RESULTS

At each station, ambient air quality parameters i.e. PM_{10}, $PM_{2.5}$, SO_2, NO_2, VOCs and CO were monitored twice a week for 3 months (March 2025– May 2025) 24 hourly at uniform intervals. The results are presented in Table 3.8 and Figures 3.9, 3.10, 3.11 and 3.12.

Table 3.8: Ambient Air Quality in the study area

Location Code	Name of the Location	Range	VALUES (µG/M³)					(MG/M³)
			PM_{10}	$PM_{2.5}$	SO_2	NO_2	VOC	CO
AAQ1	Project Site (Core)	Min	60	21	3.8	14	BDL (DL:0.5)	BDL (DL:1.14)
		Max	69	29	5.3	21	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	64.9	25.1	4.4	16.7	BDL (DL:0.5)	BDL (DL:1.14)

Location Code	Name of the Location	Range	VALUES (µG/M^3)					(MG/M^3)
			PM_{10}	$PM_{2.5}$	SO_2	NO_2	VOC	CO
		98%	68.7	28.7	5.3	20.7	BDL (DL:0.5)	BDL (DL:1.14)
AAQ2	Venmaniyathur	Min	50	18	3.0	10	BDL (DL:0.5)	BDL (DL:1.14)
		Max	63	26	3.8	19	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	55.9	21.8	3.4	16.2	BDL (DL:0.5)	BDL (DL:1.14)
		98%	62.7	25.7	3.7	19.0	BDL (DL:0.5)	BDL (DL:1.14)
AAQ3	Ural	Min	48	14	3.1	13	BDL (DL:0.5)	BDL (DL:1.14)
		Max	63	25	5.2	24	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	56.1	19.9	4.1	17.3	BDL (DL:0.5)	BDL (DL:1.14)
		98%	62.7	25.0	5.1	23.4	BDL (DL:0.5)	BDL (DL:1.14)
AAQ4	Pattanam	Min	52	18	4.2	16	BDL (DL:0.5)	BDL (DL:1.14)
		Max	70	28	6.4	19	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	60.9	24.1	5.4	17.3	BDL (DL:0.5)	BDL (DL:1.14)
		98%	69.4	28	6.3	19.0	BDL (DL:0.5)	BDL (DL:1.14)
AAQ5	Tindivanam	Min	71	25	5.4	17	BDL (DL:0.5)	BDL (DL:1.14)
		Max	86	34	6.7	24	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	75.6	28.7	6.0	20	BDL (DL:0.5)	BDL (DL:1.14)
		98%	84.9	33.7	6.7	23.7	BDL (DL:0.5)	BDL (DL:1.14)
AAQ6	Vempundi	Min	50	16	3.2	15	BDL (DL:0.5)	BDL (DL:1.14)

Location Code	Name of the Location	Range	VALUES (µG/M³)					(MG/M³)
			PM_{10}	$PM_{2.5}$	SO_2	NO_2	VOC	CO
		Max	58	25	4.2	20	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	54.4	19.9	3.7	17.3	BDL (DL:0.5)	BDL (DL:1.14)
		98%	58	24.7	4.2	20.0	BDL (DL:0.5)	BDL (DL:1.14)
AAQ7	Kollar	Min	35	16	3.1	12	BDL (DL:0.5)	BDL (DL:1.14)
		Max	54	28	4.1	19	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	43	22.3	3.6	14.5	BDL (DL:0.5)	BDL (DL:1.14)
		98%	53.4	27.7	4.1	18.4	BDL (DL:0.5)	BDL (DL:1.14)
AAQ8	Kudisipalyam	Min	33	12	3.0	12	BDL (DL:0.5)	BDL (DL:1.14)
		Max	42	18	3.6	16	BDL (DL:0.5)	BDL (DL:1.14)
		Avg	37.1	14.6	3.3	14.3	BDL (DL:0.5)	BDL (DL:1.14)
		98%	41.7	17.7	3.6	16.0	BDL (DL:0.5)	BDL (DL:1.14)
CPCB –NAAQ Standards			100	60	80	80	--	2

Note: BDL - Below Detection Limit, DL - Detection Limit.

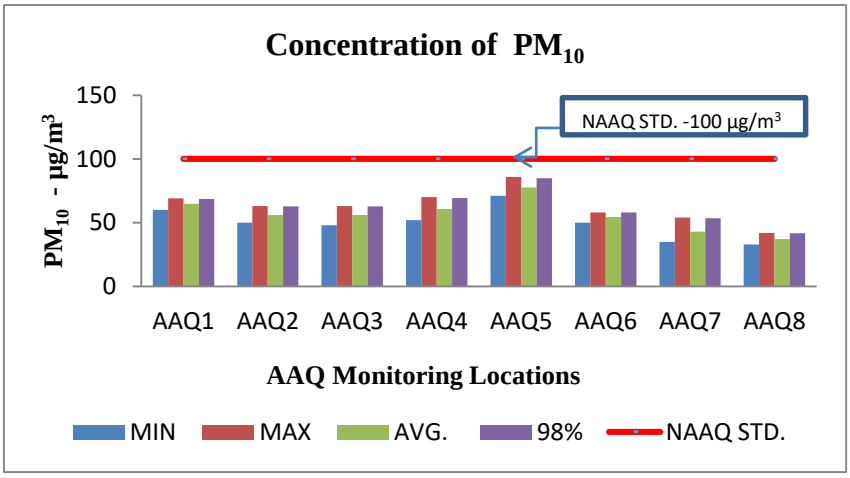


Figure 3.10: Distribution of PM_{10} concentration in the study area

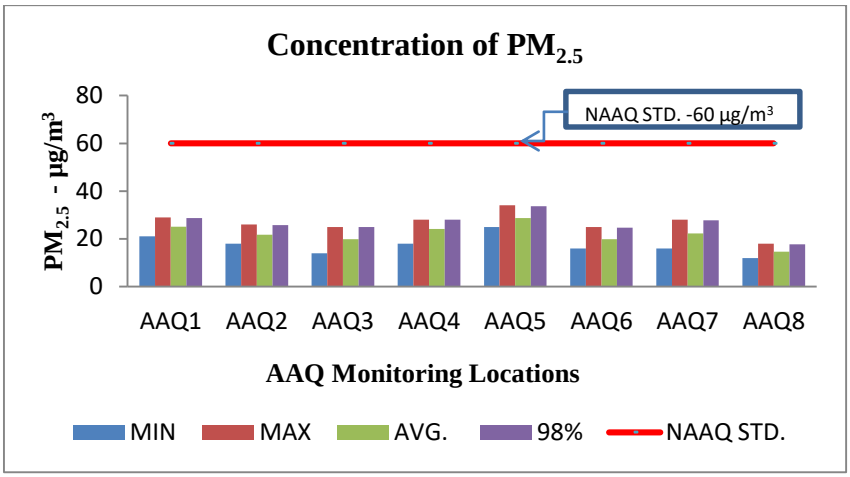


Figure 3.11: Distribution of $PM_{2.5}$ concentrations in the study area

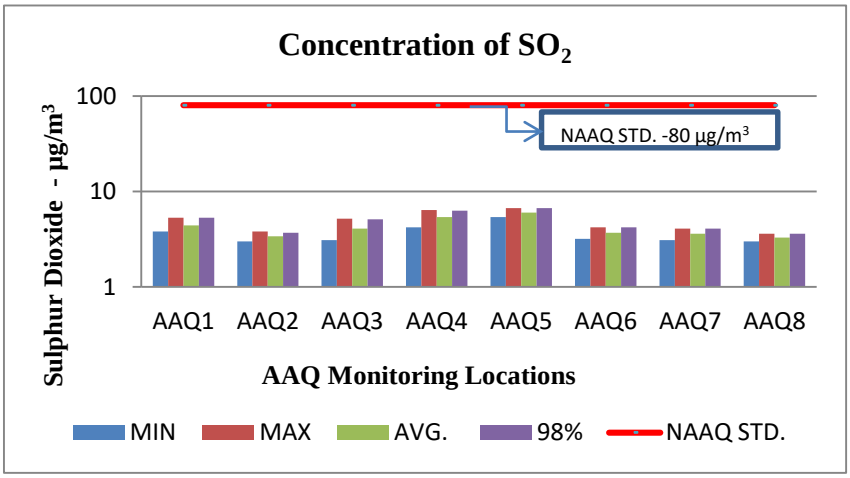


Figure 3.12: Distribution of SO_2 concentration in the study area

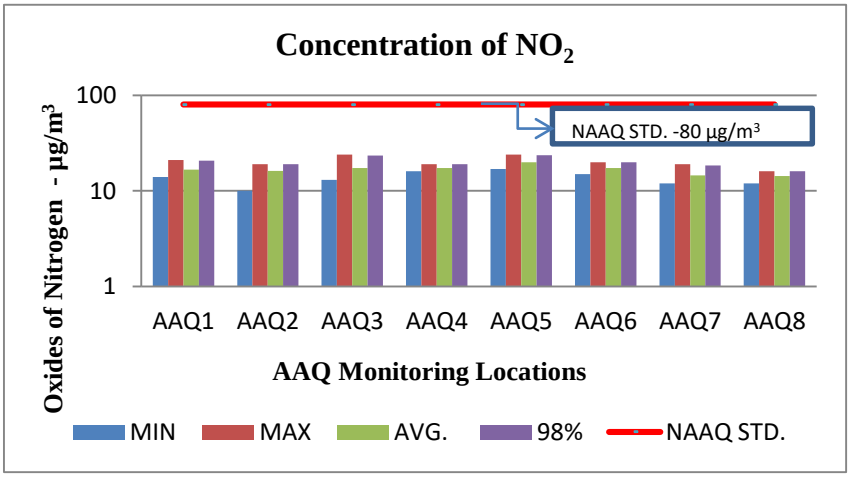


Figure 3.13: Distribution of NO_2 concentration in the study area

3.5.7 Air Quality Index

The AQI for the site area and its surrounding was calculated (Table 3.9) following AQI category by CPCB as shown in Table 3.10.

Table 3.9: Calculated AQI data

Location Code	Locations	AQI Value	AQI Range
AAQ1	Project Site (Core)	69	Satisfactory
AAQ2	Venmaniyathur	63	Satisfactory
AAQ3	Ural	62	Satisfactory
AAQ4	Pattanam	69	Satisfactory
AAQ5	Tindivanam	85	Satisfactory
AAQ6	Vempundi	58	Satisfactory
AAQ7	Kollar	53	Satisfactory
AAQ8	Kudisipalyam	42	Good

(Reference: National Air Quality Index, Control of Urban Pollution Series (Cups/87/2014-15) By CPCB, Overall AQI System, Page 19)

Table 3.10: AQI Category by CPCB

AQI RANGE	AQI CATEGORY	AQI RANGE	AQI CATEGORY
Good (0–50)	Minimal Impact	Poor (201–300)	Breathing discomfort to people on prolonged exposure
Satisfactory (51–100)	Minor breathing discomfort to sensitive people	Very Poor (301–400)	Respiratory illness to the people on prolonged exposure
Moderate (101–200)	Breathing discomfort to the people with lung, heart disease, children and older adults	Severe (>401)	Respiratory effects even on healthy people

3.5.8 Data Interpretation

The Core zone:

AAQ1 (Onsite): The 98th Percentile value of PM_{10} (68.7 µg/m^3), $PM_{2.5}$ (28.7 µg/m^3), SO_2 (5.3 µg/m^3), NO_2 (20.7 µg/m^3), VOC (BDL (DL: 0.5) µg/m^3) and CO (BDL (DL: 1.14) mg/m^3) are within the limits of National Ambient air quality standards.

The Buffer zone:

AAQ2 (Venmaniyathur): The 98th percentile value of PM_{10} (62.7 µg/m^3), $PM_{2.5}$ (25.7 µg/ m^3), SO_2 (3.7 µg/m^3), NO_2 (19.0 µg/ m^3) and CO (BDL (DL: 1.14 mg/m^3) are within the limits of National Ambient Air Quality Standards.

AAQ3 (Ural): The 98th percentile value of PM_{10} (62.7 µg/m^3), PM2.5 (25.0 µg/ m^3), SO_2 (5.1 µg/ m^3), NO_2 (23.4 µg/ m^3) and CO (BDL (DL: 1.14 mg/$m^{3)}$ are within the limits of National Ambient Air Quality Standards.

AAQ4 (Pattanam): The 98th percentile Value of PM_{10} (69.4 µg/ m^3), $PM_{2.5}$ (28.0 µg/ m^3), SO_2 (6.3 µg/ m^3), NO_2 (19.0 µg/ m^3) and CO (BDL (DL: 1.14 mg/m^3) are within the limits of National Ambient Air Quality Standards.

AAQ5 (Tindivanam): The 98th percentile value of PM_{10} (84.9 µg/ m^3), $PM_{2.5}$ (33.7 µg/ m^3), SO_2 (6.7 µg/ m^3), NO_2 (23.7 µg/ m^3) and CO (BDL (DL: 1.14 mg/m^3) are within the limits of National Ambient Air Quality Standards.

AAQ6 (Vempundi): The 98th percentile value of PM_{10} (58.0 µg/ m^3), $PM_{2.5}$ (24.7 µg/ m^3), SO_2 (4.2 µg/m^3), NO_2 (20.0 µg/ m^3) are within the limits of National Ambient Air Quality Standards.
AAQ7 (Kollar): The 98th percentile value of PM_{10} (53.4 µg/ m^3), $PM_{2.5}$ (27.7 µg/ m^3), SO_2 (4.1 µg/m^3), NO_2 (18.4 µg/ m^3) are within the limits of National Ambient Air Quality Standards.

AAQ8 (Kudisipalyam): The 98th percentile value of PM_{10} (41.7 µg/ m^3), $PM_{2.5}$ (17.7 µg/ m^3), SO_2 (3.6 µg/m^3), NO_2 (16.0 µg/ m^3) are within the limits of National Ambient Air Quality Standards.

The ambient air quality results from both the core and buffer zones indicate that the concentrations of air pollutants namely PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO are within the permissible limits prescribed by the National Ambient Air Quality Standards (NAAQS). In the core zone, the project site AAQ1, the 98th percentile values for PM10 (68.7 µg/m^3), $PM_{2.5}$ (28.7 µg/m^3), SO_2 (5.3 µg/m^3), NO_2 (20.7 µg/m^3) and CO (below detection limit) indicate good air quality. Similarly, all locations in the buffer zone (AAQ2 to AAQ8) also recorded pollutant levels within acceptable limits with the highest PM_{10} value at Tindivanam (84.8 µg/m^3) still below the standard threshold. This suggests that the ambient air quality in and around the project site is satisfactory.

Tindivanam is a key transit point on National Highway 32 (NH 32), which connects Chennai to Tuticorin. It was also formerly part of National Highway 45 (NH 45), a major arterial route. Additionally, Tindivanam serves as a junction for the former National Highway 66 (NH 66, now integrated into other highways) and State Highway 134 (SH-134), which links it to Marakkanam on the East Coast Road. The highways experience significant traffic throughout the day, including cars, light commercial vehicles, buses, and trucks, with an increased

movement of multi-axle vehicles during the night. These are all known sources of coarse particulate matter (PM_{10}). Furthermore, the presence of unpaved roads and limited green cover may exacerbate the concentration of particulates in the ambient air. These anthropogenic activities cumulatively contribute to elevated PM_{10} levels in Tindivanam.

3.6. NOISE LEVEL

Noise level monitoring evaluates existing ambient noise conditions in and around the project site. This helps assess potential noise impacts from the proposed activities and aids in the formulation of mitigation measures.

3.6.1 Ambient Noise Level Monitoring Stations

Monitoring stations (Figure 3.13 and Table 3.11) were fixed based on the Land use pattern (e.g. silent, commercial, industrial and residential zone) that lies within the core and buffer areas and their proximity to noise sources and sensitive receptors.

3.6.2 Ambient Noise Level – Monitoring Method

At each station the noise level was measured during both day and night times:

1. Day time - 6.00 a.m. to 10.00 p.m.
2. Night time - 10.00 p.m. to 6.00 a.m.

For each measurement, dB (A) readings was taken every 15 minutes for 24 hours to get Leq values following the method given in Table 3.12.



Figure 3.14: Ambient Noise Level Measurement Stations

Imagery source: Google Earth (2024)

[Online] Available at: *http://www.google.com/earth/index.html* [Accessed January 2025]

Table 3.11: Details of Ambient Noise Level Monitoring Stations

Location code	Name of the Location	Direction from Project Site	Category	Distance from Project Site (km)	Latitude; Longitude	Sampling type and parameter
ANL 1	Project Site (Core zone)	-	Industrial	-	12°25391"N 79°619672"E	Noise Values (Leq in dB(A)
ANL 2	Near Govt. Primary school- Venmaniyathur	NNW	Silent	1.1	12°266305"N 79°61229"E	
ANL 3	Near Govt.Middle school - Ural	NNE	Silent	3.0	12°281024"N 79°631563"E	
ANL 4	Near Govt. Primary school- Pattanam	NE	Silent	1.6	12°259928"N 79°637638"E	
ANL 5	Karumariyamman Kovil -Tindivanam	SE	Commercial	2.7	12°243097"N 79°644332"E	
ANL 6	Near Govt.Middle school - Vempundi	SW	Silent	1.9	12°235575"N 79°608895"E	
ANL 7	Kollar	WSW	Residential	2.5	12°247288"N 79°594248"E	
ANL 8	Near Govt. Primary school - Kudisipalayam	NW	Silent	2.4	12°259231"N 79°597015"E	

Table 3.12: Ambient Noise Level Monitoring Method

Environmental Component	Method	Sample collection		Sampling Parameter
		Equipment	Detection Limit	
Ambient Noise Level	IS 9989	Baseline Technologies AO-313-1372	0.1 dB (A)	Decibels - dB (A)

The photographs taken during the measurement of noise are in Figure 3.14.




Figure 3.15. Ambient Noise Level Monitoring

3.6.3 Ambient Noise Level – Results

The Ambient Noise Levels are given in Table 3.13. Table 3.14 presents the noise level standards according to the Noise Pollution (Regulation and Control) Rules, 2000. Figure 3.15 shows the graphical representation of the existing noise levels.

Table 3.13: Ambient Noise Levels

Location Code	Name of the Location	Noise levels in dB(A)	
		Day Time Leq	Night Time Leq
ANL 1	Project Site (Core zone – Industrial Area)	65.3	52.7
ANL 2	Near Govt.primary school – Vemaniyathur	49.1	38.5
ANL 3	Near Govt. middle school - Ural	49.9	39.1
ANL 4	Near Govt.primary school - Pattanam	51.5	42.9
ANL 5	Near Karumariyamman Kovil -Tindivanam	62.3	50.7
ANL 6	Near Govt.middle school - Vempundi	49.0	38.6
ANL 7	Kollar	49.6	37.9
ANL 8	Near Govt. Primary school - Kudisipalayam	48.9	37.1

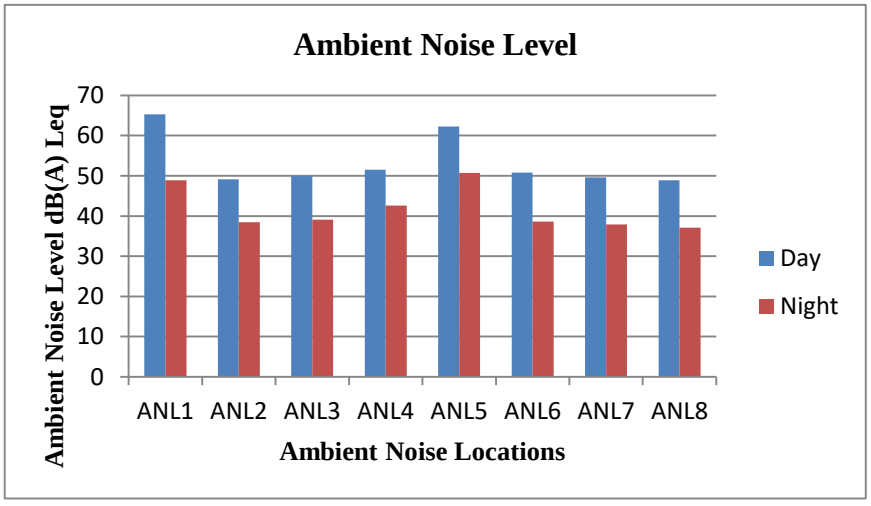


Figure 3.16: Ambient Noise Level in the study area

Table 3.14: Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence zone	50	40

Note:-

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

(Source: Standards for Noise Pollution (Regulation & control) Rules by CPCB, 2010)

3.6.4 Interpretation of Results

Noise level measurements were conducted at eight locations in and around the project site. The results indicate that seven out of eight locations comply with CPCB norms for both day and night. The only exception is ANL 4, which recorded a slightly elevated daytime noise level exceeding the Silence Zone limit of 50 dB(A), likely due to its proximity to State Highway SH–179B (Manampatti to Koot Road) with moderate vehicular movement during the day. Night-time noise levels at all locations were within permissible limits. The project site (ANL 1), categorized as an Industrial Zone, remains well within CPCB limits, indicating minimal noise impact from industrial activities. Silence Zones, typically located near schools, generally show acceptable noise levels, protecting sensitive receptors such as children

3.7 WATER ENVIRONMENT

The assessment of the water environment involves the evaluation of surface water and groundwater resources in the study area. It includes the identification of existing water bodies, drainage patterns, water quality status and usage. The objective of the study is to establish a baseline quality of water resources, assess potential impacts of the proposed project and recommend appropriate mitigation and management measures to ensure the protection and sustainable use of water resources.

3.7.1 Water Quality – Monitoring Locations

Water samples were collected from fifteen locations (Surface Water – 7 nos. and Groundwater – 8 nos.) in the study area to assess its characteristics. Sampling was carried out at the locations shown in Figure 3.16 and listed in Table 3.15 and Table 3.16. The sampling locations were finalized following a preliminary visit of the project site and a desktop assessment of the study area.



Figure 3.17: Surface water Sampling Locations

Imagery source: Google Earth (2024)

[Online] Available at: http://www.google.com/earth/index.html [Accessed January 2025]



Figure 3.18: Ground Water Sampling Locations

Imagery source: Google Earth (2024)

[Online] Available at: http://www.google.com/earth/index.html [Accessed January 2025]

Table 3.15: Details of Surface Water quality monitoring locations

Location Code	Name of the Location	Source of Water	Distance from Project Site (km)	Direction from Project Site	Latitude and Longitude
SW1	Pampundi Lake	Surface Water	3.3	NNW	12°279575"N 79°604089"E
SW2	Taniyal Lake	Surface Water	9.9	NW	12°315628"N 79°555432"E
SW3	Kodium Lake	Surface Water	7.8	N	12°315628"N 79°555432"E
SW4	Melapakkam Lake	Surface Water	4.8	NE	12°322876"N 79°629621"E
SW5	Gindangal Lake	Surface Water	3.0	SE	12°22821"N 79°645531"E
SW6	Vempundi Lake	Surface Water	2.6	SW	12°230023"N 79°606747"E
SW7	Vilukkam Lake	Surface Water	8.8	WNW	12°265809"N 79°534256"E

Table 3.16: Details of Groundwater quality monitoring locations

Location Code	Name of the Location	Source of Water	Distance from Project Site (km)	Direction from Project Site	Latitude and Longitude
GW1	Near Project site	Bore well	0.8	NNE	12°260472"N 79°615309"E
GW2	Agoor	Bore well	5.1	NW	12°266178"N 79°572857"E
GW3	Kodiyamputhur	Bore well	5.8	NNE	12°304862"N 79°634854"E
GW4	Ayyanthoppu	Bore well	4.5	NE	12°266761"N 79°657738"E
GW5	Attur	Open well	7.8	SE	12°236867"N 79°682269"E
GW6	Palakuppam	Open well	2.1	SSE	12°239157"N 79°624334"E
GW7	Rettanai	Bore well	8.3	SW	12°200119"N 79°55961"E
GW8	Peradikuppam	Bore well	3.9	WSW	12°250551"N 79°58064"E

Water samples were collected in accordance with the Standard Methods (IS 3025: Part 1 and APHA, 24th Edition 2023) and the CPCB Guidelines for Water Quality Monitoring (MINARS/27/2007-08). Necessary precautions for sample preservation were followed as per

IS 3025: Part 3 "Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater".

The physical parameters pH, Temperature, Dissolved Oxygen and Conductivity were measured at the site using a portable water analyser. Photographs taken during the work are in Figure 3.17.



Figure 3.19. Water Sampling and Onsite Monitoring

3.7.2 Water Quality Monitoring – Method of Analysis

The samples were kept under controlled conditions on reaching the laboratory according to the sample storage requirements. The parameters were analyzed as per the IS Standards and SOPs developed by our in-house laboratory as shown in the Table 3.17.

Table 3.17: Analytical Methods - Water quality

S. No.	Parameter Tested	Standard method or Technique Used	Range of Testing
1.	Temperature	IS 3025: Part 9	20-50^{o}C
2.	Turbidity	IS 3025: Part 10 Nephelometric Method	1-400 NTU
3.	pH@25^{o}C	IS 3025: Part 11 (Electrometric Method)	2-12
4.	Conductivity 25^{o}C	IS 3025: Part 14 (Electrometric Method)	5 - 50,000 µmhos/cm
5.	Total Dissolved Solids	IS 3025 : Part 16 (Gravimetric Method)	2-10,000 mg/L
6.	Total Suspended Solids	IS 3025 : Part 17 (Gravimetric Method)	2-10,000 mg/L
7.	Alkalinity as $CaCO_3$	IS 3025 : Part 23 (Titrimetric Method)	2-1,000 mg/L
8.	Total Hardness as $CaCO_3$	IS 3025 : Part 21 (Titrimetric Method)	2-5,000 mg/L

S. No.	Parameter Tested	Standard method or Technique Used	Range of Testing
9.	Sodium as Na	IS 3025 : Part 45 (Flame Photometry Method	1-1,000 mg/L
10.	Potassium as K	IS 3025 : Part 45 (Flame Photometry Method)	1-1,000 mg/L
11.	Chloride as Cl^-	IS 3025 : Part 32 (Argentometric Method)	1-2,500 mg/L
12.	Sulphate as SO_4	IS 3025 : Part 24 (Turbidity Method)	2-2,000 mg/L
13.	Ammonical Nitrogen as NH_3-N	IS 3025: Part 34 (Titrimetric Method)	0.5-200 mg/L
14.	Nitrate Nitrogen as NO_3	IS 3025: Part 34 Devarda's alloy reduction method	1.0-100 mg/L
15.	Total Kjeldal Nitrogen	IS 3025 : Part 34 (TKN-Titrimetric Method)	1.0-200 mg/L
16.	Phosphate PO_4	IS 3025 : Part 31 (Stannous Chloride Method)	0.1-50 mg/L
17.	Dissolved Oxygen O_2	IS 3025 : Part 38 (Titrimetric Method)	1-8 mg/L
18.	BOD @ 27ºC for 3 days	IS 3025:Part 44 (Incubation Method)	2-200 mg/L
19.	Chemical oxygen Demand	IS 3025 : Part 58 (Closed Reflux Method)	4-2,000 mg/L
20.	Fluoride as F^-	IS 3025 : Part 60 (Colorimetric Method)	0.1-25 mg/L
21.	Chromium as $Cr6^+$	IS 3025: Part 52 (Diphenylcarbazide Method)	0.1-20 mg/L
22.	Copper as Cu	IS 3025 : Part 42 Neocuproine Method	0.3 - 25 mg/L
23.	Iron as Fe	IS 3025:Part 53 (1,10Phenanthroline Method)	0.1 - 50 mg/L
24.	Nickel as Ni	IS 3025:Part 54 (Dimethylglyoxime Method)	0.1-5 mg/L
25.	Manganese as Mn	IS 3025:Part 59 (Formaldoxime Method)	0.05 – 20 mg/L

S. No.	Parameter Tested	Standard method or Technique Used	Range of Testing
26.	Oil & Grease	IS 3025:Part 39 (Gravimetric Method)	1.0 – 10000 mg/L
27.	Silica as SiO_2	IS 3025:Part 35 (Molybdosilicate Method)	1.0 – 100 mg/L
28.	Boron as B	APHA 24th Edn. 4500B-B	0.1 – 20 mg/L
29.	Phenols as C_6H_5OH	IS 3025:Part 43 (4-Amino Antipyrine Method)	0.01 – 5 mg/L
30.	Anionic Surfactant as MBAS	IS 3428. Annex – K	0.1 – 5 mg/L
31	Free Residual Chlorine	IS 3025:Part 26 (Iodometric Method)	0.5 – 100 mg/L
32	Lead as Pb	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
33	Arsenic as As	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
34	Cadmium as Cd	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
35	Selenium as Se	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
36	Barium as B	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
37	Silver as Ag	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
38	Zinc as Zn	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
39	Mercury as Hg	IS 3025 Part 2 (ICP Method)	0.001 – 10 mg/L
40	Poly Nuclear Aromatic Hydrocarbons (PAH)	GC Method	0.00001 – 10 mg/L
41	Polychlorinated biphenyl(PCB)	GC Method	0.00001 – 10 mg/L
42	Total coliform	IS 1622 (MPN Method)	2 -1600 MPN/100 mL
43	Faecal coliform	IS 1622 (MPN Method)	2 -1600 MPN/100 mL
44	E.Coli	IS 1622 (MPN Method)	2 -1600 MPN/100 mL

3.7.3 Surface Water Quality

The surface water quality data are presented in Table 3.18. The designated best use for surface water quality criteria as prescribed by CPCB is given in Table 3.19.

Table 3.18: Surface Water Quality Monitoring Results

S.No.	Parameters	Unit	SW1	SW2	SW3	SW4
1.	Temperature	°C	26.8	27	26.9	26.6
2.	pH	--	6.39	6.71	7.82	6.53
3.	Conductivity	µmohs/cm	535	346	708	385
4.	Salinity	ppt	0.11	0.04	0.18	0.05
5.	Total Suspended Solids	mg/L	6.1	7.4	2.4	9.2
6.	Total Dissolved Solids	mg/L	312	202	411	224
7.	Total Hardness as $CaCO_3$	mg/L	145	105	181	109
8.	Total Alkalinity as $CaCO_3$	mg/L	121	111	154	111
9.	Sodium	mg/L	30	9.0	48	11
10.	Potassium	mg/L	7.3	5.8	4.3	4.3
11.	Chloride as Cl	mg/L	61	22	99	27
12.	Sulphate as SO_4	mg/L	39	9.0	44	28
13.	Silica as SiO_2	mg/L	13	8.0	11	15
14.	Boron as B	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
15.	Phenol as C_6H_5OH	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
16.	Anoinic Detergents (MBAS)	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
17.	Free Residual Chlorine	mg/L	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
18.	Iron as Fe	mg/L	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)
19.	Nitrate as NO_3	mg/L	2.1	1.6	2.8	1.3
20.	Ammonical Nitrogen NH_3-N	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
21.	Total Kjeldal Nitrogen	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)

S.No.	Parameters	Unit	SW1	SW2	SW3	SW4
22.	Total Phosphate as PO_4	mg/L	1.53	0.09	0.03	0.44
23.	Fluoride as F	mg/L	0.46	0.51	0.73	0.26
24.	Dissolved Oxygen	mg/L	6.1	5.9	6.4	5.9
25.	COD	mg/L	18	22	8.0	20
26.	BOD	mg/L	3.1	4.0	BDL(DL:1.0)	4.0
27.	Oil & Grease	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
28.	Manganese as Mn	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
29.	Chromium as Cr^{6+}	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
30.	Copper as Cu	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
31.	Nickel as Ni	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
32.	Lead as Pb	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
33.	Arsenic as As	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
34.	Cadmium as Cd	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
35.	Selenium as Se	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
36.	Barium as Ba	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
37.	Silver as Ag	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
38.	Zinc as Zn	mg/L	1.68	2.01	1.75	1.2
39.	Mercury as Hg	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
40.	Poly Nuclear Aromatic Hydrocarbons (PAH)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)
41.	Polychlorinated biphenyl(PCB)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)
42.	Total Coliform	MPN/100 mL	3.7	6.8	<1.8	5.6
43.	Feacal Coliform	MPN/100 mL	1.8	4.5	<1.8	3.6
44.	E.Coli	MPN/100 mL	1.8	2.0	<1.8	1.8

Table 3.18: Surface Water Quality Monitoring Results (contd.)

S.No.	Parameters	Unit	SW5	SW6	SW7
1.	Temperature	°C	26.1	26.3	26.5
2.	pH	--	6.91	6.46	7.32
3.	Conductivity	µmohs/cm	1112	251	541
4.	Salinity	ppt	0.31	0.04	0.1
5.	Total Suspended Solids	mg/L	7.4	5.2	2.1
6.	Total Dissolved Solids	mg/L	660	150	316
7.	Total Hardness as $CaCO_3$	mg/L	278	54	153
8.	Total Alkalinity as $CaCO_3$	mg/L	234	71	150
9.	Sodium	mg/L	91	11	26
10.	Potassium	mg/L	8.1	1.5	4.9
11.	Chloride as Cl	mg/L	171	23	58
12.	Sulphate as SO_4	mg/L	54	17	21
13.	Silica as SiO_2	mg/L	17	9.0	12
14.	Boron as B	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
15.	Phenol as C_6H_5OH	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
16.	Anoinic Detergents (MBAS)	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
17.	Free Residual Chlorine	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
18.	Iron as Fe	mg/L	0.13	BDL(DL:0.08)	BDL(DL:0.08)
19.	Nitrate as NO_3	mg/L	3.1	1.4	2.1
20.	Ammonical Nitrogen NH_3-N	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
21.	Total Kjeldal Nitrogen	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
22.	Total Phosphate as PO_4	mg/L	0.58	0.71	0.3
23.	Fluoride as F	mg/L	0.48	0.29	0.52
24.	Dissolved Oxygen	mg/L	5.1	5.7	6.3
25.	COD	mg/L	32	8.0	4.0
26.	BOD	mg/L	7.0	BDL(DL:1.0)	BDL(DL:1.0)
27.	Oil & Grease	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
28.	Manganese as Mn	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
29.	Chromium as Cr^{6+}	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
30.	Copper as Cu	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
31.	Nickel as Ni	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)
32.	Lead as Pb	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
33.	Arsenic as As	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
34.	Cadmium as Cd	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
35.	Selenium as Se	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
36.	Barium as Ba	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
37.	Silver as Ag	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)

S.No.	Parameters	Unit	SW5	SW6	SW7
38.	Zinc as Zn	mg/L	1.06	0.98	1.19
39.	Mercury as Hg	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)
40.	Poly Nuclear Aromatic Hydrocarbons (PAH)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)
41.	Polychlorinated biphenyl(PCB)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)
42.	Total Coliform	MPN/100 mL	12	4	3.6
43.	Feacal Coliform	MPN/100 mL	6.8	2	1.8
44.	E.Coli	MPN/100 mL	4.0	1.8	1.8

Note: BDL - Below Detection Limit, DL - Detection Limit

Table 3.19: CPCB Designated best use Surface water criteria

Designated Best Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100mL shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/L or more Biochemical Oxygen Demand 5 days 20^0C 2mg/L or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100mL shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/L or more Biochemical Oxygen Demand 5 days 20^0C 3mg/L or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100mL shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/L or more Biochemical Oxygen Demand 5 days 20^0C 3mg/L or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/L or more

		Free Ammonia (as N) 1.2 mg/L or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25^0C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/L
	Below-E	Not Meeting A, B, C, D and E Criteria

(Source: CPCB: Water Quality Standards, https://cpcb.nic.in/wqstandards/,)

3.7.3 Results and Interpretation

The graphical representation of the surface water quality parameters pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Total Coliforms (TC) at locations SW1, SW2 and SW3 is shown in Figure 3.18.

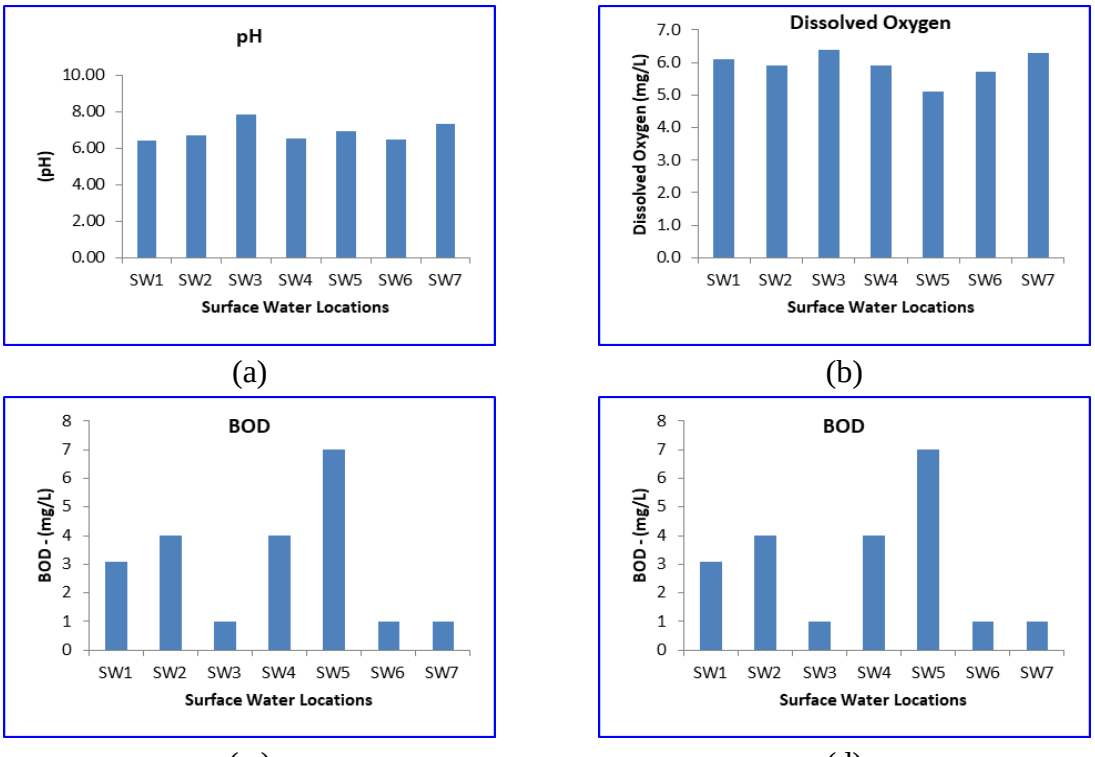


Figure 3.20: Graphical Representation of
(a) pH, (b) Dissolved Oxygen, (c) BOD, (d) Total Coliform at locations SW1, SW2, SW3

Temperature across all stations is consistent (approximately 26.1–27 °C), indicating stable thermal conditions.

The pH ranges from 6.39 to 7.82, suggesting that the water is mostly slightly acidic to neutral. SW3 (pH 7.82) is the only site approaching alkalinity.

Conductivity and Total Dissolved Solids (TDS) vary significantly across the sites, with the highest values observed at SW5. This suggests a higher ionic concentration and indicates potential pollution inputs and anthropogenic influence at this location.

At SW5, the highest conductivity (1112 µS/cm), elevated salinity (0.31 ppt), and TDS (660 mg/L) point to significant contamination. Elevated levels of nitrate (3.1 mg/L), phosphate (0.58 mg/L), chloride (171 mg/L), and hardness (278 mg/L) further support this. Chemical Oxygen Demand (COD) at 32 mg/L and Biological Oxygen Demand (BOD) at 7.0 mg/L indicate the presence of organic pollution and oxygen-demanding waste, likely from domestic or agricultural runoff.

SW4 and SW2 also show signs of moderate organic loading, as indicated by elevated COD and BOD levels.

Microbial contamination is evident from the presence of Total and Fecal Coliforms at all sites except SW3, pointing to possible sewage contamination.

Nutrient Profile and Eutrophication Risk: Phosphate levels are highest at location SW1 (1.53 mg/L), which could lead to on-going algae growth and water pollution (eutrophication). Nitrate levels are mostly below the safe limit of 45 mg/L set by the CPCB for drinking water, but locations SW5 and SW3 show slightly higher amounts compared to others. Ammoniacal nitrogen and Total Kjeldahl Nitrogen (TKN) levels are all below 1.0 mg/L, which means they are within safe and acceptable limits.

Metals and Other Inorganics: Zinc concentrations are highest at SW2 (2.01 mg/L) and SW3 (1.75 mg/L) but remain within tolerable limits. Other heavy metals were below detectable levels at all sampling locations. Fluoride levels are also below the acceptable limit of 1.5 mg/L, there is no immediate concern required. Silica and 171ulphate levels vary moderately but are within acceptable environmental thresholds.

Microbiological Quality: Total and Fecal Coliforms are present in all samples except SW3, which recorded <1.8 MPN/100 mL, indicating better microbial quality. E. coli was detected at all sites except SW3, again suggesting fecal contamination at most locations. SW5 exhibited the highest coliform counts, indicating significant microbial contamination and raising public health concerns, especially if the water is used for drinking or recreational purposes.

To conclude**, t**he collected surface water quality in the study area is generally good, except at SW5, which is the most polluted site based on almost all key indicators. The presence of organic matter, nutrients, and microbial contamination suggests notable anthropogenic influence at this location.

3.7.4 Groundwater Quality

The Groundwater quality data are presented in Table 3.20. The graphical representation of the ground water quality parameters is shown in Figure 3.19.

Table 3.20: Groundwater Quality Monitoring Results

S. No.	Parameters	Unit	GW1	GW2	GW3	GW4	IS 10500:2012	
							Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source
1	Turbidity	NTU	1.2	2.3	BDL(DL:1.0)	2.0	1	5
2	pH	--	7.36	6.73	7.51	7.03	6.5 -8.5	No relaxation
3	Conductivity	µmohs/ cm	1569	2451	809	424	--	--
4	Salinity	ppt	0.21	0.69	0.11	0.03	--	--
5	Total Dissolved Solids	mg/L	970	1530	495	270	500	2000
6	Total hardness as $CaCO_3$	mg/L	577	661	274	181	200	600
7	Alkalinity as $CaCO_3$	mg/L	545	372	238	141	200	600
8	Sodium	mg/L	63	221	24	8.0	--	--
9	Potassium	mg/L	1.6	4.1	2.6	2.7	--	--
10	Chloride as Cl	mg/L	115	379	58	16	250	1000
11	Sulphate as SO_4	mg/L	28	199	50	13	200	400
12	Nitrate as NO_3	mg/L	1.2	3.5	2.3	1.8	45	No relaxation
13	Total Phosphate as PO_4	mg/L	0.17	0.22	0.27	0.26	--	--
14	Fluorides as F	mg/L	1.12	0.36	0.44	BDL(DL:0.1)	1.0	1.5
15	Silica as SiO_2	mg/L	21	29	18	11	--	--
16	Free Residual Chlorine	mg/L	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	0.2	1.0
17	Boron as B	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.5	1.0
18	Phenol as C_6H_5OH	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.001	0.002
19	Iron as Fe	mg/L	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	1.0	No relaxation
20	Dissolved Oxygen	mg/L	5.5	5.7	5.6	5.9	--	--
21	COD	mg/L	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	--	--
22	BOD	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	--	--
23	Manganese as Mn	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.1	0.3
24	Chromium as Cr^{+6}	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.05	No relaxation
25	Copper	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.05	1.5
26	Nickel	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.02	No relaxation

S. No.	Parameters	Unit	GW1	GW2	GW3	GW4	IS 10500:2012	
							Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source
27.	Lead as Pb	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	No relaxation
28.	Arsenic as As	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	0.05
29.	Cadmium as Cd	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.003	No relaxation
30.	Selenium as Se	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	No relaxation
31.	Barium as Ba	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.7	No relaxation
32.	Silver as Ag	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.1	No relaxation
33.	Zinc as Zn	mg/L	1.23	1.39	1.21	2.08	5.0	15
34.	Mercury as Hg	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.001	No relaxation
35.	Poly Nuclear Aromatic Hydrocarbons (PAH)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	0.0001	No relaxation
36.	Polychlorinated biphenyl(PCB)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	0.0005	No relaxation
37	Total coliform	MPN/100mL	Absent	Absent	Absent	Absent	Absent	Absent
38	E. Coli	MPN/100mL	Absent	Absent	Absent	Absent	Absent	Absent

Note: BDL - Below Detection Limit, DL - Detection Limit.

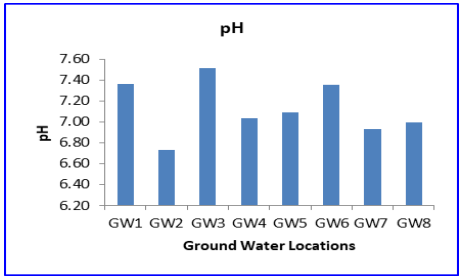
Table 3.20: Groundwater Quality Monitoring Results (contd.)

S. No.	Parameters	Unit	GW5	GW6	GW7	GW8	IS 10500:2012	
							Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source
1	Turbidity	NTU	2.0	BDL(DL:1.0)	BDL(DL:1.0)	2.1	1	5
2	pH	--	7.09	7.35	6.93	6.99	6.5 -8.5	No relaxation
3	Conductivity	µmohs/ cm	1128	453	2488	655	--	--
4	Salinity	ppt	0.16	0.04	0.73	0.07	--	--
5	Total Dissolved Solids	mg/L	716	270	1594	383	500	2000
6	Total hardness as $CaCO_3$	mg/L	456	149	750	202	200	600

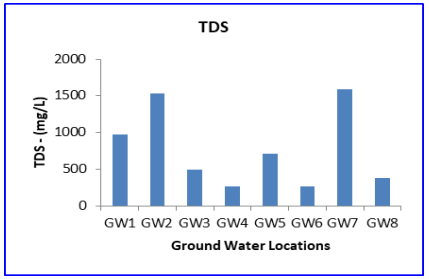
S. No.	Parameters	Unit	GW5	GW6	GW7	GW8	IS 10500:2012	
							Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source
7	Alkalinity as $CaCO_3$	mg/L	303	154	424	218	200	600
8	Sodium	mg/L	45	10	214	19	--	--
9	Potassium	mg/L	1.5	2.3	1.9	3.4	--	--
10	Chloride as Cl	mg/L	91	21	405	40	250	1000
11	Sulphate as SO_4	mg/L	53	23	169	25	200	400
12	Nitrate as NO_3	mg/L	2.7	2.1	3.5	1.6	45	No relaxation
13	Total Phosphate as PO_4	mg/L	0.13	0.18	0.13	0.53	--	--
14	Fluorides as F	mg/L	0.3	0.1	0.23	0.34	1.0	1.5
15	Silica as SiO_2	mg/L	15	9.0	13	10	--	--
16	Free Residual Chlorine	mg/L	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	0.2	1.0
17	Boron as B	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.5	1.0
18	Phenol as C_6H_5OH	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.001	0.002
19	Iron as Fe	mg/L	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	1.0	No relaxation
20	Dissolved Oxygen	mg/L	5.1	5.6	5.4	5.4	--	--
21	COD	mg/L	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	--	--
22	BOD	mg/L	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	--	--
23	Manganese as Mn	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.1	0.3
24	Chromium as Cr^{+6}	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.05	No relaxation
25	Copper	mg/L	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	0.05	1.5
26	Nickel	mg/L	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	0.02	No relaxation
27.	Lead as Pb	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	No relaxation
28.	Arsenic as As	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	0.05
29.	Cadmium as Cd	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.003	No relaxation
30.	Selenium as Se	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.01	No relaxation
31.	Barium as Ba	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.7	No relaxation
32.	Silver as Ag	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.1	No relaxation
33.	Zinc as Zn	mg/L	1.24	1.45	2.1	1.86	5.0	15

S. No.	Parameters	Unit	GW5	GW6	GW7	GW8	IS 10500:2012	
							Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source
34.	Mercury as Hg	mg/L	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	0.001	No relaxation
35.	Poly Nuclear Aromatic Hydrocarbons (PAH)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	0.0001	No relaxation
36.	Polychlorinated biphenyl(PCB)	mg/L	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	BDL(DL:0.00001)	0.0005	No relaxation
37	Total coliform	MPN/100mL	Absent	Absent	Absent	Absent	Absent	Absent
38	E. Coli	MPN/100mL	Absent	Absent	Absent	Absent	Absent	Absent

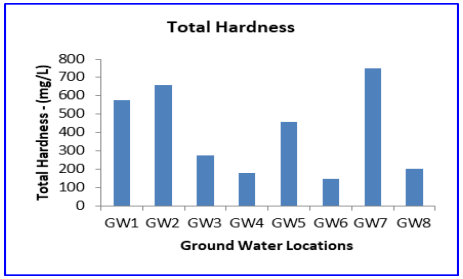
Note: BDL - Below Detection Limit, DL - Detection Limit.



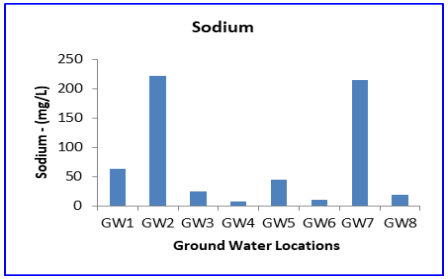
(a)



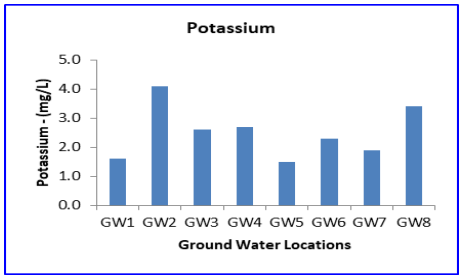
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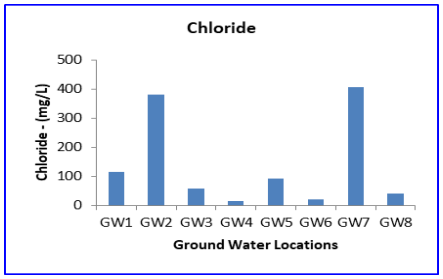
(c)



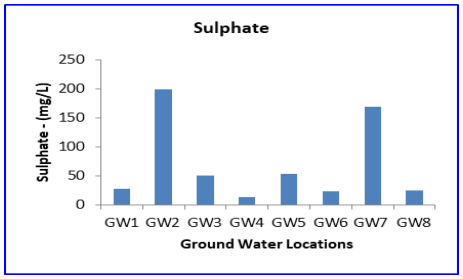
(d)



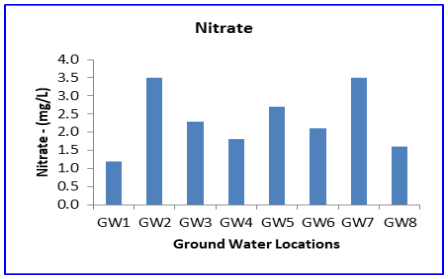
(e)



(f)



(g)



(h)

Figure 3.21 Graphical representation of groundwater quality parameters: (a) pH, (b) TDS, (c) Total hardness (d) Sodium (e) Potassium (f) Chloride (g) Sulphate (h) Nitrate

3.7.5 Results and Interpretation

Based on the groundwater sampling study, Total Dissolved Solids (TDS) levels at all locations are within the acceptable limit of 500 mg/L, except at sampling locations GW2 (1530 mg/L) and GW7 (1594 mg/L). While these two locations exceed the acceptable limit, they remain within the permissible limit of 2000 mg/L. Anion and cation concentrations exceed the acceptable limit of 200 mg/L at all locations but are within the permissible limit of 600 mg/L - except for GW7, which recorded a value of 750 mg/L, thus exceeding the permissible limit. This suggests that water from GW7 may not be suitable for drinking without treatment. All samples recorded pH levels within the acceptable range of 6.5–8.5.

Turbidity levels at GW2 and GW4 slightly exceed the acceptable limit of 1 NTU but are still within the permissible limit of 5 NTU. Dissolved Oxygen (DO) levels, ranging from approximately 5.1 to 5.9 mg/L, are considered good and suggest minimal organic pollution.
Heavy metals like Arsenic, Cadmium, Lead, Selenium, Silver, Zinc, Chromium, Copper, Iron, Nickel and Mercury are below detection limits in all locations, indicating no contamination from industrial sources. Fluoride, Nitrate, PAH, PCB, and Microbiological parameters (Total and Faecal Coliforms) are within safe limits across all locations indicating no immediate risk of contamination from sewage or agricultural runoff.

Overall, Groundwater samples from GW2 and GW7 show elevated levels of hardness ions, salinity, silica, potassium, phosphate, sodium, chloride, and sulphate. These contribute to the high TDS levels observed at these locations. As a result, water from GW2 and GW7 may not be ideal for direct consumption and may require appropriate treatment prior to use.

3.8 SOIL

The study of the soil environment aims to assess the physico-chemical characteristics of the soil within the project site and surrounding study area. This includes the evaluation of soil texture, fertility status, organic content, nutrient levels and potential contamination. The objective of the baseline study is to determine the suitability of the soil for construction, landscaping and vegetation and also to assess the potential impact of the project activities on soil quality.

3.8.1 Soil Quality – Monitoring Locations

Representative soil samples were collected from eight locations from different land use patterns including the project site. The sampling locations are indicated in Figure 3.20 and the geographical coordinates are provided in Table 3.21.

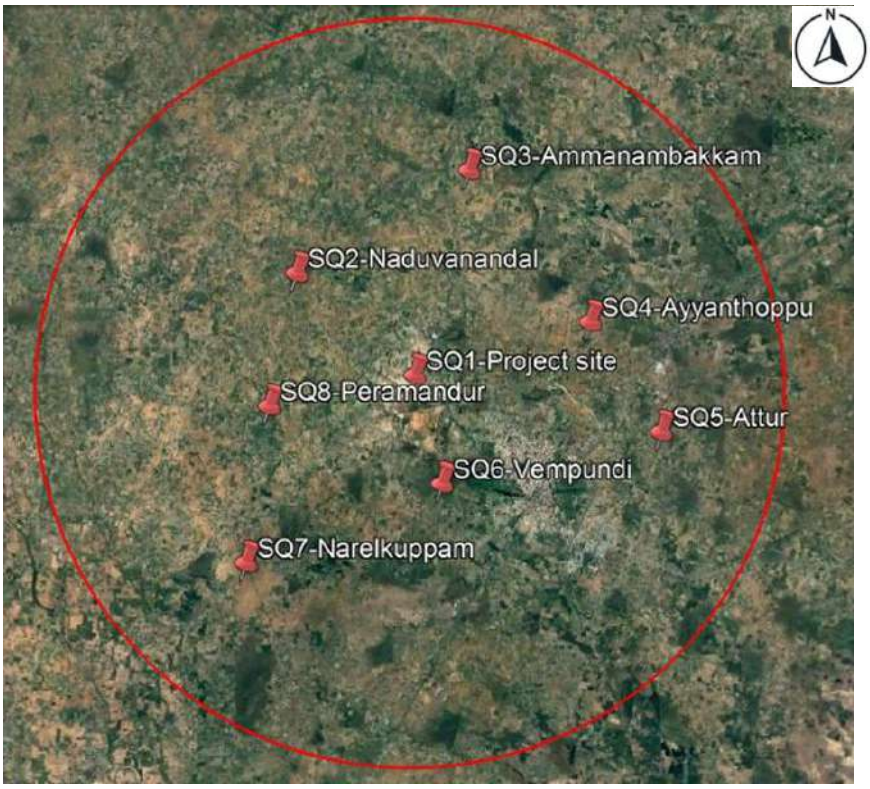


Figure 3.22: Soil Sampling Locations

Imagery source: Google Earth (2024)

[Online] Available at: http://www.google.com/earth/index.html [Accessed January 2025]

Table 3.21: Details of Soil Quality Monitoring Locations

Location Code	Name of the Location	Direction from Project Site	Distance from Project Site (km)	Latitude; Longitude
SQ 1	Project Site	-	-	12°253657"N 79°619021"E
SQ 2	Naduvanandal	NW	4.2	12°285903"N 79°580766"E
SQ 3	Ammanambakkam	NNE	5.7	12°303549"N 79°634028"E
SQ 4	Ayyanthoppu	NE	5.0	12°26741"N 79°658147"E
SQ 5	Attur	SE	6.9	12°234846"N 79°678802"E
SQ 6	Vempundi	SSE	2.8	12°225699"N 79°627929"E
SQ 7	Nareikuppam	SW	6.7	12°207975"N 79°576891"E
SQ 8	Peramandur	WSW	3.9	12°247911"N 79°584018"E

3.8.2 Sampling Procedure and Analysis

Augur method was used to collect samples at a depth of 30 cm after removing the surface litter. After mixing each spot-sample, about 1 kg of soil was retained after the process of quartering. This sample was air dried at room temperature and stored in a polythene bag with a label. Photographs taken during the soil sampling are presented in Figure 3.21. Samples were analyzed as per the analytical methods listed in Table 3.22.





Figure 3.23. Soil Sampling

Table 3.22: Analytical Methods for Soil Parameters

S.No.	Parameter Tested	Standard method or Technique Used	Range of Testing
1	Soil Texture (particle size analysis)	ESIPL/SOP/C-S/04	Sand- 1- 80% Silt - 1- 80% Clay -1- 80%
2	Permeability	ESIPL/SOP/C-S/18	0.2 – 5.0 cm/hr
3	pH@ 25^0 C	IS 2720:Part 26	2-12
4	Electrical Conductivity	IS 14767	1-10000 µmhos/cm
5	Cation Exchange Capacity (CEC)	ESIPL/SOP/C-S/10	2-100 meq/100 g
6	Water Soluble Sodium	ESIPL/SOP/C-S/07	10 -1000 mg/kg
7	Phosphorous as P (Available)	ESIPL/SOP/C-S/11	1-100 µg/g
8	Potassium as K (Soluble)	FAO method	1-250 mg/kg
9	Calcium as Ca	FAO method	0.1 meq/100g – 200 meq/100g
10	Magnesium as Mn	FAO method	0.1 meq/100g – 150 meq/100g
11	Organic Nitrogen	IS 14684	2 mg/kg – 5000 mg/kg
12	Organic Carbon	IS 2720 : Part 22	0.01% - 10%
13	Bulk Density	FAO method	0.5g/cm^3 – 2g/cm^3
14	Porosity	FAO method	Qualitative

15	SAR	ESIPL/SOP/C-S/01	Qualitative
16	Lead as Pb	USEPA 3050 B	0.02 – 100000 mg/kg
17	Manganese as Mn	USEPA 3050 B	0.02 – 100000 mg/kg
18	Iron as Fe	USEPA 3050 B	0.02 – 100000 mg/kg
19	Nickel as Ni	USEPA 3050 B	0.02 – 100000 mg/kg
20	Copper as Cu	USEPA 3050 B	0.02 – 100000 mg/kg
21	Barium as Ba	USEPA 3050 B	0.02 – 100000 mg/kg
22	Zinc as Zn	USEPA 3050 B	0.02 – 100000 mg/kg
23	Chromium as Cr^{6+}	USEPA 3050 B	0.02 – 100000 mg/kg
24	Cadmium as Cd	USEPA 3050 B	0.02 – 100000 mg/kg
25	Mercury as Hg	USEPA 3050 B	0.02 – 100000 mg/kg

3.8.3 Soil Quality – Results

The physical and chemical properties of soil are given in Table 3.23.

3.8.4 Soil Results and Interpretation

Soil Texture and Composition: The soil texture in the study area ranges from clay loam and clay to loam. Clay content is moderately high (22.2%–44.6%), which typically indicates moderate water retention capacity. Sample SQ7 has the highest clay content (44.6%), suggesting lower permeability. The sandiest sample is SQ8 (43.7%), which is expected to have better drainage.

Grain Size Distribution (≤75-micron fraction): The proportion of fine particles is highest in SQ7 (55.8%) and lowest in SQ1 (15.5%). A high content of fines can reduce soil permeability, indicating that infiltration rates may vary significantly across different samples due to mixed particle distribution.

Soil pH: Across the study area is within acceptable limits, ranging from slightly acidic to neutral. Samples SQ3 (6.14) and SQ6 (6.08) are on the more acidic side, while SQ4 shows a slightly alkaline pH (7.49). Overall, no pH-related concerns are apparent for plant growth.

Electrical Conductivity (EC): All EC values are well below the non-saline threshold of 4.0 dS/m, ranging from 0.054 to 0.166 dS/m. These low values confirm that the soils are non-saline and suitable for agriculture, with no salinity-related restrictions for plant growth.

Table 3.23: Soil Quality in different locations of the study area

S. No.	Parameters	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8	Standards*
1	pH@ 25°C	--	6.83	7.05	6.14	7.49	6.75	6.08	6.35	7.22	5 – 8
2	Electrical Conductivity @ 25°C	dS/cm	0.067	0.117	0.054	0.166	0.092	0.062	0.080	0.102	<4.0
3	Soil Texture	--	Loam	Clay Loam	Clay Loam	Clay	Clay Loam	Clay Loam	Clay	Loam	--
	Clay	%	37.8	31.9	41.9	35.6	35.6	33.5	44.6	22.2	--
	Silt	%	32.1	30	27.8	30	30.0	25.0	27.6	34.0	--
	Sand	%	30.1	38.1	30.3	34.4	34.4	41.5	27.8	43.7	--
4	Grain Size Analysis in %										
	2 mm	%	32.7	6.9	17.3	7.9	12.4	22.4	4.8	23.6	--
	425 micron	%	51.8	45.8	42.8	39.7	42.8	35.7	39.4	48.6	--
	≤75 micron	%	15.5	47.3	39.9	52.4	44.5	41.9	55.8	27.8	--
5	Phosphorous as P	mg/kg	29	36	47	62	38	24	45	21	10 – 30
6	Total Nitrogen as N	mg/kg	468	546	424	582	488	414	462	444	--
7	Sodium as Na (Soluble)	mg/kg	15	17	11	39	20	13	15	18	200 – 500
8	Potassium as K (Soluble)	mg/kg	5.0	6.5	4.6	19	6.3	3.2	4.9	4.6	150 – 250
9	Calcium as Ca	mg/kg	5.3	8.6	4.9	20	8.3	3.4	6.9	6.5	1000 – 2000
10	Magnesium as Mg	mg/kg	2.1	5.1	2.9	9.3	4.0	2.0	3.1	2.9	100 – 300
11	Organic Carbon	%	0.31	0.43	0.24	0.48	0.34	0.23	0.3	0.27	0.5 – 0.75
12	Permeability	cm/hr	2.8	4.2	2.9	3.4	3.4	3.8	2.3	4.6	--
13	Porosity	%	39.4	48.2	41.5	42.3	42.4	46.7	38.7	49.0	--

S. No.	Parameters	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8	Standards*
14	Bulk Density	g/cm^3	1.18	1.22	1.28	1.17	1.32	1.14	1.12	1.25	1 – 1.7
15	SAR	meq/kg	3.8	3.5	3.6	5.7	4.8	4.2	3.9	5.1	<10
16	Lead as Pb	mg/kg	0.13	0.18	0.08	0.15	0.13	0.19	0.06	0.15	--
17	Manganese as Mn	%	0.09	0.07	0.12	0.11	0.15	0.18	0.13	0.20	1.2 – 3.5
18	Iron as Fe	%	1.8	2.1	2.0	1.8	1.8	1.6	2.3	1.9	4 – 6
19	Nickel as Ni	mg/kg	0.05	0.08	0.06	0.1	0.07	0.08	0.03	0.10	--
20	Copper as Cu	mg/kg	0.23	0.16	0.29	0.21	0.19	0.28	0.21	0.18	0.3 – 0.8%
21	Barium as Ba	mg/kg	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	--
22	Zinc as Zn	mg/kg	21.6	18.9	22.3	20.5	18.1	22.1	17.4	18.6	1 – 3%
23	Chromium as Cr^{6+}	mg/kg	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	150
24	Cadmium as Cd	mg/kg	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	--
25	Mercury as Hg	mg/kg	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	BDL (DL:0.02)	--

Standards Reference:

1. Assessment of Soil Health and Preparation of Soil Health Card ICAR-Indian Institute of Soil Science Nabi Bagh, Berasia Road, Bhopal -462038 (M.P.)

2. Methods of analysis for soils of arid and semi-arid regions, Food and Agriculture Organization of the United Nations Rome, 2007.

Soil Nutrients:

- **Phosphorus:** According to the standard range (10–30 mg/kg), all samples except SQ8 exceed the recommended levels. Notably, SQ4 has the highest phosphorus content (62 mg/kg).
- **Nitrogen:** Nitrogen levels range from 414–582 mg/kg, which is typical for mineral soils. The highest concentration is in SQ4 (582 mg/kg), indicating good nitrogen availability across all samples.
- **Potassium:** All samples are significantly below the standard potassium range (150–250 mg/kg), with values between 3.2–19 mg/kg. This potassium deficiency could severely limit plant growth and productivity.
- **Calcium and Magnesium:** Calcium levels (3.4–20 mg/kg) are far below the standard range (1000–2000 mg/kg), with SQ4 showing the highest (yet still inadequate) level at 20 mg/kg. Magnesium levels are also very low (2.0–9.3 mg/kg) compared to the standard (100–300 mg/kg). These deficiencies can negatively impact soil structure, plant health, and metabolic functions such as chlorophyll production and enzyme activity.

Organic Carbon: All samples fall below the standard organic carbon content (0.5–0.75%), ranging from 0.23% to 0.48%.

Sodium Adsorption Ratio (SAR): SAR values are all below the critical threshold of 10, indicating no sodicity issues and confirming the soils are safe for agricultural use.

Heavy Metals and Micronutrients: Heavy metals are within safe limits. However, levels of key micronutrients—iron (1.6%–2.3%) and manganese (0.07%–0.20%) is very low. Overall, the soils are moderately textured and generally suitable for crop production. However, phosphorus levels are high in several samples, which may increase the risk of nutrient runoff or leaching and indicate potential over-fertilization. Micronutrient deficiencies, particularly in iron and manganese, could affect plant health and may require corrective measures. Additionally, low organic matter content reduces nutrient and water retention, weakens soil structure, and contributes to overall nutrient deficiencies. The nitrogen, phosphorus, and potassium (N-P-K) ratio is imbalanced across the sampling locations. Incorporating organic matter could improve soil structure, enhance fertility, and help correct nutrient imbalances in the study area.

3.9 BIOLOGICAL ENVIRONMENT

The biodiversity assessment of the study area aims to evaluate the variety of species and their ecological roles, highlighting the importance of conservation.

The objectives of the study were:

- Identification of flora and fauna and their biodiversity within the study area
- Preparation of checklist of species which also includes endangered, endemic and protected species
- Evaluation of impact of the proposed project on flora and fauna of the area.
- The methodology of the study included

- Identification of the study area including the project site and a 10 km buffer zone for ecological assessment.
- Field surveys and site visits to document flora, fauna and other biodiversity components.
- Collection of secondary data from forest departments, published literature, IUCN Red List and biodiversity databases.
- Assessment of potential impacts on biodiversity and suggestion of suitable mitigation and conservation measures.

3.9.1 Assessment of Flora and Fauna

3.9.1.1 Description about the Study Area

Core Zone: The core zone comprises the proposed project site and the immediate surroundings (2 km radius). A primary ecological survey was carried out on the March xx and xx, 2024. The project site is situated 400 mts alongside the Thindivanam to Gingee Road, all the adjacent sites are barren with connecting roads and very little agricultural activity. No vegetation cover was observed except for a few trees with lower growth

Buffer Zone: The terrain of the area is plain with few undulating spots, with mixed scrub vegetation, sparse along the roadside, ponds, and along the villages. The adjacent areas are surrounded by agricultural fields that are actively cultivated, primarily under rain-fed and limited irrigation systems. No major forest or vegetation was noticed during the survey; the entire area is characterized by isolated scrub vegetation and trees, which represent the Tropical dry evergreen forest type. It is chiefly characterized by Acacias and Prosopis community representing the Umbrella thorn forest.

3.9.1.2 Methodology

I. FLORA

Field investigations were conducted between **8:00 AM and 5:00 PM**, adopting the standard methodologies proposed by **Chaturvedi and Khanna (1982)**.

- **Sampling** was done using the **quadrat method**. (**25 m × 25 m quadrats** for trees and shrubs.**2 m × 2 m quadrats** for herbs)
- **Taxonomic identification** followed the **Bentham and Hooker classification** supported by regional floral references including:
  - Gamble's *"Flora of the Madras Presidency"*
  - Matthew's *"Flora of the Tamil Nadu Carnatic"*
- The **distribution pattern** was interpreted using **Raunkiaer's Law of Frequency (1934)**, revealing community structure and dispersion.

The instruments used in the primary survey/study included Field Guides, Compass, Binoculars, Hand Lenses and Magnification tools, Tape measures, Rope 50 mts, Head Lamps and Iron rods.

II. Fauna

Both direct and indirect observation methods were used to survey the fauna. Visual encounter (search) method was employed to record vertebrate species. Additionally, survey of relevant literature was also done to consolidate the list of vertebrate fauna distributed in the area (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988). Since birds may be considered indicators for monitoring and understanding human impacts on ecological systems (Lawton 1996), an attempt was made to gather quantitative data on the group.

- **Point Survey Method:** Observations were made in each site for 15 minutes duration.
- **Road Side Counts:** The observer traveled by motor vehicles from site to site, all sightings were recorded (this was done both in the day and night time). An index of abundance of each species was also established.
- **Pellet and Track Counts:** All possible animal tracks and pellets were identified and recorded (South Wood, 1978). Based on the Wildlife Protection Act, 1972 (WPA 1972, Anonyomous. 1991, Upadhyay 1995, Chaturvedi and Chaturvedi 1996) species were short-listed as Schedule II or I and considered herein as endangered species. Species listed in Ghosh (1994) are considered as Indian Red List species.

3.9.1.3 Floral Species in Core and Buffer Zone

The study area supports sparse and degraded vegetation, mostly comprising scattered grass species, hardy shrubs, and a few isolated trees such as Prosopis juliflora, Acacia nilotica, and Calotropis gigantea. At a distance of approximately 2 kilometers from the proposed site, agricultural fields are actively cultivated, primarily under rain-fed and limited irrigation systems. The main crops grown include sugarcane, groundnut, rice, ragi (finger millet), and seasonal vegetables such as tomato, brinjal, and okra. In some areas, farmers have also established timber plantations, with eucalyptus and casuarina being the most commonly planted species due to their fast growth and commercial value. These surrounding agricultural zones reflect the transitional land use in the region, shifting from traditional farming practices to increasing interest in non-agricultural and industrial development. The list of flora observed in core and buffer zone based on the primary survey and secondary data is provided in Table 3.24.

Table 3.24: Flora identified in the Study Area

S. No	Species	Vernacular name	Habit	IUCN
Core Zone				
1	*Alloteropsis cimicina* (L.) Stapf		Grass	NE
2	*Aristida setacea* Trin.	Thudappam	Grass	NE
3	*Asparagus racemosus* Willd.	Thaneer vittan killangu	Climber	NE
4	*Azadirachta indica* Juss	Vembu	Tree	LC
5	*Boerhavia diffusa* L.	Mookkirati	Herb	NE

6	*Butea monosperma* (Lam.)Taub.	Murukkan Maram	Tree	LC
7	*Cadaba fruticosa* (L.) Druce	Narivilzhi	Shrub	NE
8	*Calotropis gigantea* (L) W.T.Aiton	Yerukku	Shrub	LC
9	*Caralluma umbellata* Roxb.	Kallimulaiyaam	Herb	NE
10	*Chloris barbata* Sw.	Chevvarakupul, Kodai Pullu	Grass	NE
11	*Cissus quadrangularis* L.	Perandai	Climber	LC
12	*Cleome felina* L. f.	Cuvarnaciri Taivelai	Herb	NE
13	*Cleome viscosa* L.	Kattu katuku	Herb	NE
14	*Croton bonplandianus* Baill.	Railpondu,	Herb	NE
15	*Cynodon dactylon* (L.) Pers.	Arugambul	Grass	NE
16	*Cyperus rotundus* L.	Korai	Grass	LC
18	*Evolvulus alsinoides* L.	Vishnukarandi	Herb	NE
19	*Flueggea leucopyrus* Willd.	Pullathi	Shrub	LC
21	*Hybanthus enneaspermus* Jacq	Orithazh Thamarai	Herb	EN
22	*Indigofera linnaei* Ali	Sheppunerunji	Herb	NE
24	*Phoenix sylvestris* (L.) Roxb.	Inthupaanai	Tree	LC
25	*Portulaca oleracea* L	Paruppu keerai	Herb	LC
26	*Prosopis juliflora* (Sw.) DC	Vaelikaruvai	Tree	NE
27	*Rivea hypocrateriformis* (Desr.) Choisy	Musuttai Kodi	Climber	LC
29	*Solanum virginianum* L.	Kantankattari	Herb	NE
30	*Toddalia asiatica* (L.) Lam.	Milakaranai	Shrub	NE
32	*Tribulus terrestris* L	Nerinjil	Herb	NE
33	*Tridax procumbens* L.	Vettukkaya puntu	Herb	NE
Buffer Zone				
1	*Abrus precatorius* L	Gundu Mani	Climber	NE
2	*Acacia leucophloea* (Roxb.) Willd.	Velvelam	Tree	NE
3	*Acacia nilotica* (L.) Delile	Karuvelam	Tree	LC
4	*Acalypha indica* L.	Kuppaimeni	Herb	NE
5	*Aerva lanata* (L.) Juss. ex Schult.	Poolai Poo	Herb	NE
6	*Albizia amara* (Roxb.)B.Boivin	Usilai	Tree	LC
7	*Albizia lebbeck* (L.)Benth.	Vaagai	Tree	LC
9	*Alternanthera ficoidea* (L.) P. Beauv.	Semmai Ponnanganni	Herb	NE
10	*Alternanthera sessilis* (L.) R. Br. ex DC.	Ponnangani	Herb	LC
12	*Anisochilus carnosus* (L.f.) Wall.	Karppuravalli	Herb	NE
13	*Anisomeles malabarica* (L.) R.Br. ex Sims	Peyimarutti	Shrub	NE
14	*Arachis hypogaea* L.	verkkadalai	Herb	NE
17	*Aristida setacea* Trin.	Thudappam	Grass	NE
18	*Artocarpus heterophyllus* Lam.	Palaamaram	Tree	NE

19	*Arundo donax* L.	Mudam pul	Grass	LC
20	*Asparagus racemosus* Willd.	Thaneer vittan killangu	Climber	NE
21	*Azadirachta indica* Juss	Vembu	Tree	LC
22	*Bambusa vulgaris* Schrad.	Moongil	Grass	NE
23	*Benkara malabarica* (Lam.) Tirveng.	Sirukarai	Tree	NE
24	*Boerhavia diffusa* L.	Mookkirati	Herb	NE
25	*Borassus fabellifer* L.	Panai maram	Tree	LC
27	*Butea monosperma* (Lam.)Taub.	Murukkan Maram	Tree	LC
28	*Calotropis gigantea* (L) W.T.Aiton	Yerukku	Shrub	LC
29	*Canna indica* L.	Kalvazhai	Herb	NE
31	*Caralluma umbellata* Roxb.	Kallimulaiyaam	Herb	NE
33	*Casuarina equisetifolia* L.	Savukku	Tree	LC
34	*Catunaregam spinosa* (Thunb.) Tirveng.	Matukkarai	Shrub	NE
36	*Chloris barbata* Sw.	Chevvarakupul, Kodai Pullu	Grass	NE
38	*Chrysopogon zizanioides* (L.) Roberty	Vettiver	Grass	NE
39	*Cissus quadrangularis* L.	Perandai	Climber	LC
40	*Cleome felina* L. f.	Cuvarnaciri Taivelai	Herb	NE
41	*Cleome gynandra* L	Nallavelai	Herb	NE
42	*Cleome viscosa* L.	Kattu katuku	Herb	NE
43	*Coccinia grandia* (L.) Voigt	Kovakai	Climber	NE
44	*Cocos nucifera* L.	Thenna Maram	Tree	NE
45	*Coldenia procumbens* L.	Seruppadai	Herb	NE
47	*Cordia obliqua* Willd.	Narruvizhi	Tree	NE
49	*Croton bonplandianus* Baill.	Railpondu,	Herb	NE
50	*Cyanotis axillaris (L.) D.Don ex Sweet*	Vazhukai Pul	Herb	NE
51	*Cyanthillium cinereum* (L.) H.Rob.	Puvamkuruntal	Herb	NE
52	*Cymbopogon flexuosus* (Steud.) Watson	Inchipullu	Grass	NE
54	*Cynodon dactylon* (L.) Pers.	Arugambul	Grass	NE
58	*Cyperus esculentus* L	Kunnai	Grass	LC
60	*Cyperus rotundus* L.	Korai	Grass	LC
62	*Dactyloctenium aegyptium* (L.) Willd.	Mutankali	Grass	NE
64	*Dalbergia sissoo* Sensu Miq.	Thothakatti	Tree	LC
65	*Datura metel* L.	Oomatthai	Herb	NE
67	*Dregea volubilis* (L. f.) Benth	Ankara - valli	Tree	NE
70	*Eleusine coracana* (L.) Gaertn.	Ragipullu	Grass	NE

71	*Eleusine indica (*L.) Gaertn.	Kezvarazhu pillu	Grass	LC
73	*Eucalyptus tereticornis* Sm.	Thaila maram	Tree	LC
74	*Euphorbia hirta* L	Amman Pacharisi	Herb	NE
75	*Euphorbia indica* Lam.	Chinna Ammanpacharisi	Herb	NE
76	*Evolvulus alsinoides* L.	Vishnukarandi	Herb	NE
77	*Ficus benghalensis* L	Aalamaram	Tree	LC
78	*Ficus benjamina* L.	Nintamaravakai	Tree	LC
79	*Ficus racemosa* L.	Atthi	Tree	LC
80	*Ficus religiosa* L.	Arasamaram	Tree	LC
81	*Flueggea leucopyrus* Willd.	Pullathi	Shrub	LC
82	*Gmelina asiatica* L.	Sirukumalaan	Shrub	LC
83	*Gomphrena serrata* L.	Vellai vadamalli	Herb	NE
84	*Grewia hirsuta* Vahl	Kalunnu	Shrub	LC
85	*Heliotropium indicum* L.	Thel kodukku	Herb	NE
87	*Hemidesmus indicus* (L.) R.Br	Nannari	Climber	NE
90	*Hibiscus tiliaceus* L.	Nir Paratthi	Tree	LC
91	*Hybanthus enneaspermus* Jacq	Orithazh Thamarai	Herb	EN
92	*Hyptis suaveolens (*L.) Poit.	Neer thulsi	Shrub	NE
94	*Indigofera linnaei* Ali	Sheppunerunji	Herb	NE
95	*Indigofera tinctoria* L.	Avuri	Herb	NE
96	*Ipomoea carnea* Jacq	Neyveli kaatamanakku	Shrub	NE
98	Jasminum auriculatum Vahl	Uccimalligai	Shrub	NE
99	*Jasminum sambac* (L.) Aiton	Gundu Malli	Shrub	NE
100	*Jatropha gossypifolia* L.	Siria Amanakku	Shrub	NE
101	*Lannea coromandelica* (Houtt.) Merr.	Oti	Tree	NE
102	*Lantana camara* L.	Arasimala	Shrub	LC
103	*Limonia acidissima* L.	Vilamphazam	Tree	NE
104	*Lycopersicon esculentum* Mill.	Thakkaali	Herb	NE
105	*Madhuca longifolia*	Illupai	Tree	LC
106	*Mangifera indica* L	Maamaram	Tree	DD
109	*Morinda pubescens* Sm.	Nuna,Manchanari	Tree	LC
110	*Mukia maderaspatana* (L.) M. Roem.	Mosumosukkai	Climber	LC
111	*Muntingia calabura* L.	Teen Pazham	Tree	NE
112	*Ocimum sanctum* L.	Tulasi	Shrub	NE
113	*Ocimum tenuiflorum* L.	Nalla Thulasi	Herb	NE
114	*Oldenlandia corymbosa* L.	Imbural	Herb	NE
116	*Opuntia stricta* (Haw.) Haw.	Chappathi kalli	Shrub	LC
118	*Oryza sativa* L.	Arishi, Nellu	Grass	LC
120	*Parthenium hysterophorus* L.	Carrot pundu	Shrub	NE
122	*Passiflora foetida* L.	Mosukkattan	Climber	NE
125	*Phoenix pusilla* Gaertn.	Echam	Shrub	NE

126	*Phoenix sylvestris* (L.) Roxb.	Inthupaanai	Tree	LC
127	*Phyla nodiflora* (L.) Greene	Podutalei	Herb	NE
128	*Phyllanthus emblica* L	Kattu-nelli	Tree	LC
129	*Phyllanthus maderaspatensis* L.	Nila-nelli	Herb	LC
130	*Phyllanthus niruri* L.	Kizhanelli	Herb	LC
132	*Pithecellobium dulce (*Roxb.)Benth.	Kodukkapuli	Tree	LC
133	*Polyalthia longifolia* (Sonn.) Thwaites	Asogam	Tree	NE
134	*Pongamia pinnata* (L.)Pierre	Ponga Maram	Tree	LC
135	*Portulaca oleracea* L	Paruppu keerai	Herb	LC
136	*Portulaca tuberosa* Roxb	Mukkulikkirai	Herb	NE
137	*Prosopis juliflora* (Sw.) DC	Vaelikaruvai	Tree	NE
139	*Ricinus communis* L.	Amanakku	Shrub	NE
140	*Rivea hypocrateriformis* (Desr.) Choisy	Musuttai Kodi	Climber	LC
141	*Ruellia tuberosa* L.	Tapasukai	Herb	NE
142	*Saccharum officinarum* L.	Karumbu	Grass	NE
143	*Samanea saman* (Jacq.)Merr.	Thoongumoonji maram	Tree	NE
145	*Scoparia dulcis* L.	Sakarai vaembu	Herb	LC
146	*Sesamum indicum* L.	Ellu	Herb	NE
149	*Sida acuta* Burm. f.	Karuncaranai	Herb	NE
150	*Sida cordata* (Burm. f.) Borss. Waalk.	Kurunthotti	Herb	NE
151	*Solanum melongena* L.	Kathirikai	Herb	NE
152	*Solanum nigrum* L	Manattakkali,Milagetakkali	Shrub	NE
153	*Solanum trilobatum* L	Tuthuvalai.	Herb	NE
154	*Solanum xanthocarpum* Schrad.	Kandanghathiri	Herb	NE
155	*Striga asiatica* (L.) Kuntze	Kollaippalli	Herb	LC
157	*Syzygium cumini* (L.) Skeels	Naval	Tree	NE
158	*Tamarindus indica* L.	Puliyamaram	Tree	LC
159	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Tharani	Tree	LC
160	*Tectona grandis* L.f.	Thaekku	Tree	EN
161	*Tephrosia purpurea* (L.)Pers.	Kattukozhinji	Herb	LC
162	*Terminalia arjuna* (Roxb.) Wight & Arn	Marudha Maram	Tree	NE
163	*Terminalia bellirica* (Gaertn.) Roxb.	Tooth brush tree	Tree	LC
164	*Terminalia catappa* L.	Naattu vadumai	Tree	LC
165	*Thespesia populnea* (L.) Soland. ex Correa	Puvarasu	Tree	NE
166	*Toddalia asiatica* (L.) Lam.	Milakaranai	Shrub	NE
168	*Tribulus terrestris* L	Nerinjil	Herb	NE

169	*Tridax procumbens* L.	Vettukkaya puntu	Herb	NE
170	*Typha angustifolia* L.	Sambu	Herb	NE
171	*Urena lobata* L.	OttAtthi	Shrub	LC
174	*Wrightia tinctoria* R. Br	Veppalai	Tree	LC
176	Zea mays L.	Makka cholam	Grass	NE
177	*Ziziphus oenoplia* (L.) Miller	Chooraimullu	Tree	LC
LC – Least Concerned; DD – Data Deficient; EN – Endangered; NT – Near Threatened				

Figure 3.22 and Figure 3.23 shows the flora observed in the study area and the photographs taken during the survey, respectively



Acacia nilotica



Aerva lanata



Asparagus racemosus



Mutingia calabura



Evolvulus alsinoides



Phyllanthus maderaspatensis



Canna indica



Ipomea carnea



Indigofera aspalathoides



Tephrosia purpurea



Wrightia tinctoria



Polyalthis longifolia



Riccinus communis



Rhychnosia minima



Mukia maderaspatensis

Figure 3.24: Photographs of Flora observed in the study area

3.9.1.4 List of Faunal Species in Core and Buffer Zone

In the study area the due to poor soil fertility and the absence of water bodies, faunal diversity is limited, with occasional sightings of common reptiles, rodents, and a few avian species such as the Indian myna and house sparrow. The fauna within the core and buffer zones of the study area was documented and the details are summarized in Table 3.25. Field surveys of birds and butterflies were conducted from 8 am to 12 pm and 4 pm to 5 pm. Opportunistic surveys were employed for reptiles and amphibians. Birds and butterflies were surveyed using point counts and transect walks. Reptiles and Mammals were surveyed using visual encounter surveys systematically searching various habitats in the study area. The species were categorized into invertebrates, amphibians, reptiles, birds, and mammals based on field observations.

Table 3.25: Fauna identified in the Study Area

S. No	Scientific Name	Local Name	Conservation Status
Amphibians and Reptiles			
1	*Rana hexadactyla*#*	Frog	LC
2	*Rana tigrina*	Bull frog	LC
3	*Lepus nigricollis*	Hare	LC
4	*Funabulus palmarum**	Squirrel	LC
5	*Rattus norvegicus**	Field mouse	LC
6	*Herpestes edwardii*#*	Common mongoose	LC
7	*Bandicota indica*	Bandicoot	LC
8	*Rtyas mucosus**	Rat snake	LC
9	*Dendrelaphis tristis#*	Bronzeback tree snake	LC
10	*Calotes versicolor**	Garden lizard	LC
Butterflies			
1	*Danaus genutia*	Striped Tiger	LC
2	*Danaus chrysippus chrysippus**	Plain Tiger	LC
3	*Euploea core*#*	Common Crow	LC
4	*Acraea terpsicore**	Tawny Coster	LC
5	*Melanitis leda leda*	Common Evening Brown	LC
6	*Jamides celeno celeno*	Common Cerulean	LC
7	*Everes lacturnus#*	Indian Cupid	LC
8	*Papilio polytes polytes*	Common Mormon	LC
9	*Papilio polytes romulus **	Common Mormon	LC
10	*Pachliopta aristolochiae*	Common Rose	LC
11	*Papilio demoleus demoleus*	*Lime Butterfly*	LC
12	*Hypolimnas misippus*	Danaid Eggfly	LC
13	*Junonia almanac**	Peacock Pansy	LC
14	*Junonia hierta*	Yellow Pansy	LC

15	*Junonia lemonias#*	Lemon Pansy	LC
16	*Hypolimnas bolina*	Great Egg Fly	
17	*Hypolimnas misippus*	Danaid Eggfly	LC
18	*Phalanta phalantha*	Common Leopard	LC
19	*Zizula hylax*	Tiny Grass Blue	LC
20	*Catochrysops Strabo*	Forget-Me-Not	LC
18	*Euchrysops cnejus#*	Gram Blue	LC
19	*Lampides boeticus#*	Pea Blue	LC
Birds			
1	*Bubulcus ibis**	Cattle Egret	LC
2	*Accipiter badius*	Shikra	LC
3	*Columba livia*	Blue Rock Pigeon	LC
4	*Streptopelia chinensis#*	Spotted Dove	LC
5	*Halcyon smyrnensis*	White-breasted Kingfisher	LC
6	*Merops orientalis*	Small Bee-eater	LC
7	*Pycnonotus cafer#*	Red-vented Bulbul	LC
8	*Saxicoloides fulicata*	Indian Robin	LC
9	*Coracias benghalensis*	Indian Roller	LC
10	*Upupa epops*#*	Common Hoopoe	LC
11	*Dinopium javanense*	Common Golden-backed Woodpecker	LC
12	*Anthus rufulus#**	Paddyfield Pipit	LC
13	*Turdoides caudatus*	Common Babbler	LC
14	*Nectarinia minima*	Small Sunbird	LC
15	*Acridotheres tristis*	Common Myna	LC
16	*Vanellus indicus*	Red-wattled Lapwing	
17	*Dicrurus macrocercus*	Black Drongo	LC
18	*Lonchura punctulata**	Spotted Munia	LC
19	*Dendrocitta vagabunda*	Indian Treepie	LC
20	*Corvus splendens*	House Crow	LC

 # Species observed at Project Site

**** Species observed at Gangaikondan Wildlife Sanctuary during the field visit***

LC – Least Concerned: DD – Data Deficient

EN – Endangered; NT – Near Threatened

Figure 3.24 shows the fauna observed in the study area



Calotes versicolor



Vanellus indicus



Aegithina tiphia



Spilopelia chinensis



Trumala limniae



Popilio polytes

Figure 3.25: Photographs of Fauna observed in the study area

3.9.1.5 Summary of Flora and Faunal Assessment

The results of the biodiversity study indicate that the vegetation cover and associated fauna within and around the project site are very sparse and highly fragmented. The site lacks forest cover or dense vegetation, and no major ground vegetation patches or ecologically sensitive zones are located within or nearby. The nearest village is situated more than 2 km away from the site. No perennial water body or major wetland exists within or along the project area; however, temporary wetlands may appear during the monsoon and post-monsoon seasons. The existing floral diversity also does not indicate the presence of any permanent wetland ecosystem on the site.

Based on these observations, the project is unlikely to cause any significant, irreversible, or diverse ecological impacts. The proposed activities will involve construction and operational phases, and the potential biodiversity impacts are expected to be localized and insignificant.

Out of the 177 floral species identified, the majority are classified as Not Evaluated or Least Concern. The very low density and sparse distribution of vegetation are expected to further minimize potential impacts. Additionally, as there are no economically significant species present, no adverse effects on the livelihood of the local community are anticipated. Overall, the predicted impacts are site-specific, primarily associated with the construction phase, and are expected to be short-term in nature.

3.10 SOCIO ECONOMIC AND HEALTH ENVIRONMENT

Socio-Economic Impact Assessment (SEIA) is done to evaluate the potential socio-economic effects of the proposed project on the local livelihoods, aiming to minimize impacts and enhance positive outcomes.

3.10.1 Objectives of the Socio Economic Study

- To assess the socio-economic impacts of the proposed project on local communities.
- To evaluate changes in livelihoods, access to resources and quality of life.
- To recommend strategies for minimizing impacts and enhancing positive outcomes for sustainable development.

3.10.2 Study Methodology

- Identification the study area around the project site
- Assessment of Socio-Economic Profile of the study area through secondary (Literature survey) and primary (Field visit) data.
- Collection of Primary data through Socio Economic Survey conducted with the stakeholders (household, local body, focused group etc., Commercial Establishments etc.).
- Validation of Secondary data with Primary data
- Interpretation of Socio-Economic study
- Identification of Socio-economic impacts due to project
- Suggestion of Mitigation measures

3.10.3. Description of Study area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius that spreads in 317 Sq.km. A total of 88 villages fall within the radial distance of 10km at Pelakuppam Village, Tindivanam Taluk, Viluppuram District. The list of villages within radial distance of 10 Km from the project site is provided in Figure 3.25.

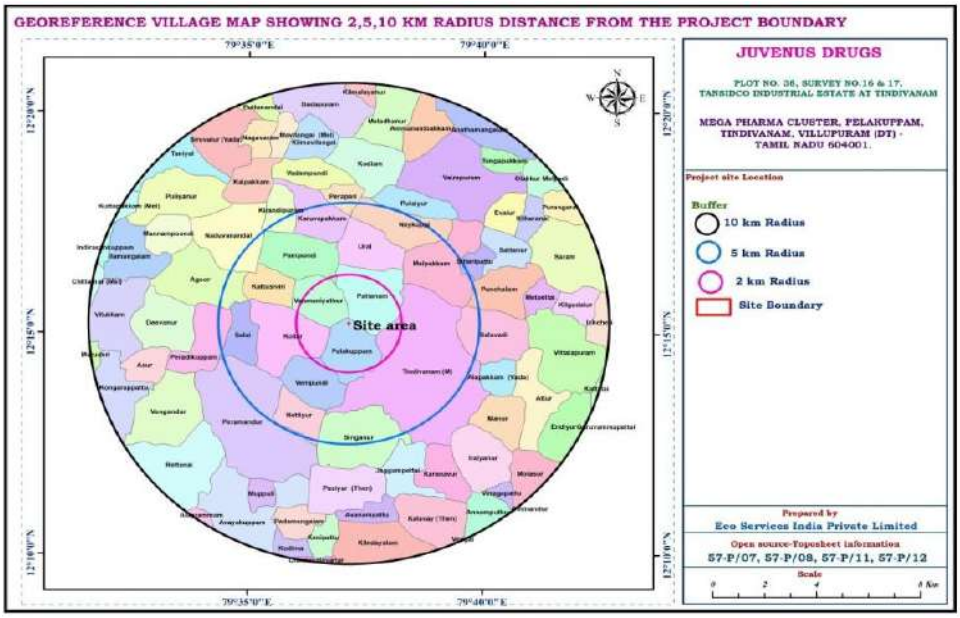


Figure 3.26: Village Map of the Study Area

3.10.4 Demographic Profile

The summary of demographic data based on district census, 2011 on household, population, density, sex ratio and literacy is presented in below table 3.26.

The significant demographic features of the areas are:

- Total population of the region as per 2011 census is 2,26,561 out of which are 1,13,402 male and 1,13,159 are female.
- Total number of households in the region about 53,919
- Sex ratio (number of male per thousand female) in the region is 998 this shows that male population is higher in the region as compared to the female population but ratio from other state good.
- Out of the total population Scheduled Caste and Scheduled Tribe population is about 29.05 % and 1.37% respectively.
- Total main worker population is about 36.08%, 9.65% comes under marginal worker category and 54.27 % belongs to non-workers category
- Literacy rate of the population in the study area is about 77.40%.

3.10.5 Population Projection

Regression is a statistical method used to determine the relationship between two or more variables. The **Simple Linear Regression (SLR)** model is predictive in nature and examines the relationship between a dependent variable (Y) and an independent variable (X), establishing a linear correlation between them.

(Source: https://online.stat.psu.edu/stat462/node/93/)

The following formula was used for population projection:

Y = a + bt

Where,

Y = Dependent variable (Population)
a = Intercept
b = Slope
t = Independent variable (Time)

This formula was applied to project the population for the years **2021, 2031, 2041, and 2051**. To minimize manual calculation errors, the statistical software **SPSS (Version 26)** was used to compute the intercept and slope. Due to limited population data, the results show similar growth values for the projected years. If more historical data were available, the projections would be more accurate. *Reference:* As per the **Indian Economic Survey**, the **Simple Linear Regression (SLR)** technique is used by the Statistical Department, Government of India, for population projections *(Source: https://www.ibm.com/in-en/analytics/spss-statistics-software)*

Population projection is an estimation of the number of people expected to be alive at a future date, based on assumptions about population structure, fertility, mortality, and migration. It is essential for assessing the future need for jobs, schools, healthcare, housing, food, clothing, energy, and other resources. It also supports policymakers in understanding existing challenges and developing effective solutions. Table 3.26 and 3.27 illustrates the population and population projection in the study area, respectively. Figure 3.26 shows the graphical representation of the curve fit of population.

Table 3.26: Population in Study Area

Population in 2001	Population in 2011
2,08,873	2,26,561

Source: *https://censusindia.gov.in/census.website/*

Table 3.27: Population Projection of Study Area

S.No.	Year	Projected Population (Estimated)
1.	2021	2,44,249
2.	2031	2,61,937
3.	2041	2,79,625
4.	2051	2,97,313

Source: SPSS V26 using SLR model.

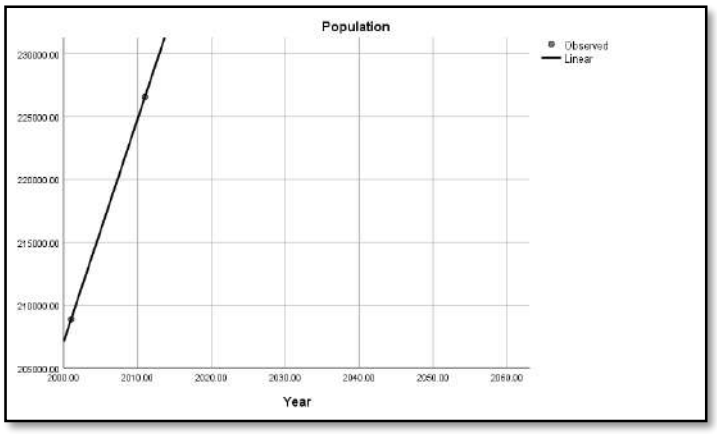


Figure 3.27 Curve fit of Population

3.10.6 Impact zone

It has been observed that the social impacts of an industrial project are generally more significant in villages or habitations located close to the project site than in those situated farther away. Accordingly, the impact area has been divided into three zones: Core Impact Zone: up to 2 km from the project site, Buffer Zone: 2–5 km and Transition (Tertiary) Zone: beyond 5 km and up to 10 km. Out of the total 88 villages and habitations within the overall project impact area, 4 fall in the Core Impact Zone, 11 in the Buffer Zone, and 73 in the Tertiary Zone. In terms of population distribution, approximately 4% reside in the Core Zone, 40% in the Buffer Zone, and 56% in the Tertiary Zone. Therefore, a conscious effort has been made by the study team to cover a greater number of villages in the Core and Buffer Zones during the socio-economic survey. Table 3.28 provides the overall demographic structure of the study area. Table 3.29 and Figure 3.27 shows the zone wise demographic profile of the study area

Table 3.28: Demographic Structure of the Study Area

Sl.No	Village Name	Household	Population			SC Population	ST Population	Literacy	Main workers	Marginal Workers	Non workers
			Total	Male	Female						
0-2 km											
1	Pattanam	721	2896	1457	1439	758	141	1770	1043	446	1407
2	Palakuppam	376	1610	809	801	1325	0	1202	348	312	950
3	Venmaniyathur	271	1350	691	659	401	0	874	856	96	398
4	Kollar	655	2802	1385	1417	1551	5	1957	1120	259	1423
	Total	2023	8658	4342	4316	4035	146	5803	3367	1113	4178
2-5 km											
5	Karuvapakkam	273	1059	539	520	239	6	766	536	48	475
6	Ural	621	2578	1288	1290	198	3	1653	1045	519	1014
7	Kattusiviri	409	1775	861	914	129	33	1182	732	166	877
8	Pampundi	277	1206	615	591	422	0	842	753	107	346
9	Salai	289	1241	637	604	547	0	886	702	11	528
10	Vempundi	426	1843	960	883	1221	0	1018	892	17	934
11	Singanur	731	3255	1572	1683	2496	0	2424	560	1057	1638
12	Nettiyur	283	1323	666	657	590	0	907	639	9	675
13	Tindivanam (M)	17088	72796	36338	36458	12078	354	56920	21273	3142	48381
14	Melpakkam	416	1652	828	824	870	13	1009	752	112	788
15	Neykuppi	275	1077	539	538	1070	0	633	532	4	541
	Total	21088	89805	44843	44962	19860	409	68240	28416	5192	56197
5- 10 km											
16	Puttanandal	686	2716	1386	1330	37	218	1946	803	302	1611
17	Dadapuram	661	2723	1330	1393	798	0	1726	930	391	1402
18	Kilmalayanur	146	571	276	295	119	199	306	373	0	198
19	Meladhanur	236	910	454	456	506	0	551	280	189	441
20	Ammanambakkam	106	391	201	190	222	0	248	240	26	125
21	Vairapuram	547	2161	1091	1070	1011	108	1166	845	42	1274

22	Tengapakkam	42	159	80	79	62	0	62	92	11	56
23	Olakkur Melpadi	898	3849	1933	1916	19	1	2534	1671	53	2125
24	Saram	855	3390	1688	1702	2189	54	2489	949	683	1758
25	Purangarai	228	1006	502	504	571	6	759	215	268	523
26	Kilkaranai	142	567	296	271	435	0	355	295	50	222
27	Evalur	191	832	424	408	345	0	600	447	0	385
28	Sattanur	115	482	246	236	213	0	286	131	82	269
29	Sitteripattu	152	659	329	330	202	0	412	148	252	259
30	Pulaiyur	160	711	354	357	266	0	481	358	76	277
31	Kodiam	370	1460	722	738	330	0	988	476	324	660
32	Kilmavilangai	264	1000	500	500	94	0	696	222	291	487
33	Mavilangai (Mel)	152	638	327	311	156	8	431	310	2	326
34	Nagavaram	156	649	315	334	649	0	386	386	1	262
35	Siruvalur (Vada)	346	1305	645	660	387	88	826	648	24	633
36	Taniyal	233	1013	494	519	688	67	761	525	47	441
37	Puliyanur	441	1872	904	968	888	58	1188	901	33	938
38	Kalpakkam	102	391	199	192	148	0	316	243	1	147
39	Kirandipuram	263	1138	574	564	453	101	711	593	10	535
40	Vadampundi	330	1379	692	687	468	52	814	705	8	666
41	Perapari	75	273	139	134	157	0	185	120	0	153
42	Salavadi	598	2467	1218	1249	319	129	1477	1004	7	1456
43	Panchalam	273	1072	500	572	581	0	693	540	27	505
44	Melpettai	205	827	400	427	541	0	647	407	23	397
45	Vittalapuram	449	1985	1013	972	1140	9	1368	1049	80	856
46	Endiyur	773	3103	1556	1547	0	0	2092	1186	350	1567
47	Attur	360	1473	746	727	602	17	892	608	71	794
48	Alapakkam (Vada)	297	1282	677	605	278	0	836	492	5	785
49	Naduvanandal	613	2412	1236	1176	436	59	1576	746	444	1222
50	Mannampoondi	94	386	198	188	83	15	251	101	93	192
51	Ilamangalam	248	1063	541	522	160	25	738	377	296	390

52	Vilukkam	710	2799	1412	1387	1274	41	2090	1066	552	1181
53	Deevanur	462	2065	1014	1051	952	7	1296	789	321	955
54	Agoor	522	2156	1086	1070	743	132	1302	885	431	840
55	Peradikuppam	337	1404	699	705	350	0	902	715	20	669
56	Manur	1513	6290	3114	3176	1806	5	4775	2061	381	3848
57	Molasur	639	2798	1412	1386	1637	0	1691	1087	246	1465
58	Manoor	886	3550	1793	1757	625	91	2181	2144	27	1379
59	Ommandur	615	2594	1308	1286	932	49	1461	690	575	1329
60	Annamputhur	324	1480	769	711	903	0	1000	708	47	725
61	Varagapattu	105	406	201	205	0	246	213	31	175	200
62	Iraiyanur	907	3869	1919	1950	1192	1	2763	1244	365	2260
63	Karanavur	282	1165	585	580	540	184	693	584	123	458
64	Jaggampettai	328	1411	703	708	911	0	977	682	61	668
65	Peramandur	1079	4635	2288	2347	1844	59	2791	1589	595	2451
66	Asur	408	1716	860	856	650	0	1000	75	956	685
67	Vengandur	944	3893	1938	1955	995	0	2185	985	1050	1858
68	Rettanai	1907	7816	3969	3847	923	221	5000	4044	529	3243
69	Avayakuppam	689	2814	1446	1368	490	0	1651	733	962	1119
70	Muppuli	177	783	377	406	0	28	605	537	7	239
71	Kodima	227	956	473	483	0	0	588	342	115	499
72	Padamangalam	147	664	327	337	510	0	453	241	84	339
73	Kenipattu	184	723	350	373	188	0	486	433	18	272
74	Pasiyar (Then)	382	1749	881	868	702	0	1117	812	52	885
75	Avanampattu	177	703	387	316	417	0	450	192	205	306
76	Kalavay (Then)	427	1748	895	853	661	0	1108	402	294	1052
77	Vengai	264	1346	673	673	1212	0	822	507	4	835
78	Kiledayalam	762	3455	1762	1693	1915	20	2288	1221	647	1587
79	Chinnavalavanur	81	424	197	227	422	0	274	124	96	204
80	Indirasankuppam	105	461	225	236	94	14	321	312	5	144
81	Chittamur (Mel)	571	2252	1126	1126	18	26	1472	504	474	1274

82	Maruderi	120	518	250	268	206	0	323	283	24	211
83	Kongarappattu	610	2590	1296	1294	607	18	1625	959	522	1109
84	Kuttapakkam (Mel)	71	280	143	137	150	0	177	201	6	73
85	Kilgudalur	231	879	427	452	519	0	512	401	71	407
86	Ichcheri	192	780	409	371	183	0	482	493	11	276
87	Kattalai	365	1453	723	730	3	0	747	629	99	725
88	Alagrammam	1251	5158	2594	2564	1786	197	2972	1836	853	2469
Total		**30,808**	**1,28,098**	**64,217**	**63,881**	**41,913**	**2,553**	**82,586**	**49,957**	**15,565**	**62,576**
G.Total		**53,919**	**22,6561**	**1,13,402**	**1,13,159**	**65,808**	**3,108**	**1,56,629**	**81,740**	**21,870**	**1,22,951**

Table 3.29: Zone Wise Demographic Profile of Study Area

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 2 km)	4	2,023	8,658	4,342	50.15	4,316	49.85
Secondary Zone (2 - 5 km)	11	21,088	89,805	44,843	49.93	44,962	50.07
Tertiary Zone (5 - 10 km)	73	30,808	1,28,098	64,217	50.13	63,881	49.87
Study Area (0-10 km)	88	53,919	2,26,561	1,13,402	50.05	1,13,159	49.95

Source: Census of India, 2011

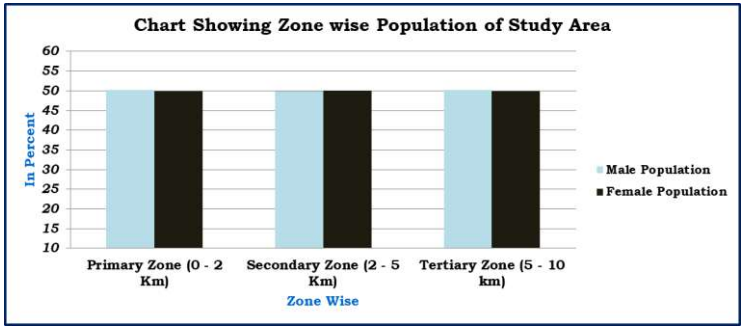


Figure 3.28: Zone wise Population of study area

3.10.7 Population Growth Rate

A positive growth rate indicates an increase in population, while a negative growth rate signifies a decrease. A growth rate of zero means the population size remained the same at the beginning and end of the period. However, a zero growth rate can still occur even when there are significant changes in birth rates, death rates, immigration, or age distribution during that time.

Calculating Percent (Straight-Line) Growth Rates

The percent change from one period to another is calculated from the formula:

$$PR = \frac{(VPresent - VPast)}{\frac{VPast}{N} \times 100}$$

Where, PR=Percent Rate

VPresent = Present or Future Value

VPast = Past or Present Value

The annual percentage growth rate is simply the percent growth divided by N, the number of years. Table 3.30 shows the population growth rate of the study area since 2001. Source https://pages.uoregon.edu/rgp/PPPM613/class8a.html. Figure 3.28 shows the graphical representation of the population growth rate.

Table 3.30: Population Growth Rate in Study Area

Year	Actual Population	Growth Rate
2001	2,08,873	-
2011	2,26,561	10.85
2021	2,44,249	10.78
2031	2,61,937	10.72
2041	2,79,625	10.68
2051	2,97,313	10.63

Source: SPSS v26 and MS-Excel software

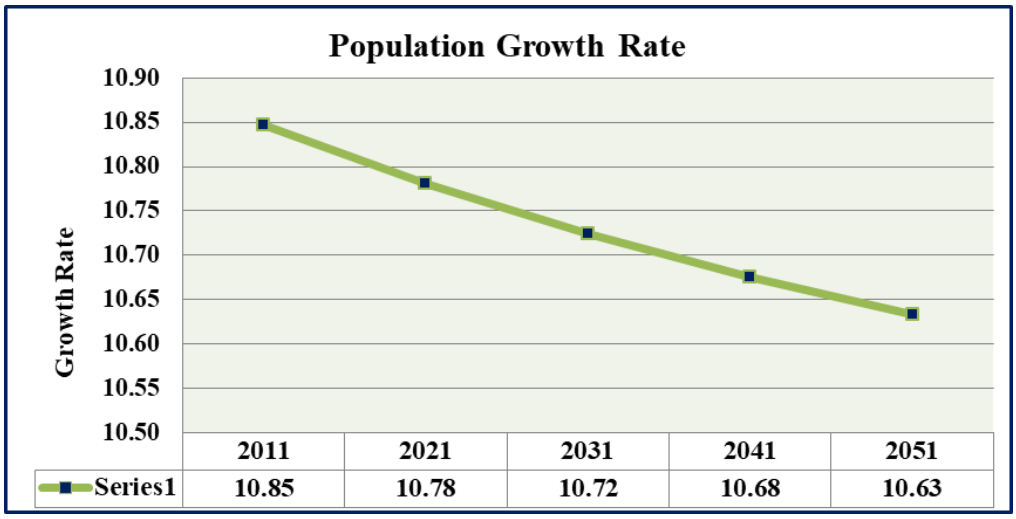


Figure 3.29 Graphical representation of Population Growth Rate

As per the Census, the population was **2,08,873** in 2001 and **2,26,561** in 2011, indicating a growth rate of **10.85%**. The projected population is approximately **2,44,249** in 2021 and **2,97,313** in 2051. The population growth rate is expected to gradually decline to around **10.63%** by 2051. Source: (https://statisticstimes.com/demographics/india/tamil-nadu-population.php)

3.10.8 Gender and Sex Ratio

The sex ratio (Figure 3.29) represents the number of females per 1,000 males and serves as an important indicator of gender balance and social development. As per Census 2011, India's sex ratio is 940**,** while the study area shows a healthier ratio of 998 females per 1,000 males**,** reflecting better gender parity across the primary, secondary, and tertiary zones The sex ratio of the study area is provided in Table 3.31.

Table 3.31: Sex Ratio of the Study Area

S.No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	994
2	Secondary zone (3-7 km)	1003
3	Tertiary Zone (7-10 km)	995
Total Study area		**998**

Source: Census of India, 2011

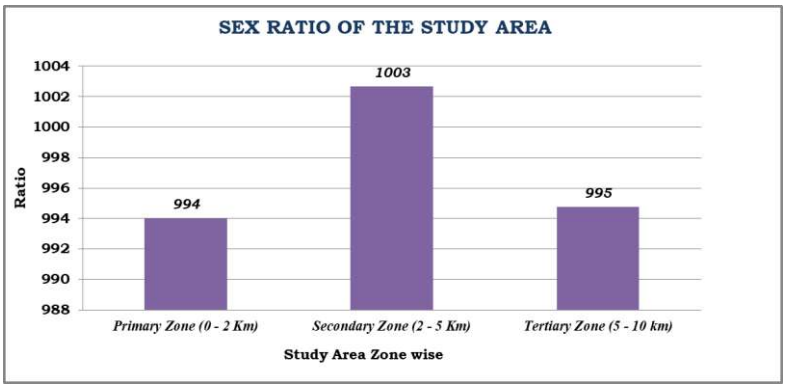


Figure 3.30: Sex Ratio within 10 Km study area

3.10.9 Child Sex Ratio

The child sex ratio (Table 3.32 and Figure 3.30) represents the number of girls per 1,000 boys in the 0–6 year age group. The study area records a child sex ratio of 962 females per 1,000 males**.**

Table 3.32: Child Sex Ratio of the Study Area

S. No.	Buffer Zone	Child Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	943
2	Secondary zone (3-7 km)	949
3	Tertiary Zone (7-10 km)	971
4	Study area	962

Source: Census of India, 2011

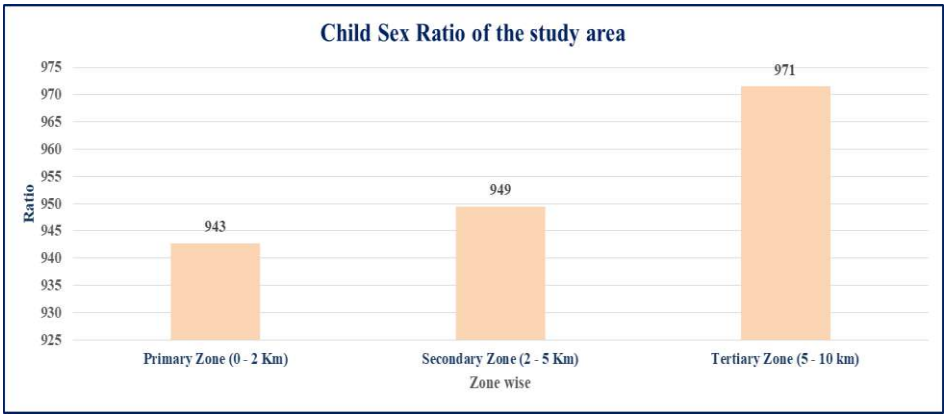


Figure 3.31 Child Sex Ratio within 10 Km study area

3.10.10 Literacy Rate

Literacy Rate (Table 3.33 and Figure 3.31) is the percentage of people in a country with the ability to read and write. The **literacy rate** within the 10 km study area is **77.40%** (Census 2011), with **male literacy at 85.19%** and **female literacy at 69.64%**, highlighting the need for focused efforts to improve educational access and promote gender equality in learning.

Table 3.33: Literacy Rate of the Study Area

Zone	No. of Villages	Male Literacy	Male Literacy	Female Literacy	Female Literacy	Total Literacy	Total Literacy
Primary Zone (0 - 2 Km)	4	3259	83.82	2544	65.43	5803	74.63
Secondary Zone (2 - 5 Km)	11	36237	90.74	32003	79.41	68240	85.05
Tertiary Zone (5 - 10 km)	73	46593	81.40	35993	63.04	82586	72.23
Study Area (0-10km)	88	86089	85.19	70540	69.64	156629	77.40

Source: Census of India, 2011

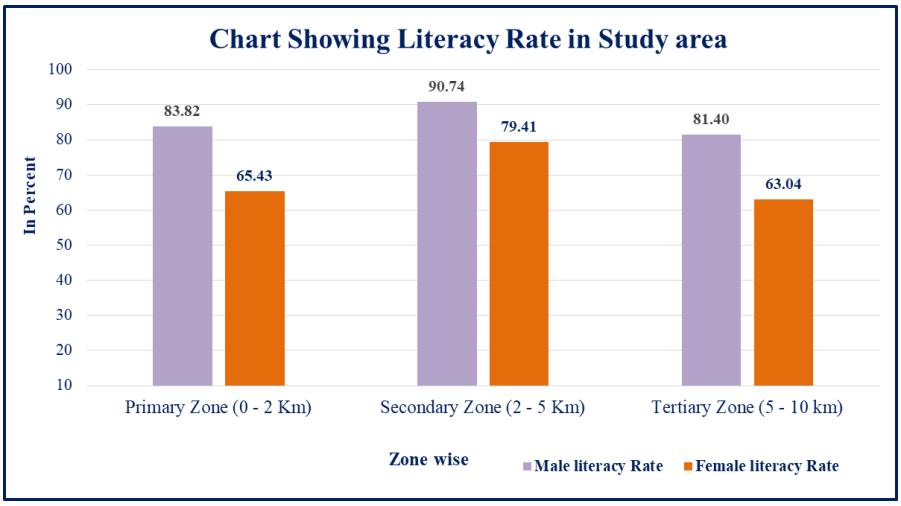


Figure 3.32 Literacy Rate in the study area

3.10.11 Vulnerable Groups

In developing an action plan, it is essential to prioritize marginalized and vulnerable groups**.** Within the study area, Scheduled Castes constitute 29%**,** Scheduled Tribes 1.37%**,** and other populations 69.58%**,** highlighting the need for special focus and targeted development measures**.** Table 3.34 and Figure 3.32 shows the vulnerable groups of the study area.

Table 3.34: Vulnerable Groups of the Study Area

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 2 Km)	4	4035	46.60	146	1.69	4477	51.71
Secondary Zone (2 - 5 Km)	11	19860	22.11	409	0.46	69536	77.43
Tertiary Zone (5 - 10 km)	73	41913	32.72	2553	1.99	83632	65.29
Study Area (0-10km)	88	65808	29.05	3108	1.37	157645	69.58

Source: Census of India, 2011

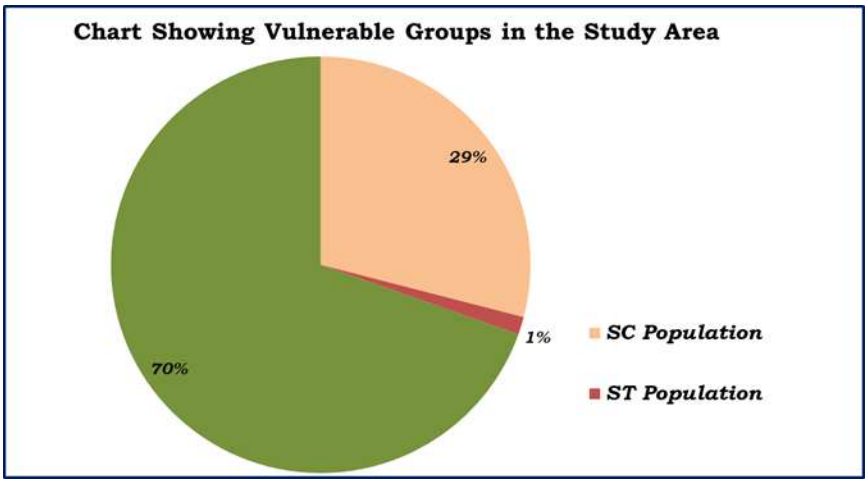


Figure 3.33: Vulnerable groups

3.10.12 Economic Activities

The economy of an area is determined by the occupational pattern and income levels of its people. In the study area, the occupational structure is categorized into total workers, main workers, and non-workers. Main workers include cultivators, agricultural laborers, household industry workers, and service providers, while non-workers comprise individuals engaged in unpaid household duties, students, dependents, retirees, and others not involved in economic activitie. Table 3.35 and Figure 3.33 illustrate the workforce in the study area.

Table 3.35: Shows the Work Force of the Study Area

Zone	No. of Villages	Total Workers	%	Main Workers	%	Marginal workers	%	Non-Workers	%
Primary Zone (0 - 2 Km)	4	4480	51.74	3367	38.89	1113	12.86	4178	48.26
Secondary Zone (2 - 5 Km)	11	33608	37.42	28416	31.64	5192	5.78	56197	62.58
Tertiary Zone (5 - 10 km)	73	65522	51.15	49957	39.00	15565	12.15	62576	48.85
Study Area (10 Km)	88	103610	45.73	81740	36.08	21870	9.65	122951	54.27



Figure 3.34 Work Force in the study area

The study area has 45.73% working and 54.27% non-working population, with 36.08% as main workers and 9.65% as marginal workers. The proposed project is expected to provide stable employment opportunities and enhance livelihood sustainability for the local population

3.9.13 Infrastructure facilities

A well-developed network of physical infrastructure—including built-up areas, roads, irrigation, power supply, and social infrastructure such as health, education, water, and sanitation—is essential for the development of the rural economy. A review of the infrastructural facilities in the study area has been conducted using information from census data and Google Earth. The available infrastructural facilities in the area are described in the following sections

I. **Provision to Basic Amenities**

A primary survey conducted in the rural area focused on the development of basic needs, such as the provision of food, clothing, shelter, employment opportunities, transport connectivity, education, health infrastructure, cooking fuel, and availability of natural resources. The survey revealed the following:

The average annual income of a family varies, with many earning less than ₹20,000. Major expenses are incurred on food, medical care, and water.

Sanitation and hygiene facilities in the study area are inadequate.

The main sources of water are piped water supplied from bore wells.

Most households use LPG as cooking fuel, while small hamlets continue to rely on wood fires.

II. **Educational facilities:**

Primary education up to the 5th standard and Anganwadi centres are available in most villages. The area has 18 high schools, 15 senior secondary schools, 15 private high schools, and 13 private senior secondary schools. Colleges are limited and located over 5 km from most habitations, with only polytechnic institution within the study area. The survey highlights the need to further expand educational facilities. The total number of schools in the study area is given in Table.3.36.

Table 3.36: Educational Facilities in the Study Area

S.No	Village Name	Govt Primary School (Numbers)	Private Primary School (Numbers)	Govt Middle School (Numbers)	Private Middle School (Numbers)	Govt Secondary School (Numbers)	Private Secondary School (Numbers)	Govt Senior Secondary School (Numbers)	Private Senior Secondary School (Numbers)	Govt Arts and Science Degree College (Numbers)	Private Arts and Science Degree College (Numbers)	Govt Engineering College (Numbers)
1	Core Zone (0-2km)	5	2	1	0	1	0	0	0	0	0	0
2	Buffer Zone (2-5 Km)	14	9	8	16	5	11	4	9	2	1	1
3	Tertiary Zone (5-10 km)	75	14	36	7	12	4	11	4	0	0	0
Total		**94**	**25**	**45**	**23**	**18**	**15**	**15**	**13**	**2**	**1**	**1**

III. **Health Care Facilities**

The study area has limited basic amenities and educational facilities compared to healthcare infrastructure. Major healthcare facilities include Tindivanam Hospital (North) and Government Sub-Health Centres in Kattusiviri and Vempundi villages. Overall, medical facilities are average, lacking modern equipment and adequate staff, with delayed access in nearby villages. The area comprises 8 Primary Health Centre (PHC), 44 Primary Health Sub-Centre (PHSC), 9 Maternity and Child Welfare Centres, and 9 veterinary hospitals, while dispensaries and family welfare centres are limited. The total number of the health care facilities available in the study area is provided in Table 3.37.

Table 3.37 Healthcare facilities in the study area

Zone	No. of Villages	Community Healthcare Centre	PHC/GH	Primary Health Sub Centre	Maternity Child welfare Centre	TB Clinic	Hospital Allopathic	Dispensary	Veterinary Hospital	Mobile Health Clinic	Family Welfare Centre	Family Welfare Centre Doctors Total Strength (Numbers)	Non-Government Medical facilities Medical Practitioner with other Degree	Non-Government Medical facilities Medical Practitioner with no Degree	Non-Government Medical facilities Medicine Shop	Non-Government Medical facilities Others
Primary Zone (0 - 2 Km)	4	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0
Secondary Zone (2-5km)	11	0	0	4	0	1	1	0	1	2	0	1	15	20	0	0
Tertiay Zone (5-10km)	73	2	8	38	9	8	0	0	8	10	0	8	1	3	4	0
Study Area (0-10 Km)	88	2	8	44	9	9	1	0	9	13	0	9	16	23	4	0

Source: Census of India, 2011.

IV. **Water Facilities**

Water is an essential resource for sustaining human life; however, the study area faces inadequate water supply. Tanks and lakes are primarily utilized for domestic purposes, while drinking water needs are met through limited panchayat supply systems and hand pumps available within the village. Water facilities available in the study area is provided in Table 3.38

Table 3.38 Water Facilities in the study area

Description	Tap Water-Treated (Status A(1)/NA(2))	Tap Water Untreated (Status A(1)/NA(2))	Covered Well (Status A(1)/NA(2))	Uncovered Well (Status A(1)/NA(2))	Hand Pump (Status A(1)/NA(2))	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Others (Status A(1)/NA(2))
Core Zone (0-2km)	7	6	8	4	4	6	8	8	5	8
Buffer Zone (2-5 Km)	19	14	20	13	11	18	22	22	18	22
Tertiary Zone (5-10 km)	121	94	121	93	78	104	146	146	119	146

Note: A(1) indicate Available, NA (2) means Not Available

V. **Drainage Pattern**

The drainage system in the study area is poorly developed. As per Census 2011, villages have a mix of open, closed, and no drainage systems, with most areas lacking proper drainage. Wastewater often overflows along village streets, and where open drains exist, they are poorly maintained, while closed drains are limited only in few locations. The Table 3.39 shows the drainage system of the villages in the study area.

Table 3.39: Drainage pattern in the study area

S.No	Village Name	Closed Drainage (Status A(1)/NA(2))	Open Drainage (Status A(1)/NA(2))	No Drainage (Status A(1)/NA(2))
0-2 km				
1	Pattanam	2	2	1
2	Palakuppam	2	2	1
3	Venmaniyathur	2	1	2
4	Kollar	2	2	1
2-5 km				
5	Melpakkam	2	1	2
6	Neykuppi	2	2	1
7	Karuvapakkam	2	2	1
8	Ural	2	2	1
9	Kattusiviri	2	2	1

10	Pampundi	2	2	1
11	Salai	2	2	1
12	Vempundi	2	2	1
13	Singanur	2	1	2
14	Nettiyur	2	2	1
15	Tindivanam (M)	2	1	1
5-10 km				
16	Kuttapakkam (Mel)	2	2	1
17	Indirasankuppam	2	2	1
18	Chittamur (Mel)	2	1	2
19	Maruderi	2	1	2
20	Kongarappattu	2	2	1
21	Puttanandal	2	2	1
22	Dadapuram	2	1	2
23	Kilmalayanur	2	2	1
24	Meladhanur	2	2	1
25	Ammanambakkam	2	2	1
26	Vairapuram	2	2	1
27	Tengapakkam	2	2	1
28	Olakkur Melpadi	2	1	2
29	Saram	2	2	1
30	Purangarai	2	2	1
31	Kilkaranai	2	2	1
32	Evalur	2	2	1
33	Sattanur	2	1	2
34	Sitteripattu	2	1	1
35	Pulaiyur	2	2	1
36	Kodiam	2	2	1
37	Kilmavilangai	2	2	1
38	Mavilangai (Mel)	2	2	1
39	Nagavaram	2	2	1
40	Siruvalur (Vada)	2	2	1
41	Taniyal	2	2	1
42	Puliyanur	2	2	1
43	Kalpakkam	2	2	1
44	Kirandipuram	2	2	1
45	Vadampundi	2	2	1
46	Perapari	2	2	1
47	Salavadi	2	2	1
48	Panchalam	2	1	1
49	Melpettai	2	1	2
50	Vittalapuram	2	1	2
51	Kilgudalur	2	1	1
52	Ichcheri	2	1	1
53	Kattalai	2	2	1
54	Endiyur	2	2	1
55	Attur	2	1	2
56	Alapakkam (Vada)	2	2	1

57	Naduvanandal	2	2	1
58	Mannampoondi	2	1	1
59	Ilamangalam	2	2	1
60	Vilukkam	2	1	2
61	Deevanur	2	2	1
62	Agoor	2	2	1
63	Peradikuppam	2	2	1
64	Manur	2	1	2
65	Molasur	2	1	2
66	Manoor	2	2	1
67	Ommandur	2	2	1
68	Annamputhur	2	2	1
69	Varagapattu	2	2	1
70	Iraiyanur	2	1	2
71	Karanavur	2	1	2
72	Jaggampettai	2	1	2
73	Peramandur	2	2	1
74	Asur	2	2	1
75	Vengandur	2	2	1
76	Rettanai	2	2	1
77	Avayakuppam	2	1	1
78	Muppuli	2	1	1
79	Kodima	2	2	1
80	Padamangalam	2	2	1
81	Kenipattu	2	1	2
82	Pasiyar (Then)	2	1	2
83	Avanampattu	2	1	2
84	Kalavay (Then)	2	1	2
85	Vengai	2	2	1
86	Kiledayalam	2	2	1
87	Chinnavalavanur	2	2	1
88	Alagrammam	2	2	1
Note: A(1) indicate Available, NA (2) means Not Available				

VI. **Communication Services**

Mobile Networks: The district has comprehensive telecommunication connectivity, with all major mobile network operators providing reliable service across the area.

Internet Services: Internet services are available in the study areas, with expanding its coverage in rural areas.

VII. **Power**

The study area has a well-established power supply network, providing reliable electricity access to the local population

VIII. **Transportation**

Tindivanam Taluk possesses a well-developed transportation network that plays a vital role in linking the area to major urban centers and supporting regional economic growth.

IX.

X. **Road Transport**

Rural road development initiatives ensure all-weather connectivity, improving accessibility between villages and enhancing local transportation efficiency.

XI. **Rail Transport**

Tindivanam, located in Viluppuram District, Tamil Nadu, is served by the Tindivanam Railway Station (Station Code: TMV). The nearest major rail hub is Viluppuram Junction (Station Code: VM), situated approximately 37–38 km away, providing regional and inter-state connectivity.

XII. **Air Transport**

The nearest airport is Chennai International Airport, located about 101 km northeast of the study area. It offers extensive domestic and international flight connectivity, facilitating business, trade, and tourism.

XIII. **Public Transport**

Public transportation is operated by the State Express Transport Corporation (SETC) and Tamil Nadu State Transport Corporation (TNSTC), along with private bus operators. These services provide efficient connectivity within the district and to neighboring regions, contributing significantly to mobility, trade, and overall socio-economic development.

XIV. **Religion and Festivals**

Tindivanam, located in Viluppuram District, is predominantly Hindu, with Christian and Muslim minorities also present. Major festivals such as Pongal, Tamil New Year, and Deepavali are celebrated with enthusiasm, along with various local temple festivals that highlight the community's cultural diversity.

XV. **Culture and Heritage**

Tindivanam is renowned for its rich cultural and religious heritage. Hinduism is the predominant faith, and the region observes festivals such as the Thanjavur Chariot Festival and Natyanjali Dance Festival with great devotion and cultural significance, reflecting Tamil Nadu's traditional artistry and spiritual legacy.

3.10.14 Primary Data Collection

Primary data collection (Table 3.40) involved gathering basic information on village facilities, including physical infrastructure, social amenities, sustainable development initiatives, and recreational resources. Data was obtained through direct observation, photography, and door-

to-door surveys, including interviews with village residents. Photographs taken during the survey is shown in Figure 3.34.

Table 3.40 List of nearest beneficiary Villages and Population around 5 km Radius

Sl.No	Name	Rural/Urban	Population			
			Household	Total	Male	Female
0-2 km						
1	Pattanam	Rural	721	2896	1457	1439
2	Palakuppam	Rural	376	1610	809	801
3	Venmaniyathur	Rural	271	1350	691	659
4	Kollar	Rural	655	2802	1385	1417
		Total	2023	8658	4342	4316
2-5 km						
5	Karuvapakkam	Rural	273	1059	539	520
6	Ural	Rural	621	2578	1288	1290
7	Kattusiviri	Rural	409	1775	861	914
8	Pampundi	Rural	277	1206	615	591
9	Salai	Rural	289	1241	637	604
10	Vempundi	Rural	426	1843	960	883
11	Tindivanam (M)	Urban	17088	72796	36338	36458
12	Melpakkam	Rural	416	1652	828	824
		Total	19799	84150	42066	42084

Source: Census of India, 2011



Core zone (Pelakuppam)



Site area (Pelakuppam)



Pattanam (Panchayat President)



Kollar



Pattanam



Pelakuppam

Figure 3.35: Photographs of the Socio Economic Survey

3.9.14 Interpretation of Primary Data – Field Survey

Field surveys were conducted to collect accurate socio-economic information and to validate secondary data. Villages were selected based on factors such as proximity to the project site, presence of vulnerable groups, population density, literacy levels, standard of living, and transport accessibility.

Infrastructure Facilities

In the surveyed villages, facilities such as schools, roads, drinking water, electricity, transportation, places of worship, and community self-help groups were found to be adequate. However, sanitation, toilets, banks/ATMs, markets, recreational centers, and solid waste management were insufficient or largely unavailable. Table 3.41 illustrates the infrastructural Facilities available in the study area during primary survey.

Factor Analysis

Factor analysis was performed to examine correlations among variables. A total of 378 respondents were surveyed, with 14 variables considered, including disease prevalence, socio-economic status, literacy, water availability, and healthcare accessibility. Mean, standard deviation, and number of cases (N) were calculated for each variable. SPSS was used with

listwise deletion to handle missing values, and analysis was conducted on correlation matrices, accommodating variables measured on different scales.

This matrix provides a quantitative overview of the respondent's behavioral and socio-economic characteristics, supporting further analysis of the study areas development and resource accessibility. The socio economic status of the village is provided in table xx
The factor analysis indicates an eigenvalue of 2.1, explaining 15.28% of the total variance. The factor comprises both positively and negatively loaded variables. A high positive loading (0.877) for Panchayat-provided drinking water reflects heavy dependence on this source, while water quality shows a moderate positive loading (0.342), indicating general satisfaction among households. Gender (0.700) and occupational status (0.718) also exhibit strong positive loadings, reflecting active participation of men and women in occupations such as daily wage labor, self-employment, driving, technical work, and painting. Educational attainment up to the 12th standard shows a slight negative loading (-0.151), whereas graduates show a small positive loading (0.180), typically employed in private sector jobs or nearby industries like SIPCOT. No government job holders were observed. Income levels show a negative loading (-0.192), indicating most households earn between ₹5,000 and ₹10,000 per month, often supplemented by weekly wages. Housing type also has a negative loading (-0.109), suggesting that most houses are katcha or semi-permanent concrete structures.

The factor analysis indicates an extracted factor with an eigenvalue of 1.634, explaining 11.671% of the total variance. High positive loadings are observed for educational qualification (0.693), water quality (0.608), and type of house (0.598), highlighting their strong influence on living standards. Moderate positive loadings include number of family members (0.313), number of graduates (0.210), and proximity to health facilities (0.197), while type of toilet (0.109) contributes minimally. Income (-0.403) shows a strong negative loading, with weak negative correlations for age (-0.145), working population (-0.158), and occupational status (-0.150). Overall, the factor reflects basic infrastructure and educational conditions, with inverse associations with economic and demographic characteristics. The Table 3.42 and Table 3.43 illustrates the Socio-Economic status and living condition of the villages in the study area.

Community Needs

Interactions with village residents revealed requirements for employment opportunities, improved transportation, banking facilities, public toilets, primary healthcare centres, 24-hour medical services, community resources, and proper drainage systems. The proposed TANCIDCO project faced no objections, and there is no evidence of negative impacts. Primary and higher secondary government schools are available, representing positive aspects of the area.

Other Issues in the Study Area

- Deforestation due to tree cutting
- Increasing air and water pollution

- Lack of awareness among vulnerable groups regarding welfare programs
- Need for medical facilities, PHCs, and SHCs in core and buffer zones
- Proper solid waste management in villages
- Functioning of hospital facilities and sub-health centres
- Requirement for proper drainage systems and public toilets
- Improved transport facilities for beneficiary villages

Findings on Socio-Economic Conditions

Field assessment indicates that villages are generally in a stable condition but require socio-economic development interventions. Key gaps include the absence of PHCs, safe drinking water supply, public transportation, and community amenities such as playgrounds, parks, libraries, and markets. Most residents are engaged in self-employment or small-scale businesses, including drivers, workshop operators, grocery shop owners, and teachers. These observations underscore the need for targeted development planning to enhance infrastructure and support local livelihoods.

Table 3.41: Infrastructure Facilities for Surveyed villages

Sl. No	Parameters	Pattanam	Pelakuppam	Venmaniyathur	Kollar	Ural	Pampundi	Vempundi	Melpakkam	T.Panchalam	Kattusiviri
1	Household	721	376	271	655	621	277	426	416	273	409
2	Occupation	MGNREGA Scheme, Daily Wagers,	Daily Wagers, Agriculture Labourer, Daily Wagers, Factories, SIPCOT	Weekly Labour, Maligai Business	MGNREGA Scheme, Daily Wagers,	Dailywage Labourer	Weekly wage labour, Painter	Daily wagers, Painter	Daily wage Labourer Cattle rearing	Daily wage Labourer	Daily wage Labourer
3	Crops	Paddy	Vegetables, Paddy	Paddy, Cholam,	Groundnut	Paddy, Cholam	Groundnut, Sugarcane, Paddy	Sugancane	Paddy, cholam	Groundnut, Sugarcane, Paddy	Groundnut, Sugarcane, Paddy
4	Drinking Water facilities	Piped Water Supply	Panchayat Water	Panchayat Water	Panchayat Water	Piped Water Supply	Piped Water Supply	Panchayat Water	Piped Water Supply	Piped Water Supply	Piped Water Supply
5	Schools	Primary school Adequate	Adequate	Adequate, Anganwadi, Primary school	Adequate	Adequate	Adequate	Primary school Adequate	Primary School, Anganwadi Adequate	Primary School, Anganwadi Adequate	Primary school Adequate
6	Hospitals	Adequate	Inadequate	Adequate	Inadequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
7	Electricity	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
8	Sanitation facilities-Toilets	Adequate	Adequate	Inadequate	Inadequate	Adequate	Adequate	Inadequate	Basic	Basic	Adequate
9	Transportation/Local	Adequate	Adequate	Adequate	Inadequate	Inadequate	Inadequate	Adequate	Inadequate	Inadequate	Adequate
10	Public roads	Adequate	Adequate	Adequate	Inadequate	Adequate	Adequate	Adequate	Adequate	Basic	Basic
11	Bank/ATM	Adequate	Adequate	Basic	Basic	Basic	Basic	Basic	Basic	Basic	Basic
12	Market shops	Basic	Basic	Basic	Inadequate	Inadequate	Inadequate	Basic	Basic	Inadequate	Inadequate
13	Place of worship	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
14	Community self groups	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
15	Solid waste management	Adequate	Basic	Inadequate	Inadequate	Basic	Basic	Basic	Basic	Inadequate	Inadequate

Source: Field survey 2025

Table 3.42 Socio-Economic status of the villages in the study area

Sl. No	Name of the variables	Factor loading
1	Drinking water	0.877
2	Occupational Status	0.718
3	Gender	0.704
4	No. of Graduate	0.184
5	Healthcare facility	0.320
6	Water quality	0.342
7	Working Population	-0.146
8	Income status	-0.192
9	Educational Qualification	-0.151
10	Types of House	-0.109
Eigen Value=2.139	Percent of Trace = 15.28	

Table 3.43 Dimension 5 - Socio economic living conditions

Sl. No	Name of the variables	Factor loading
1	Educational Qualification	0.693
2	Water quality	0.608
3	Types of House	0.598
4	No.of Graduate	0.210
5	Visiting the near Health facility	0.197
6	No.of People in the family	0.313
7	Types of Toilet	0.109
8	Income	-0.403
9	Age	-0.145
10	Working Population in the family	-0.158
11	Occupational Status	-0.150
Eigen Value=1.634	Percent of Trace = 11.671	

3.11 TRAFFIC STUDY

A Traffic Study was carried out in the Thiruvannamalai – Tindivanam Highway which is the nearest highway which connects the project site on March 13, 2025 to assess the existing traffic during the morning and evening peak hours.

3.11.1 Methodology adopted for the Traffic Study

The following methodology was adopted to conduct the Traffic Study

- Identification of Road and Type of Carriageway
- Assessment of existing traffic conditions in the selected roads: Traffic count of vehicles under different heads (Two Wheelers, Three Wheelers, Four Wheelers, Six Wheelers and Others like Carts etc.) observed at every 15 min interval for 8 hours, Morning 7.00

am to 11.00 am and Evening 4.00 pm to 8.00 pm in the identified approach roads and recorded.

- Estimation of percentage composition of vehicles and conversion to equivalent Passenger Car Unit (PCU) factors.
- Volume- to- Capacity Analysis:
  - ✓ Estimation of incremental traffic volume (V) from proposed project in PCU's/hour.
  - ✓ Capacity of Existing Road in PCUs per Hour as per IRC 106-1990 (C)
- Interpretation on Level of Service of the identified road from (V/C) value

The traffic count of vehicles under different heads observed during the morning and evening hours is compiled in Table 3.44 and Table 3.45, respectively. The Traffic summary is given in Table 3.46.

Table 3.44: Traffic observed during Morning Peak Hours

Type of Carriageway: Two Lane – Two way						
Time	**Two Wheelers (Motor cycle, Scooter etc.)**	**Three Wheelers (Auto rickshaws, motorised carts etc.)**	**Four Wheelers (Passenger cars, Pickup vans etc.)**	**Six Wheelers (Light commercial vehicles, Trucks & Buses etc.)**	**Bicycles**	**Others (Carts etc)**
07.00 - 07.30 Hrs	45	15	32	15	5	2
07.30 - 08.00 Hrs	75	48	61	18	11	5
08.00 - 08.30 Hrs	85	57	83	25	15	5
08.30 - 09.00 Hrs	99	85	98	32	21	9
09.00 - 09.30 Hrs	120	91	105	38	15	6
09.30 - 10.00 Hrs	90	45	86	19	12	5
10.00 - 10.30 Hrs	78	45	74	12	10	2
10.30 - 11.00 Hrs	56	21	43	10	8	3
Item Total	648	407	582	169	97	37
						1940
Percentage Composition	33	21	30	9	5	2
M. Factor	0.75	1.2	1	3.7	0.5	2
PCU	**486**	**488**	**582**	**625**	**49**	**74**
Total No. of PCUs (For 4 Hrs)						**2304**
Total No. of PCUs/Hr (Avg.)						**576**

Table 3.45: Traffic observed during Evening Peak Hours

Type of Carriageway: Two Lane – Two way						
Time	**Two Wheelers (Motor cycle, Scooter etc.)**	**Three Wheelers (Auto rickshaws, motorised carts etc.)**	**Four Wheelers (Passenger cars, Pickup vans etc.)**	**Six Wheelers (Light commercial vehicles, Trucks & Buses etc.)**	**Bicycles**	**Others (Carts etc)**
04.00 - 04.30 Hrs	54	21	41	8	5	1
04.30 - 05.00 Hrs	75	52	53	10	8	8
05.00 - 05.30 Hrs	90	63	60	12	17	5
05.30 - 06.00 Hrs	112	75	85	22	22	6
06.00 - 06.30 Hrs	96	85	92	30	16	7
06.30 - 07.00 Hrs	102	65	88	23	12	5
07.00 - 07.30 Hrs	75	60	66	18	11	5
07.30 - 08.00 Hrs	101	66	52	8	13	3
Item Total	**705**	**487**	**537**	**131**	**104**	**40**
						2004
Percentage Composition	35	24	27	7	5	2
M. Factor	0.75	1.2	1	3.7	0.5	2
PCU	**529**	**584**	**537**	**485**	**52**	**80**
Total No. of PCUs (For 4 Hrs)						**2267**
Total No. of PCUs/Hr (Avg.)						**567**

Table 3.46 - Traffic Summary

Existing Traffic Load in PCUs/Hr	Increase in Vehicular Population due to Proposed Development	Estimated Future Traffic Volume in PCUs/Hr (V)	Capacity of Existing Road in PCUs per Hour as per IRC 106-1990 (C)	V/C Ratio
MP- 576	PCUs/Hr-200	MP -776	1500 PCU	0.52
EP- 567		EP - 767		

3.11.2 Interpretation of V/C Ratio

The Volume to Capacity (V/C) ratio at the assessed location is 0.52. As per the Indian Roads Congress (IRC) guidelines, IRC:106-1990 and IRC:64-1990, V/C ratio below 0.85 indicates that the road operates under acceptable service conditions with no serious congestion or delay.

- **V/C ≤ 0.75** – Excellent Level of Service: Free flow conditions.
- **0.75 < V/C ≤ 0.85** – Good Level of Service: Stable flow, acceptable delays.
- **0.85 < V/C ≤ 1.0** – Approaching capacity; increasing delays.
- **V/C > 1.0** –Oversaturated; unstable flow with frequent stoppages.

Therefore, a V/C ratio of 0.52 implies that the roadway is operating within its design capacity, and no significant adverse impact is anticipated from the projected increase in traffic volume.

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 INTRODUCTION

The chapter presents the anticipated impacts on the environment due to the project activity in the study area.

4.1 IDENTIFICATION OF IMPACTS

The "Matrix Method" was adopted, which involves an understanding of the cause-condition-effect relationship between an activity and environmental parameters. It is very useful as a gross screening tool for impact identification methods. This method is advantageous in recognizing the series of impacts that could follow from the project activities. This process was repeated until all possible types of impacts were identified. The potential impact of the project proposed is evaluated on the different environment during every phase of the project as stated below:

Environment:	**Phases:**
Air Environment	Construction Phase
Land Environment	Operation Phase
Water Environment	Closure Phase
Socio-Economic Environment	Accidental/Emergency Phase
Biological Environment	

4.2 IMPACT AND MITIGATION MEASURES FOR THE CONSTRUCTION PHASE

The activities during the construction phase which attribute to the various aspects of pollution and the impacts identified are summarized. The detailed Impact Matrix adopted incorporating the severity of impact is covered

4.2.1 Air Environment

The project activities that are likely to affect the air environment are site clearance site levelling, excavation, stacking and handling of construction materials like sand, cement, stone aggregates, paints etc. in open yards, generation and disposal of construction waste, vehicular movement and operation of temporary DG sets.

- The aspects of air pollution will be
  - ✓ Incremental dust, Increased PM level and VOC Emissions concentration in the site premises.
  - ✓ Smoke generated from construction machinery and DG sets.
- The potential impact identified is as follows:

- ✓ During Construction phase incremental ground level concentration (GLC) of dust clouds, fumes, temperature increase due to dust emission from excavation and material handling, Emission from Vehicles and construction equipment and fabrication / installation of equipment.
- ✓ This will create health hazard to humans like respiratory problems, lung disorder, and visual impairment.

Mitigation Measures:

- Watering the site surface to arrest the dust and particulates generated due to material handling vehicle movement.
- Temporary barricade screens (steel sheets /green fabric mesh) of heights ranging from 5m - 8m shall be installed around the periphery of the activity area to control and prevent dust/particulates from moving outside the premises.
- Personal protective equipment like nose masks and goggles shall be provided to the workers engaged in construction areas generating dust.
- Pollution Under Control (PUC) certificate obtained vehicles shall be identified and engaged for construction activity. Monthly maintenance of vehicles and equipment shall be ensured to reduce gaseous emission.
- Vehicular speed shall be limited to 20 kmph within the project site.
- The vehicles carrying construction material shall not be overloaded and covered with tarpaulin to reduce spills on roads.
- All materials shall either be stored under covered sheds or covered under tarpaulins.
- Paints and emulsions with Low VOC content shall be used. Any kind of paint/emulsion spills shall be cleaned immediately using dry adsorbents and cotton and the same shall be disposed in scientific manner.
- Latest emission norms (B5 / B6 norms) shall be used within the project site premises in addition to usage of Low sulphur diesel which would reduce the gaseous emissions. Shall promote the usage of cleaner fuel (gas) for the operation of DG sets instead of high-speed diesel
- Stacks heights per CPCB norms based on the individual DG set capacities shall be installed so as to disperse the gaseous emissions into the atmosphere. CPCB Certified brands of DG sets (for emission and noise) shall be used in the construction site.
- Periodic monitoring of the DG set emissions shall be carried out to ensure the air emissions are under control.
- Regular monitoring of ambient air quality through NABL/MOEFandCC accredited laboratories especially during summer and windy seasons.
- Greenbelt with minimum 5-m width shall be provided all around the periphery of the project site.

4.2.2 Noise

The project activities that are likely to affect the noise level are site clearance, site leveling, site excavation, drilling, foundation and heavy fabrication work. The noise level will range from 75 dB (A) to 85 dB (A)

- The aspects of the noise pollution will be Operation of Construction Machinery and Equipment, Unloading of Construction Material, Loading of Construction Waste and Idle running of vehicles.

  The potential impact to the ambient noise level will be as follows:
  - Increased noise exposure during the entire construction period will lead to annoyance, headache, high blood pressure and increases the risk such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss etc. to construction workers and people in nearby areas.
  - An increase in vibration will leads to fatigue, stomach problems, headache, loss of balance and "shakiness" shortly after or during exposure.

The mitigation measures proposed are as follows:

- Night time and weekend construction activities shall be avoided. Construction activities will be restricted to the day time.
- Temporary barricade walls (noise barriers) of heights ranging from 5m - 8m shall be installed all around the construction site to contain the noise.
- Regular maintenance and lubrication of temporary DG sets, construction equipment/machinery shall be ensured.
- Pile caps shall be provided with noise-dampening pads to reduce noise during piling operations.
- Personal protective devices like earmuffs/earplugs shall be provided to the construction workers. Night time and weekend construction activities shall be avoided. Construction activities will be restricted to the Day time

4.2.3 Land Environment

- The project activities that are likely to affect the land environment are site clearance, leveling, soil excavation, foundation works, littering/spillage of construction materials (like Paints, cement, etc.) and infiltration of leachate into the soil.
- The aspects of pollution with respect to the land environment are loss of top soil, green cover and decreased soil stability.
- The potential impact with respect to land environment will be as follows:
  - ✓ Loss of soil fertility and micro species on the land
  - ✓ Loss of topsoil and its nutrients, organic matter and biological activity
  - ✓ Increasing soil erosion, contamination of soil, decreasing mineral content and reduction in the ion exchange capacity due to above said activities

- ✓ Creation of barriers and pathways for groundwater flow formed by foundations or ground-improvement processes.
- ✓ Contamination of a soil by hazardous and other waste materials through the accidental discharge or leakage of fuel from DG sets and transporting vehicles which will reduce the growth of flora and yield of the plant.
- ✓ Solid waste generation of 24.6 kg/day from the occupants, Hazardous waste of xxx TPA and E-waste of 0.50 TPA will lead to odour nuisance and leaching into soil/land pollution.

- **The mitigation measures proposed are as follows:**
  - ✓ Construction waste collection point to be earmarked and after recycling of aggregates, excavated earth, the pipe conduits, TMT bar trimmings, sheets, plywood can be stored and sold in the markets through scrap dealers.
  - ✓ Collection and appropriate storage of Hazardous wastes shall be established as a practice towards safe disposal of these wastes.
  - ✓ Appropriate quantity estimation and efficient construction planning would reduce the construction waste to a substantial extent.
  - ✓ Necessary storage (covered) and preservation of construction materials would result in lesser generation of such wastes.
  - ✓ Proper segregation and storage of construction debris should be ensured. Materials which can be reused for purpose of construction, levelling, making roads / pavement should be reused and other wastes should be disposed as per Construction and Demolition Waste Rules 2016.
  - ✓ The sides of the excavated area shall be provided with Shoring, bracing, underpinning or some combination of safety measures as necessary, to protect workers and to prevent soil subsidence.
  - ✓ Stripping and appropriate stockpiling of topsoil should be undertaken; this ensures its preservation for later use together with its stored plant seeds and other organic matter. This stored topsoil shall be utilized in the area earmarked for the greenbelt.
  - ✓ The runoff from the project site shall be made to pass through the silt trap
  - ✓ Impervious flooring should be provided to avoid spillage as well as for the storage of raw material.

4.2.4 Water Environment

- The project activities that are likely to affect the water environment are water consumption, sewage generation and disposal, spillage of chemicals (Such as Paint, additives, etc.)
- The aspects of pollution will be
  - ✓ Depletion of water resources and scarcity in the surrounding.
  - ✓ Contamination of surface water bodies and ground water due to improper sewage disposal.
- The Impacts in the water environment
  - ✓ Domestic water requirement (Inhouse strength: 60) is estimated to be about 2.7 KLD.

- ✓ Sewage generation from the construction labour camp 2.2 KLD will lead to ground water contamination and stagnation of sewage will result in health hazard to working population.
- ✓ Health hazards due to the presence of pathogens causing diarrhea, vomiting, cramps, nausea, headaches, fever, fatigue, etc.
- ✓ Hazards to the livelihood of aquatic species which may lead to the loss of particular species.

- **The mitigation measures proposed are as follows:**
  - ✓ Avoid waste of water during curing by adopting the following measures:
    - Water shall be sprayed on concrete instead of free flow of water
    - Admixtures should be used in the concrete to save water.
    - Preliminary coating with gunny bags before spraying of water should be ensured.
  - ✓ Sewage should be collected through water-tight plumbing arrangements.
  - ✓ During windy and summer season prior booking shall be made for the water required.
  - ✓ Septic tank with soak pit arrangement shall be provided for treating the sewage.
  - ✓ The separate area with impervious flooring shall be earmarked for cleaning equipment, clothes, and washing of hands for labours involved in painting and varnishes.
  - ✓ The wastewater generated during the cleaning of paints and varnishes shall be collected in the drums and settling to be carried out before discharge.
  - ✓ A temporary drain with a silt trap shall be provided to collect the runoff during the monsoon season.

4.2.5 Socio-Economic Environment

- The project activities that may have likely impact on the socio-economic environment are site clearance and levelling, excavation, foundation works, heavy fabrication, Cutting Gas works, Painting etc., vehicular movement, Economic activity, Employment, and Public Health and Safety.
- The aspects on the Socio Economic Environment include generation of local employment
- The potential impact will be as follows:
  - ✓ Construction activities result in damages to built environment of the surroundings. Dust generation during construction activities affect the cleanliness of the surrounding houses and vehicles. Noise and vibration results in the loss of peace and quietness in the neighbourhood and degradation of ambient conditions. The vehicular movement due to construction results in road congestion, temporary road closure and detours. It also results in road safety problems and loss of parking spaces.
  - ✓ The project development would enhance the landscape of the area by attracting direct and indirect employment during construction phase of the project.
  - ✓ Leads to the infrastructural development of the surrounding area.
- The mitigation measures proposed are as follows:

- ✓ Preventive measures to control dust generation, control of noise and vibration as prescribed in the EMP.
- ✓ Regulating the construction traffic, restricting the vehicular movement during non-peak day time so as to avoid external disturbances.
- ✓ Working in coordination with local traffic police department and the surrounding inhabitants to ensure adequate road safety measures are put in place to avoid disturbances to the public.
- ✓ Comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7: Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards
- ✓ Provide clean drinking water to all workers.
- ✓ Provide the adequate number of decentralized latrines and urinals to construction workers.
- ✓ Safety Precautions shall be displayed in all areas with instructions to be followed.
- ✓ Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition.

4.2.6 Biological Environment

- The project activities that are likely to affect the biological environment are site clearance and levelling, excavation, foundation works, wastewater generation and disposal, disposal of construction waste and vehicular movement.
- The aspects like loss of native species, decrease in species density, loss of natural resources, dust settlement on flora and disturbance to fauna, in the surrounding area and the project site due to above said activities will cause an impact on the biological environment.
- The potential impact will be as follows:
  - ✓ Leads to species isolation, reduction in habitation
  - ✓ Clearing of vegetation during land preparation activity would lead to removal of endemic and RET species
  - ✓ Dust on plant leaves plug stomata, reducing chlorophyll content of plants, and respiratory diseases in animals, etc.
  - ✓ Stunted growth in flora
  - ✓ Disturbance to breeding and nesting grounds of birds and other fauna
  - ✓ Movement/ relocation of fauna from the project area to nearby calmer places due to noise and vibration from construction activities.
- The mitigation measures proposed are as follows:
  - ✓ The nutrient-rich topsoil should be preserved and reused for gardening and landscape development.
  - ✓ The open area should be planted with native tree species and proper maintenance such as periodic watering, weeds removal and manuring should be done to maintain soil fertility.
  - ✓ Proper barricading of the construction site to combat dust spreading and noise disturbances.

- ✓ Watering of site regularly for dust suppression.

The overall impact evaluation matrix for the construction phase is given in the below Table 4.1.

Table 4.1: Impact Evaluation Matrix – Construction Phase

Environmental Component	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S*P)	Impact Intensity	Mitigation/ EMP Proposed
Air Environment	Site Clearance and Leveling	Increase in dust and Particulate Matter (PM) concentration in ambient air	Create health hazard to human like Respiratory issues, Lung Disorder, and Visual Impairment.	Direct and Negative	-2	3	-6	Minor	✓
	Excavation	Increase in dust and PM Concentration in ambient air	Create health hazard to humans leading to reduce in lungs performance and triggers lung diseases.	Direct and Negative	-3	2	-6	Minor	
	Material Storage and Handling	Increase in concentration of PM and Fugitive emission.	PM will create health hazard to human by passing through their bloodstream and Fugitive emissions will cause Respiratory related diseases, cause irritation to eyes, nose and throat.	Direct and Negative	-2	3	-6	Minor	✓
	Generation and disposal of construction waste	Generation of dust clouds	Will create health hazard to humans leading to reduce in lungs performance and triggers lung diseases.	Indirect and Negative	-2	2	-4	Minor	✓
	Vehicular Movement	Increase in Concentration of PM, CO, NO_2	PM will create health hazard to human related Respiratory Problems. CO will cause Blockage of oxygen supply when it reacts with hemoglobin upon inhaling	Direct and Negative	-3	2	-6	Minor	✓

Environmental Component	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S*P)	Impact Intensity	Mitigation/ EMP Proposed
	Generation of Dust	Dispersion of dust particles in ambient air due to construction activities	Causes Respiratory Illness to the workers in the site and surrounding Reduces Visibility in the area	Indirect and Negative	-2	2	-4	Minor	
	Operation of Temporary DG Sets	Increases PM concentration	PM will create health hazard to human related Respiratory Problems.	Indirect and Negative	-3	1	-3	Minor	
Noise	Site Clearance and Leveling	Increase in Noise and Vibration due to Heavy Machinery works	Increase in noise will cause health hazard to human like fatigue from lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, and tinnitus and hearing loss. Also increase in noise level will make animals and birds to relocate to a calmer area for habitation. Increase in vibration will leads to fatigue, stomach problems, headache, loss of balance and "shakiness" shortly after or during exposure.	Indirect and Negative	-2	2	-4	Minor	✓
	Site excavation	Increase in Noise level due to Excavation work by Machineries		Direct and Negative	-2	3	-6	Minor	✓
	Foundation Works	Increase in Noise and Vibration due to filling of materials in the Foundation and reinforcement works		Indirect and Negative	-2	2	-4	Minor	
	Material Storage and Handling	Increase in Noise due to handling of Materials and equipment's used for movement and Storage		Indirect and Negative	-2	2	-4	Minor	✓
	Disposal of construction waste	Increase in Noise due to loading and unloading of the Waste		Indirect and Negative	-1	1	-1	Non – Significant	
	Vehicular Movement	Increase in Noise due to Movement of Vehicles		Direct and Negative	-3	2	-6	Minor	✓
	Usage of Power and Energy	Increase in Noise due to temporary DG Sets		Direct and Negative	-2	2	-4	Minor	✓

Environmental Component	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S*P)	Impact Intensity	Mitigation/ EMP Proposed
	Heavy Fabrication Work (like cutting, welding, laying underground pipe line, etc.)	Increase in ambient noise level		Direct and Negative	-2	2	-4	Minor	
Land Environment	Site Clearance and Leveling	Loss in soil fertility/ Loss in micro species in the land Loss of Top Soil Loss of top soil functionality and reduces its nutrient, organic matter and biological activity.	Reduces the possibility of proper plant growth in the land. Leads to reduction in micro species in the surrounding area. Reduces the richness of the top soil required for flora	Direct and Negative	-3	2	-6	Minor	
		Loss of Green Cover	Leads to increase in air and noise pollution. Reduces the Soil stability and increase in Soil erosion.	Direct and Negative	-2	2	-4	Minor	
	Soil excavation Foundation	Decrease the soil stability. Soil erosion	Decline in organic matter which leads to reduction in flora and fauna in the surrounding.	Direct and Negative	-1	2	-2	Non – Significant	
	Littering/ spillage of Construction Materials (like Paints, cement, etc.)	Loss of Soil Fertility Decrease in Soil Nutrients due to chemicals contamination	Reduces the possibility of proper plant growth in the land. Leads to reduction in micro species in the surrounding area.	Direct and Negative	-3	3	-9	Moderate	✓
	Infiltration of Leachate into the Soil	Decreases the mineral content of the Top Soil	Reduction in the ion exchange capacity and in water and nutrient use efficiency.	Direct and Negative	-2	2	-4	Minor	
Water Environment	Water Consumption	Depletion of Water resource in the surrounding	Will leads to water scarcity in the surrounding area.	Direct and Negative	-2	3	-6	Minor	

Environmental Component	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S*P)	Impact Intensity	Mitigation/ EMP Proposed
	Sewage Generation and Disposal	Increase BOD level Presence of Bacteria and Pathogens Creates Foul odor	Increase in concentration of BOD and COD will reduces the concentration of Dissolved oxygen which will turn the water source into septic condition. Presence of Pathogens will cause health hazard to humans like diarrhea, vomiting, cramps, nausea, headaches, fever, fatigue, etc.	Direct and Negative	-2	2	-4	Minor	✓
	Spillage of Chemicals (Such as Paint, additives, etc.)	Increase in chemical constituents of Surface / Ground Water Increases COD level in the water Changes in pH of the water	Increase in chemical concentration and pH above the threshold limit in surface water environment can lead to hazard to the aquatic species which may lead to loss of particular species.	Direct and Negative	-3	2	-6	Minor	✓
Socio Economic Environment	Site Clearance and Leveling, Excavation, Foundation Works, Heavy Fabrication, Cutting , Gas Works, Painting, etc.	Generation of Local Employment	Increases the earning potential of the individual employee which leads to enhancements in the living standards	Indirect and Positive	+2	2	+4	Minor	✓
	Resettlement and Rehabilitation of people	Influx of humans in the local area	Will lead to human settlement in the surrounding area and creates Indirect employment.	Indirect and Positive	+2	2	+4	Minor	
	Vehicular Movement	Provides employment opportunity for the locals	Creates direct employment to the surrounding people	Indirect and Positive	+3	3	+9	Moderate	✓

Environmental Component	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				
					Significant (S)	Probability (P)	Total Weigh tage (S*P)	Impact Intensity	Mitigation/ EMP Proposed
	Economic Activity	Increases revenue to the local government and local employee due to Direct and Indirect jobs Changes in Economic pattern of the Locals	Increases life standard of Local people Leads to improvement in infrastructure of the surrounding area.	Indirect and Positive	+2	2	+4	Minor	
	Public Health and Safety	Vulnerable to diseases in new environment	Will create Occupational Health Hazard to the employee in the surrounding area.	Indirect and Negative	-2	2	-4	Minor	
Biological Environment	Site Clearance and Leveling	Habitat loss of native species	Leads to species isolation, reduces the area where they can live, and creates new ecological boundaries.	Direct and Negative	-2	2	-4	Minor	
		Loss of Species Decrease in Species Density		Direct and Negative	-2	2	-4	Minor	
	Site excavation and Foundation Works	Loss of natural resources	Loss of Micro Biodiversity in the surrounding area due to loss of top soil	Direct and Negative	-2	1	-2	Minor	
	Generation and disposal of construction waste	Dust Settlement on Flora and Fauna in the Surrounding area Loss of Micro Species in the Project Site	Reduces the plant and animal growths, reduced chlorophyll of plants, and creates respiratory diseases in animals, eye defects, etc.	Indirect and Negative	-2	3	-6	Minor	✓
	Vehicular Movement			Direct and Negative	-2	2	-4	Minor	✓

4.3 IMPACT AND MITIGATION MEASURES FOR OPERATION PHASE

4.3.1 Air Environment

- The project activities that likely to affect the air environment are the operation of DG Sets, ETP and other manufacturing process equipment, furnaces, usage of power, energy and increased vehicular movement.
- The aspects like increase in emission of SO_2 NO_2, Particulate Matter, CO, and generation of acidic and alkaline fumes from the process will cause an impact on the air environment.

- The potential impact on health to people such as respiratory problems like cough, wheezing, shortness of breath, asthma, pneumonia etc., lung disorders, and visual impairment to the people in the vicinity.
- The mitigation measures proposed include:
  - ✓ Opting/choosing DG sets that are certified for emission limits prescribed by CPCB shall be installed with stack height as per CPCB norms
  - ✓ Providing air pollution control measures to process equipment, furnaces such as scrubbers, dust collectors and stack height as per CPCB norms
  - ✓ Periodic monitoring of the DG set emissions shall be carried out to ensure the air emissions are under control
  - ✓ Annual maintenance and servicing shall be carried out to reduce the wear and tear of the machinery/equipment which plays a significant role in emissions
  - ✓ Greenbelt with 5 m all around the periphery of the project site
  - ✓ Promotion of cleaner fuel (gas) for the operation of DG sets instead of high-speed diesel
  - ✓ Regulation of internal traffic by the occupants / EM Cell to prevent idle running of vehicles within the premises
  - ✓ Wide entry and exit point will be provided for free movement of vehicles
  - ✓ Creating awareness among the occupants to reduce idle running of vehicles and promote the use of electric vehicles in future
  - ✓ The incremental ground level concentration due to the emission from point and line source is estimated through AERMOD. The point source emission is given in Table 4.2 and the line source emission is given in Table 4.3. The summary of Predicted Ground Level Concentration is given in Table 4.4. The Ambient Air Quality including the incremental GLC due to the proposed project has found to be within the within the NAAQ Standards.

TABLE 4.2 – Ground Level Concentration from Stack Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	6.70	1,140
Predicted incremental GLC through AERMOD	0.071	0.936	0.061	1.986
Overall Scenario	84.871	24.636	6.761	1,141.986
NAAQ Standards	100	80	80	4000

TABLE 4.3 – Ground Level Concentration from Vehicular Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	1,140

Predicted incremental GLC through AERMOD	0.11	1.21	39.76
Overall Scenario	84.91	24.91	1,179.76
NAAQ Standards	100	80	4000

TABLE 4.4 – Ground Level Concentration from Cumulative Emission

Description	PM ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)
Baseline Scenario	84.80	23.70	6.70	1,140
Predicted incremental GLC through AERMOD	0.09	0.996	0.061	39.76
Overall Scenario	84.89	24.696	6.761	1,179.76
NAAQ Standards	100	80	80	4000

4.3.2 Noise

- The project activities that are likely to affect the noise level are the operation of DG Sets, Process Machinery/Equipment, ETP, APC Measures and Vehicular Movement.
- The aspects like an increase in noise will cause the impact to the noise level.
- The potential impact will be as follows:
  - ✓ An increase in noise will cause health hazards to people like fatigue from lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss.
  - ✓ Physiological and psychological effects on people like annoyance, problems like speech interference, headache, auditory impact, and increase in heartbeat of elderly people due to high levels of noise generation from the continuous operations of DG sets.
  - ✓ An increase in vibration will leads to fatigue, stomach problems, headache, loss of balance and shakiness shortly after or during exposure
  - ✓ The sources noise considered at the project site for the analysis with their approximate Sound Pressure Levels considered slightly on the higher side for more critical analysis
  - ✓ Increase of sound level due to operation of DG Sets, Process Machinery/ Equipment, APC Measures and Vehicular Movement

4.3.2.1 Noise Prediction by Quantitative Operation Equipment Assessment:

Assessment of Noise modelling using dB Foresight Software:

- Noise modelling study was done using the Software tool called “dB Foresight” which predicts the Noise Map generated due to the sources present at the project site and predicts the Noise Level at various receiver points due to the sources present at the project site.
- To analyse the Noise Map of the project site, first, the geometrically coordinated Google Earth images of the Project site were imported into the software. Various Sources of noise

were added with their approximate Sound Pressure Level (SPL), and the "Receiver points" were added at various locations where Noise Monitoring was conducted.

- "dB Foresight" generates the Noise Map with colored pattern isoplates, which indicate whether or not the SPL in the particular region is above the limits mentioned by CPCB or not.
- The mitigation measures proposed include:
  - ✓ DG equipment shall be housed inside an acoustic enclosure module with the prescribed insertion loss of a minimum 25 dB (A).
  - ✓ DG set should be provided with a proper exhaust muffler to reduce noise
  - ✓ CPCB-certified brands of DG sets (for noise and emission) shall be used.
  - ✓ Regular maintenance and lubrication of DG sets, manufacturing equipment / machinery and regulation of internal traffic shall be ensured.

4.3.3 Land Environment

- The project activities that are likely to affect the land environment are spillage of used oil from DG Sets, improper disposal of untreated sewage, effluent, improper storage and disposal of solid waste, hazardous waste, sludge, soil contamination due to leaching of wastes and Green Belt Development/Increase in Green Cover.
- The aspects of pollution include decrease in soil fertility; spread of disease vectors, Increase/Decrease in soil pH will have an impact on the land environment.
- The potential impact will be as follows:
  - ✓ Reduces the growth of flora
  - ✓ Reduces yield of the plant in the contaminated soil
  - ✓ Turns the soil into a septic condition (anaerobic) which is not suitable for Flora
  - ✓ Creates nuisance to humans due to flies and breed due to sewage on the ground.
  - ✓ Increase in groundwater storage and reduced dependency on freshwater due to harvesting the rainwater.
  - ✓ Unhygienic conditions and the spread of diseases to the humans.
  - ✓ Reduction in the ion exchange capacity and water and nutrient use efficiency.
  - ✓ Improper disposal of solid waste will lead to odour nuisance and leaching into the soil causing land pollution
  - ✓ Mishandling and spillage of Spent oil and other residues arising out of DG sets and process machinery/equipments.
- The mitigation measures proposed are as follows:
  - ✓ The plumbing network should be made without any leakages
  - ✓ Handling of solid and hazardous waste should be done in the earmarked area having impervious flooring and covered roof.
  - ✓ Identifying appropriate vendors for collection of recyclable waste streams including e-wastes would enhance resource recovery, resource conservation and improper dumping around the project periphery.

- ✓ Allocation of adequate funds necessary for deploying the man power and equipment needed for waste collection and disposal shall augment waste management in an effective way.
- ✓ Solid waste will be handed over to TANSIDCO waste collection system, Hazardous waste will be handed over to authorized recyclers/ TANSIDCO TSDF facility and the E – waste to be handed over to Authorized collection centers / recyclers.
- ✓ Dedicated E waste bin to be placed in the earmarked area. The E – waste will be disposed once in a month.
- ✓ Spent oil and oil containing waste residues, barrels are of scheduled as Hazardous waste which must be collected regularly and stored away from DG yard or any other Flammable sources. It shall be handed over to authorized recyclers for further processing.
- ✓ Vegetation and other ground cover serve to shield soil from erosive water (and wind) impacts; by intercepting rainwater and improving soil permeability
- ✓ Impervious flooring should be provided to avoid spillage as well as for the storage of raw material.

4.3.4 Water Environment

- The project activities that are likely to affect the water environment are operation of ETP and Rainwater Harvesting.
- The aspects like reduced availability of water to the surrounding people, recycling and reuse of water, mixing of Sewage to the nearby natural drain.
- The potential impact will be as follows:
  - ✓ Increase in fresh water requirement for the project activity including process operations, domestic use and greenbelt development.
  - ✓ Sewage generation from the project activity.
  - ✓ Effluent generation from the project activity. Effluent recycling reduces the water consumption and dependency of fresh water for Process requirement.
  - ✓ Probability of ETP failure risk.
  - ✓ The presence of pathogens will cause health hazards to humans like diarrhea, vomiting, cramps, nausea, headaches, fever, fatigue, etc.
  - ✓ Spillage/ Disposal of ETP Salt on ground will contaminate the soil and ground water.
- The mitigation measures proposed are as follows:
  - ✓ Fresh water required for the project will be sourced from TANSIDCO water supply distribution system
  - ✓ Effluent shall be conveyed to ETP with RO system through double walled pipes and shall be utilized for process operations and greenbelt development.
  - ✓ ETP salts will be scientifically stored and handed over to authorized Recyclers/TSDF
  - ✓ Ensure water-tight plumbing arrangements and recycling arrangements
  - ✓ Fixtures for showers, toilet flushing and drinking water should be of low flow type by adopting the use of aerators/pressure reducing devices/sensor-based control.

- ✓ Continuous operation of ETP should be ensured and the treated effluent shall be sent to underground line connecting the Common ETP facility
- ✓ Continuous operation of ETP with RO system shall be ensured by providing backup power source.

4.3.5 Socio Economic Environment

- The project activities that are likely to affect the socio-economic environment are occupancy, operation of ETP, rainwater harvesting, transportation of raw materials and products and implementation of occupational health and safety practices.
- The aspects like Increased employment opportunities, avoiding the direct disposal of sludge to nearby surroundings, Healthy and safe working environment for the employees.
- The potential impact will be as follows:
  - ✓ Improve the lifestyle and infrastructure of the local area.
  - ✓ The project development would enhance the landscape of the area by attracting direct and indirect employment operation phases of the project. This would also improve the revenue generation to the local body/government which would result in increased spending on the local infrastructure thus improving the living conditions of the people in the long run.
  - ✓ Influx of population increases the generation of different kinds of wastes from the population. This would increase the load on the public infrastructure and various services provided by the local body/government thus affecting the quality of services offered to the general public in the locality during the initial periods.
  - ✓ The health of the local inhabitants, inhouse employees and the surrounding sensitive environment may be impacted on improper sewage, effluent and emissions disposal due the plant operations.

The identified impacts on the socio-environment will have a positive impact on the environment.

- The mitigation measures proposed are as follows:
  - ✓ Appropriate regulations and planning by the local body/government shall ensure that the revenue generation due to the project is spent on all necessary public goods and services that would improve the social wellbeing of the people.
  - ✓ Appropriate waste management measures shall be implemented as suggested in the EMP so as to reduce or avoid the waste throughput into the environment.
  - ✓ Proper planning and utilization of the direct and indirect revenue generation to the local body due to the development would ensure the public goods and services in the surroundings.
  - ✓ Continuous operation of ETP shall be ensured with backups in case of failures. The sludge shall be managed as per TNPCB norms.
  - ✓ Health Camps in the neighbouring villages shall be conducted periodically.
  - ✓ Occupational Health and Safety of the Employees shall be ensured including pre placement medical screening and periodic medical checkups.

Corporate Environmental Responsibility

The overall project cost is Rs. 4.52 Crores. The proponent has allocated 1% of the project cost which is equal to 4.52 lakhs for CER activities. The budgetary allocation for CER activities is provided in Table 4.5.

Table 4.5: Budgetary allocation for CER Activities

Beneficiary	Type of CER Activity	Budgetary Allocation (Rs. In Lakhs)
Government Higher Secondary School, Vellimedupettai Village, Tindivanam Taluk, Villupuram District	• Construction of New Toilet Facility (4 Toilets – 2 Male + 2 Female) • Carrying out electrical maintenance activities, including replacement of electrical fixtures. • Conducting life skill training program	4.52
Total		4.52

4.3.6 Biological Environment

- In long-term view after the completion of the project, in the evolutionary processes no structural changes in the region is expected, such as change in the topography, geology, soil, temperature, and vegetation, and combinations of any of these components.
- During the Operation phase usage of machinery can elevate the PM, SOx, NOx and CO levels in the atmosphere. Poor air quality will affect the Flora and fauna due to poor, air quality monitoring need to be done during construction and any impacts need to be protected.

Mitigation Measures

- The construction of the compound wall of the project site should be completed before the commencement of the construction activities at the site.
- Eradication of invasive species at the site (for eg: *Prosopis juliflora*) by adopting mechanical vegetation clearance or by organic herbicides.
- The greenbelt development shall be undertaken in the pre-construction and construction phases. The forest department may be approached for obtaining saplings of local native species for plantation in the greenbelt.
- Only organic herbicides, fertilizers and pesticides shall be used for the green belt development.
- Restrict construction activities requiring high levels of illumination to daylight hours to reduce the requirement of artificial lighting to the extent possible.
- 33% of the land area shall be utilized for greenbelt development
- Biodiversity conservation plan shall be implemented in consultation with the Forest Department.

The impact evaluation for the operation phase is provided below (Table 4.6)

Table 4.6: Impact Evaluation Matrix – Operation Phase

Environmental Parameter	Project Activity	Aspects	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				Mitigation/EMP Proposed
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	
Air Environment	Operation of DG Sets, ETP and Other Process Equipment	Increase in emissions like SO_2, NO_2, and Particulate matter	Causes Health hazards to humans such as Respiratory Problems, Lung Disorders, and Visual Impairment, etc.	Direct and Negative	-3	3	-9	Moderate	✓
	Usage of Power and Energy	Usage of High-Speed Diesel releases CO, PM, SO_2 into the atmosphere		Direct and Negative	-2	3	-6	Minor	
	Movement of Vehicles	Generation of Dust Clouds, Increases the concentration of PM, NO_2, CO	Causes Health hazards to humans such as Respiratory Problems, Lung Disorders, and Visual Impairment, etc.	Direct and Negative	-3	2	-6	Minor	✓
Noise level	Operation of DG Sets, ETP, and Other Process Equipment	Increase in Noise	Increase in noise will cause health hazard to humans like fatigue from	Direct and Negative	-2	3	-6	Minor	
				Indirect and Negative	-2	2	-4	Minor	

Environmental Parameter	Project Activity	Aspects	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				Mitigation/EMP Proposed
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	
	Vehicular Movement	Increase in Noise	lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss. Also increase in noise level will make animals and birds to relocate to a calmer area for habitation. Increase in vibration will leads to fatigue, stomach problems, headache, loss of balance and "shakiness" shortly after or during exposure.	Direct and Negative	-3	2	-6	Minor	✓
Land Environment	Spillage of Spent Oil from DG Sets	Contamination of Heavy Metals in the Soil	Reduces the growth of Flora Reduces Yield of the plant in the contaminated Soil	Direct and Negative	-2	2	-4	Minor	✓
	Spillage of untreated Sewage/effluent	Decreases the DO concentration in Soil Creates Fly nuisance in the surrounding	Turns the soil into a septic condition (anaerobic) which is not suitable for Flora Creates nuisance to humans due to flies and breed due to sewage on the ground.	Direct and Negative	-3	1	-3	Non Significant	
	Improper Storage and Disposal of Solid Waste	Creates Fly nuisance in the surrounding Contamination of Top Soil	Unhygienic conditions and the spread of diseases to the humans	Indirect and Negative	-2	2	-4	Minor	

Environmental Parameter	Project Activity	Aspects	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				Mitigation/EMP Proposed
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	
	Green Belt Development/ Increase in Green Cover	Increases the Soil Stability, Soil Nutrients.	Increases the richness of Top Soil Reduces the Air/Noise pollution level within the site boundary	Direct and Positive	+3	2	+6	Moderate	
Water Environment	Extraction of Surface/Ground Water	Reduces the availability of Water to the surrounding people and activity	This will leads to water scarcity in the surrounding area.	Direct and Negative	-3	1	-3	Non Significant	
	Operation of ETP	Recycling and reuse of water	Reduces Water Consumption and dependency on fresh water for domestic activity	Directand Positive	+3	3	+9	Moderate	✓
		Mixing of Sewage, Effluent to the nearby Natural Drain	An Increase in the concentration of BOD and COD will reduce the concentration of Dissolved oxygen which will turn the water source into a septic condition. The Presence of Pathogens will cause health hazards to humans like diarrhea, vomiting, cramps, nausea, headaches, fever, fatigue, etc.	Direct and Negative	-3	3	-9	Moderate	
		Increase in Sewage generation due to Housekeeping activities		Direct and Negative	-2	2	-4	Minor	
	Rainwater Harvesting	Collecting and storing rainwater in a harvesting sump for future use	Reduced the dependency on freshwater from Surface / Ground Water	Direct and Positive	+3	2	+6	Moderate	✓
Socio Economic Environment	Occupancy	Increases the employment opportunities	Improve the lifestyle and local infrastructure of the local area.	Direct and Positive	+3	2	+6	Moderate	

Environmental Parameter	Project Activity	Aspects	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/ Negative	Significance				Mitigation/EMP Proposed
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	
	Operation of ETP and Process Equipment	Avoiding the direct disposal of sludge to the nearby surrounding	Act as manure on composting which helps to improve the topsoil richness and helps the plant growth.	Direct and Positive	+3	3	+9	Moderate	✓
	Transportation of Raw Materials and Products	Increase in Local Employment	Improve the lifestyle and local infrastructure of the local area.	Direct and Positive	+3	3	+9	Moderate	✓
	Implementation of Occupational Health and Safety Practices	Healthy and Safe working environment for the employees	Creates a better and healthy workplace for the employees	Direct and Positive	+2	3	+6	Minor	✓
Biological Environment	Increase in Fugitive emission and Emissions due to operations DG, Process Equipment and ETP	Disorder/ Diseases/ Loss of Flora and Fauna in the Local area	This leads to species isolation, reduces the area where they can live, and creates new ecological boundaries.	Direct and Negative	-3	2	-6	Moderate	✓
	Usage of Manure for Green Belt	Improved organic matter in the Soil	Increases the richness of the topsoil which will help the plant growth	Direct and positive	+3	2	+6	Moderate	✓

The impact evaluation for the accident/emergency phase of the project is given in the below Table 4.7.

Table 4.7: Impact Evaluation Matrix - Accident/Emergency phase

Environmental Parameter	Project Activity	Aspects	Probable Impacts	Type and Nature of Impact Direct /Indirect and Positive/Negative	Significance				Mitigation/EMP Proposed
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	
Air Environment	Earthquake	Probable release of Dust into the atmosphere	Will create health Hazard to humans like Respiratory Problems, Lung Disorders, and	Indirect and Negative	-3	2	-6	Moderate	
	Fire Accident	Increase of emissions to the atmosphere		Direct and negative	-3	2	-6	Moderate	✓

Environmental Parameter	Project Activity	Aspects	Probable Impacts	Type and Nature of Impact Direct /Indirect and Positive/Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	Mitigation/EMP Proposed
	Accidental Release of Acidic and Alkaline Fumes	Increase of Chemical concentration in the atmosphere	Visual Impairment. Also, create health hazard/Loss of the fauna present in the surrounding	Direct and negative	-3	3	-9	Moderate	
Noise level	Earthquake	Increase in ambient Noise	An increase in noise will cause health hazards to humans like fatigue from lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss. Also, an increase in noise level will make animals and birds to relocate to a calmer area for habitation.	Indirect and Negative	-2	2	-4	Minor	
	Fire Accident	Impulsive Noise due to fire Accident		Indirect and Negative	-2	2	-4	Minor	✓
Land Environment	Flood/Tsunami	Topsoil Removal Reduces Soil Stability Leeching of Soil nutrients like organic matter, NPK, etc.	The reduction of Topsoil and Soil nutrients will lead to a reduction in floral growth and loss of microspecies density in the surrounding.	Direct and negative	-3	3	-9	Moderate	
Water Environment	Flood/Tsunami	Contamination of Surface Water	Contamination of the water leads to an increase in health hazards to human loss of aquatic species	Direct and negative	-2	2	-4	Minor	
	Fire Accident	Contamination of Surface Water		Direct and negative	-2	2	-4	Minor	✓
Socio-Economic Environment	Earthquake	Loss of Livelihood of people Damage to the Plant and types of machinery on the project site	Property Damage and Loss of Humans and animals.	Direct and negative	-2	2	-4	Minor	
	Flood/Tsunami	Loss of Livelihood of people		Direct and negative	-2	2	-4	Minor	
	Fire Accident	Loss of lives and Property		Direct and negative	-2	2	-4	Minor	✓
Biological Environment	Earthquake	Migration of Faunal Species	This leads to species isolation reduce the area where they can	Indirect and Negative	-2	2	-4	Minor	
	Flood/Tsunami	Loss of Flora and Fauna species		Direct and negative	-2	2	-4	Minor	✓

Environmental Parameter	Project Activity	Aspects	Probable Impacts	Type and Nature of Impact Direct /Indirect and Positive/Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	Mitigation/EMP Proposed
	Fire Accident	Loss of Flora and Fauna species	live, and creates new ecological boundaries. Reduction in Species Diversity and its density						
Risk And Hazard	Fire Hazard	Fire due to Spillage or Leak of Chemical/Electrical in the warehouse	Possibility of injury or loss of lives of people in the near surroundings.	Direct and negative	-3	2	-6	Moderate	✓
	Electrical Hazard	Electrocution due to Electrical items	Loss/injury to the employee	Direct and negative	-2	2	-4	Minor	✓
	Slips, Trips and Fall	Falling of objects from Heights	Injury/Loss of employee	Direct and negative	-3	2	-6	Moderate	✓

The impact evaluation for the Closure phase of the project is given in Table 4.8:

Table 4.8: Impact Evaluation Matrix – Closure Phase

Environmental Parameter	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	Mitigation/EMP Proposed
Air Environment	Demolition of project	Increase in PM Concentration	PM will create health hazards to humans by passing through their bloodstream	Direct and negative	-3	2	-6	Moderate	
Noise level	Demolition of project	Increase in Impulsive Noise Level	An increase in noise will cause health hazards to humans like fatigue from lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss.	Indirect and Negative	-3	2	-6	Moderate	
Land Environment	Demolition of project	Contamination of topsoil with debris	Loss of micro species on the topsoil	Indirect and Negative	-2	2	-4	Minor	
	Spillage and Contamination of Soil	Increase in chemical constituents in Soil	Decrease in Dissolved Oxygen level of Top Soil	Direct and negative	-2	2	-4	Minor	
	Land use change due to the closure of the Unit	Loss of Green Cover established earlier in the Project Site.	Loss or Reduction of Micro Species in the Green cover establishes on the project site.	Direct and negative	-1	2	-2	Non – Significant	

Environmental Parameter	Project Activity	Aspect	Probable Impact	Type and Nature of Impact Direct /Indirect and Positive/Negative	Significance				
					Significant (S)	Probability (P)	Total Weightage (S X P)	Impact Scoring	Mitigation/EMP Proposed
Water Environment	Demolition of project	Contamination of Surface Water due to debris	Create Health hazards to humans and increases the cost of treatment of the water.	Indirect and Negative	-2	2	-4	Minor	
	Dismantle Machinery, Equipment, etc.	Contamination of Metal Scrap and Other Wastes during Housekeeping		Direct and negative	-2	1	-2	Minor	
Socio-Economic Environment	Demolition of project	Loss of Livelihood	Loss of Employment	Direct and negative	-1	2	-2	Non – Significant	
	Dismantle Machineries and Equipment	Loss of Employment	Reduces the spending power of the people due to loss of employment and decrease in living standards.	Direct and negative	-3	2	-6	Moderate	
		Loss of Revenue to the Government		Direct and negative	-3	2	-6	Moderate	
Biological Environment	Demolition of project	Loss of Micro Habitat in the surrounding	This leads to species isolation, reduces the area where they can live, and creates new ecological boundaries.	Indirect and Negative	-3	2	-6	Moderate	

CHAPTER 5

ANALYSIS OF ALTERNATIVES

The chapter emphasizes the alternatives with respect to site, waste management options and fuel alternatives.

5.1 SITE SELECTION

TANSIDCO has already established the Mega Pharma Cluster at Tindivanam with all necessary infrastructure for pharmaceutical industries. Accordingly, M/s. Juvenus Drugs has procured the land parcel at Plot No. 38, Survey Nos. 16 & 17 within the TANSIDCO Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu for establishing the proposed API and Intermediates Manufacturing Unit. Hence, no alternative site has been considered.

5.2 WASTE MANAGEMENT PRACTICES

5.2.1 Wastewater management

Septic tank with soak pit will be provided to treat the sewage generated from the project activity. This treatment is selected as the sewage generation per day is less than 5 KLD and it's easy to maintain.

An Effluent Treatment Plant (ETP) has been proposed for treating the effluent. The ETP is designed to reduce the fresh water requirement for the manufacturing process. The treated effluent from the RO will be utilized for greenbelt development.

5.2.2 Solid Waste management

The solid waste generated (24.6 kg/day) from the project site will be collected, segregated and stored in the colour coded bins and handed over to the TANSIDCO daily waste collection system. The TANSIDCO will hand over the solid waste collected to Municipal Solid Waste Management Centre or it has proposed to setup a solid waste management facility to handle/treat the solid waste generated from the TANSIDCO Mega Pharma Cluster, Tindivanam.

The alternate options of treating the biodegradable waste are Onsite Composting, Organic Waste Convertor and Bio gas plant were analyzed. As the biodegradable waste generated is only 14.76 kg/day. Hence, it was decided by the management team to hand over the biodegradable waste to the TANSIDCO daily waste collection as it is the most cost-effective and practical option.

5.2.3 Water Conservation Measures

Rain water harvesting sump of capacity 100 m^3 is proposed towards storage and reuse of storm water runoff keeping in mind the peak and overall runoff from the project site.

5.3 FUEL ALTERNATIVES

PNG is used for the boiler for cleaner combustion. The alternate options were briquette, coal and furnace oil. The industry has adopted PNG due to lower emissions of PM, SO_2 and NO_x when compared to briquette, coal and furnace oil.

To reduce SO_2 emissions, low-sulphur fuels such as LDO and HSD will be used in the thermo pack heater and DG sets, replacing conventional furnace oil and other high-sulphur fuels.

CHAPTER 6
Environmental Monitoring Program

The Environmental Monitoring Program is a vital process in successful implementation the Environment Management Plan (EMP) for the project development. This helps in signalling the potential problem that would result from the project and allow for prompt implementation of necessary corrective measures. As per the guidelines of MoEF&CC, the environmental monitoring process is required during the construction and operational phases. The environmental monitoring will be done through NABL laboratory. The six monthly compliance reports will be submitted in the PARIVESH portal. The environmental monitoring schedule for the construction and operation phases of the project is provided in Table 6.1 and 6.2, respectively.

Table 6.1 Environmental Monitoring Programme Schedule for Construction Phase

S. No	Description	Monitoring Parameters	Number of Locations/ Samples	Frequency of Sampling and Analysis	Budgetary Allocation Rs.
1	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2 & CO	4	Monthly once	2,64,000/-
2	Stack Emissions from DG set	PM, SO_2, NO_x & HC	2	Monthly once	60,000/-
3	Ambient Noise Level	The Noise level in dB (A) Leq (Day & Night) time	6	Monthly once	12,000/-
4	Water Quality Monitoring	All parameters mentioned in IS:10200:2012	2	Monthly once	1,32,000/-
5	Soil Quality Monitoring	pH,Sodium as Na, Potassium as K ,Total Nitrogen as N,Phosphorous as P ,Calcium as Ca,Magnesium as Mn,Organic	2	Monthly once	1,20,000/-

		Carbon, sodium adsorption ratio (SAR)			
Total					**5,34,000/-**

Table 6.2 Environmental Monitoring Programme Schedule for Operation Phase

S. No	Environmental Description	Monitoring Parameters	Number of Locations/ Samples	Frequency of Sampling and Analysis	Budgetary Allocation Rs.
1	Ambient Air Quality	PM_{10}, PM $_{2.5}$, SO_2, NO_2, CO & VOCs	4	Monthly once	3,36,000/-
2	Work place Air Quality Monitoring	VOCs	3	Monthly once	72,000/-
3	Stack Emissions (Boiler, DG sets)	Particulate Matter, SO_2, NO_x	2	Monthly once	60,000/-
4	Process Stack Emissions	Particulate Matter, SO_2, NO_x & VOCs	2	Monthly once	84,000/-
5	Ambient Noise Level	The Noise level in dB (A) Leq (Day & Night) time	6	Monthly once	4,800/-
6	ETP Treated Water	pH, Total Dissolved Solids, Total Suspended Solids, Ammonical Nitrogen, Free Ammonia, Total Kjeldahl Nitrogen, Free Residual Chlorine, Chloride, COD, BOD, Sulphate, Sulphide, Fluoride, Dissolved Phosphate, Hexavalent Chromium,	1	Monthly once	24,000/-

		Total Chromium, Boron, Copper, Nickel, Phenolic Compound, Arsenic, Lead, Cadmium, Selenium, Zinc & Mercury			
Total					**5,08,800/-**

Work Zone Monitoring Arrangement for Hazardous Chemicals (Health Assessment)

Arrangement for Monitoring in the Work Zone

Monitoring is conducted to assess potential exposure of operators to hazardous chemicals. Exposure may occur due to:

- Mechanical failure of hoses or seals.
- Inadequate closure of hatches and chutes.
- Activities such as:
- Sample collection and testing.
- Truck loading and unloading, and filling of drums.
- Equipment cleaning and maintenance.
- Opening of tanks and other equipment.
- Accidental spills.

Method of Testing: NIOSH Method 2541 (National Institute for Occupational Safety and Health).

Duration of Sampling: 6–10 hours per sampling session.

Benefits of Monitoring:

- Control potential health risks to operators.
- Provide guidance for implementing control measures, including:
- Elimination – Removing the hazardous chemical or process if possible.
- Substitution – Replacing with a less hazardous material.
- Engineering Controls – Ventilation, containment, and automation to reduce exposure.
- Safe Work Practices (Administrative Controls) – Standard operating procedures, training, and scheduling.
- Personal Protective Equipment (PPE) – Gloves, respirators, protective clothing, etc.

CHAPTER 7
ADDITIONAL STUDIES

7.0 RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

In order to support the environment impact assessment and environment management plan, following additional studies have been included in the report.

- Risk and Hazard assessment
- Disaster Management Plan
- On-site and off-site emergency action plan
- Occupational Health and Safety Management System

7.1 PUBLIC CONSULTATION

The draft EIA report is herewith prepared to conduct the Public Hearing. Post to the Public Hearing the responses to the issues raised during Public Hearing will be incorporated in the EIA Report.

7.2 REHABILITATION AND RESETTLEMENT (R & R)

The unit is located in TANSIDCO Industrial Estate and land use is intended for industrial activity. Hence, R & R is not applicable.

7.3 HAZARD IDENTIFICATION

Risk is a measure of potential economic loss or human injury in terms of the probability of the loss or injury occurring and magnitude of the loss or injury if it occurs.

Risk thus comprises of two variables:

- Magnitude of consequences and;
- The probability of occurrence.

The Quantitative Risk Analysis (QRA) study is done to identify and assess those hazards and risks arising from their activities connected to the handling of hazardous chemicals and associated infrastructure that require management to comply with regulatory requirements, company policy and business requirements. It is done to eliminate or reduce to As Low As Reasonably Practical (ALARP) in terms of risk to human health, risk of injury, risk of damage to plant, equipment and environment, business interruption or loss etc.

7.4 RISK ASSESSMENT

Hazard identification and risk assessment involves a series of steps as follows:

Step 1: Identification of the Hazard

Hazard identification is a critical step in Risk Assessment. Many aids are available, including experience, engineering codes, checklists, detailed process knowledge, equipment failure experience, hazard index techniques, What-if Analysis, Hazard and Operability (HAZOP) Studies, Failure Mode and Effects Analysis (FMEA), and Preliminary Hazard Analysis (PHA).

In this phase all potential incidents are identified and tabulated. Site visit and study of operations and documents like drawings, process write-up etc. are used for hazard identification

Step 2: Assessment of the Risk

Consequence estimation is the methodology used to determine the potential for damage or injury from specific incidents. A single incident (e.g. rupture of a pressurized flammable liquid tank) can have many distinct incident outcomes (E.g. Unconfined Vapor Cloud Explosion (UVCE), Boiling Liquid Expanding Vapor Explosion (BLEVE), flash fire, etc.) Likelihood assessment is the methodology used to estimate the frequency or probability of occurrence of an incident. Estimates may be obtained from historical incident data on failure frequencies, from failure sequence models, such as fault trees and event trees or both. In this study the historical data developed by software models and those collected by CPR18E – Committee for Prevention of Disasters, Netherlands (Edition: PGS 3, 2005) are used. Risks arising from the hazards are evaluated for its tolerability to personnel, the facility and the environment. The acceptability of the estimated risk must then be judged based on IS-15656 criteria appropriate to the particular situation.

Step 3: Elimination or Reduction of the Risk

This involves identifying opportunities to reduce the likelihood and/or consequence of an accident Where deemed to be necessary. Risk assessment combines the consequences and likelihood of all incident outcomes from all selected incidents to provide a measure of risk. The risk of all selected incidents are individually estimated and summed to give an overall measure of risk. Risk-reduction measures include those to prevent incidents (i.e. reduce the likelihood of occurrence) to control incidents (i.e. limit the extent and duration of a hazardous event) and to mitigate the effects (i.e. reduce the consequences). Preventive measures, such as using inherently safer designs and ensuring asset integrity, should be used wherever practicable. In many cases, the measures to control and mitigate hazards and risks are simple and obvious and involve modifications to conform to standard practice. The general hierarchy of risk reducing measures is:

- Prevention (by distance or design)
- Detection (E.g. fire and gas, Leak detection)
- Control (E.g. emergency shutdown and controlled depressurization)
- Mitigation (E.g. firefighting and passive fire protection)
- Emergency response (In case safety barriers fail)

7.4.1 Details of the Software

PHAST and PHAST Risk (SAFETI) 9.0 Version. The software developed by DNV is used for risk assessment studies involving flammable and toxic hazards where individual and societal risks are also to be identified. It enables the user to assess the physical effects of accidental releases of toxic or flammable chemicals.

PHAST is used for consequence calculations and PHAST Risk (SAFETI) is used for risk calculations. It contains a series of up to date models that allow detailed modeling and quantitative assessment of release rate pool evaporation, atmospheric dispersion, vapor cloud explosion, combustion, heat radiation effects from fires etc.,

The software is developed based on the hazard model given in TNO Yellow Book as the basis. The software is developed based on the various incidents that had occurred over past 25 years. VAL has used the latest version of PHAST software for developing the consequences and risks for each model.

7.4.2 Methodology

The Quantitative Risk Assessment (QRA) methodology involves systematic steps to evaluate hazards associated with handling hydrocarbons and other hazardous materials. Hazard identification is the first step, focusing on uncontrolled releases that may ignite and cause fire or explosion. Each hazard is then developed into accident scenarios such as leaks or ruptures, followed by source term modeling to define release parameters based on inventory, process conditions, release size, and weather. Consequence modeling is carried out to predict the impacts of jet fires, pool fires, toxic or flammable gas dispersion. Frequency analysis, supported by historical data, estimates the likelihood of these events, while ignition probabilities are assessed in line with established criteria. Risk analysis integrates the calculated consequences and frequencies to determine individual risk levels. Risk summation combines all events to quantify overall facility risk, which is then benchmarked against acceptance criteria to classify risks as tolerable, ALARP, or unacceptable. Hazard identification emphasizes the role of material composition, inventory, and process parameters in defining consequence severity. Typical scenarios considered include loss of containment from storage tanks, drums, vessels, or pipelines. Accidental releases of flammable materials can lead to localized fires or, in case of delayed ignition, large-scale explosions with severe impacts on people, property, and the environment. Figure 7.1 shows the QRA methodology.

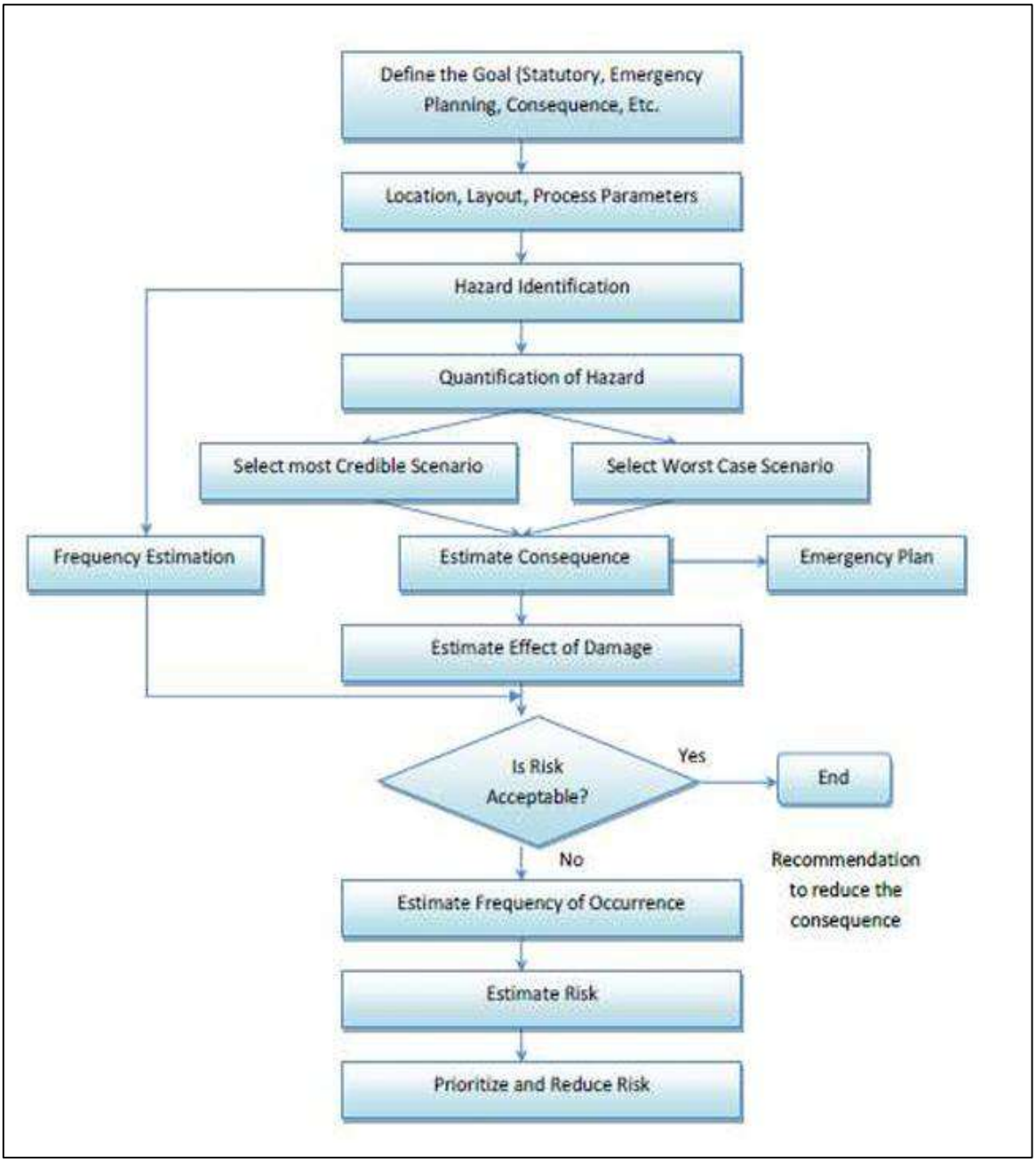


Figure 7.1: QRA Methodology

7.4.3 List of Chemicals Considered for QRA

The hazardous solvents will be stored in HDPE barrels under room temperature. 10 chemicals were taken for the study. The details of the chemicals and their properties are given in table 7.1

Table 7.1 List of Chemicals and its Properties

S. No.	Chemical Name	State at Room Temperature	Flash Point	Hazard Type	Hazardous Properties of Chemicals
1.	Isopropyl Alcohol	Liquid	12	Flammable	Highly flammable; vapors can form explosive mixtures with air. Irritating to eyes and respiratory tract.
2.	Acetone	Liquid	-20	Flammable	Extremely volatile and flammable. Can cause dizziness and respiratory irritation. May defat skin on contact.
3.	Methylene dichloride	Liquid	39-40	Toxic	Volatile and toxic. Can cause central nervous system depression, liver damage, and is a potential carcinogen
4.	Tetrahydrofuran	Liquid	-14	Flammable, Toxic	Forms explosive peroxides upon prolonged exposure to air. Toxic fumes; irritates eyes, skin, and

S. No.	Chemical Name	State at Room Temperature	Flash Point	Hazard Type	Hazardous Properties of Chemicals
					respiratory tract.
5.	n-Hexane	Liquid	-26	Flammable, Toxic	Neurotoxic with prolonged exposure. Highly flammable. Can cause peripheral neuropathy and skin irritation.
6.	Toluene	Liquid	4	Flammable	Flammable and volatile. Can affect the central nervous system. May cause developmental toxicity with chronic exposure.
7.	Ethyl acetate	Liquid	-4	Flammable	Flammable and volatile. Can cause eye and respiratory irritation. May lead to narcosis at high concentrations.
8.	Acetonitrile	Liquid	2	Flammable, Toxic	Toxic and volatile. Can release cyanide upon metabolism. Affects liver

S. No.	Chemical Name	State at Room Temperature	Flash Point	Hazard Type	Hazardous Properties of Chemicals
					and central nervous system.
9.	Chloroform	Liquid	Non flammable	Toxic, Reactive	Nonflammable but highly toxic. Can cause liver and kidney damage. Suspected carcinogen and may react with strong bases
10.	Pet-ether	Liquid	-26	Flammable	Extremely flammable. Contains a mixture of hydrocarbons; inhalation can cause dizziness, nausea, and CNS effects.

7.4.4 Accident Scenarios

A list of failure cases was prepared based on process knowledge, engineering judgment, experience, past incidents associated with such facilities and considering the general mechanisms for loss of containment.

The leak sizes (Table 7.2) are considered based upon the failure database for various facilities as mentioned below:

Table 7.2 Leak size distribution

S.No.	Leak Description	Representative Hole Diameter	Remarks
1.	Small (0-10mm)	5 mm	Represents release due to failure of small-bore piping (instrument tapping, drain connection etc.).

2.	Medium (10-50mm)	25 mm	Represents leaks from flange joints and pump seals.
3.	Large (50-150 mm)	100 mm	Represents release due to failure of large section of equipment or piping (e.g., damage due to external impact, failure of flexible pipe/ hose).
4.	Rupture	>150 mm	Represents release due to failure of large section of equipment or piping equivalent to its rupture / full bore release.

Source: Leak sizes are taken from Centre of Chemical Process Safety (CCPS) AIChE

Scenarios considered for QRA Report is mentioned in Table 7.3.

Table 7.3 List of Scenarios for QRA

S.No	Loss of Containment	Storage Condition	Scenario
1.	Isopropyl Alcohol	HDPE Drums	Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
2.	Acetone	HDPE Drums	
3.	Methylene dichloride	HDPE Drums	
4.	Tetrahydrofuran	HDPE Drums	
5.	n-Hexane	HDPE Drums	
6.	Toluene	HDPE Drums	
7.	Ethyl acetate	HDPE Drums	
8.	Acetonitrile	HDPE Drums	
9.	Chloroform	HDPE Drums	
10.	Pet-ether	HDPE Drums	

7.4.5 Atmospheric Stability Classes

The consequences of flammable material release are strongly influenced by prevailing meteorological conditions, especially those affecting dispersion. Important parameters include wind speed, wind direction, temperature, and atmospheric stability, while rainfall has little direct effect but can help by washing out pollutants. Atmospheric stability refers to the atmosphere's ability to resist or enhance vertical air motion and turbulence. It depends on temperature lapse rate, wind speed, and surface roughness. A neutral atmosphere (Class D) neither enhances nor suppresses turbulence, unstable conditions (Classes A–C) enhance turbulence and mixing, while stable conditions (Classes E–F) suppress turbulence and limit dispersion. The Pasquill-Turner classification system defines six stability classes (Table 7.4): **A (very unstable), B (unstable), C (slightly unstable), D (neutral), E (stable), and F (very stable).** These classes are linked to solar radiation, wind speed, and cloud cover during day and night. In unstable conditions, vertical mixing disperses flammable material rapidly, reducing localized hazard concentration. Conversely, stable conditions inhibit dispersion, increasing

persistence and risk. Neutral conditions represent a balanced state, typically occurring during overcast or transitional periods.

Table 7.4 Typical Pasquill Stability classes

Wind Speed (m/s)	Day: Solar Radiation			Night: Cloud Cover		
	Strong	Moderate	Slight	Thin<40%	Moderate	Overcast >80%
<2	A	A-B	B	-	-	D
2-3	A-B	B	C	E	F	D
3-5	B	B-C	C	D	E	D
5-6	C	C-D	D	D	D	D
>6	C	D	D	D	D	D

7.4.6 Wind Data

The wind conditions considered for the study are 2/F and 5/D.

The following weather parameters will be taken as input for consequence modeling & risk calculation.

Ambient Temperature: 33^0C (Average Annual Temperature)
Minimum Temperature: 16^0C
Maximum Temperature: 42^0C
Average Relative Humidity: 60% (Average annual relative humidity)
Average Solar Radiation Flux: 1.380Kw/m^2

7.4.7 Frequency analysis

Frequency analysis was conducted for each of the release scenarios identified based on the number of potential leak sources contained within each isolatable section. Leaks may occur from various components such as pipes, valves and flanges. Each component has a generic historical leak frequency per single item such as a leak frequency per flange-year or per meter of pipe per year.

7.4.8 Ignition Probability Estimation

Only a small portion of the potential releases will ignite to become a fire or explosion hazard. The others will disperse, evaporate or be controlled manually before getting in contact with an ignition source, but may poses toxic risks to those exposed. The probability that a release is ignited depends upon the size of the release and the presence of ignition sources within the release area. Delayed ignition probabilities are classified by PHAST Risk into following categories:

- Fixed ignition point – This could relate to a fixed ignition point such as burners, hot surfaces, open flames, welding in the workshop etc. Considering that the new and existing facilities are classified for hazardous area, fixed ignition points would be limited.

- Electrical lines
- Static generation & Lightening

7.4.8.1 Immediate Ignition Probability:

Immediate ignition can be considered as the situation where the fluid ignites immediately on release through auto-ignition or because the accident which causes the release also provided an ignition source. Immediate ignition probability is assumed based on the CPR 18E - Guidelines for Quantitative Risk Assessment, developed by the Committee for the Prevention of Disasters, Netherlands. Probability of Immediate Ignition is provided in Table 7.6.

Table 7.6 Immediate Ignition Probability

Substances	Release rate, continuous	Release rate, instantaneous	Probability direct ignition
Flammable gases and liquids with flash point < 0°C and boiling point < 35°C with medium/ high reactivity	< 10 kg/s	< 1000 kg/s	0.2
	10 - 100 kg/s	1000 – 10.000 kg/s	0.5
	> 100 kg/s	>10.000 kg/s	0.7
Flammable gases and liquids with flash point < 0°C and boiling point < 35°C with low reactivity	< 10 kg/s	< 1000 kg/s	0.02
	10 - 100 kg/s	1000 – 10.000 kg/s	0.04
	> 100 kg/s	>10.000 kg/s	0.09
Flammable liquid with flash point below 21°C	All discharges	All discharges	0.065
Flammable liquid with flash point equal or higher than 21 °C but below 55 °C	All discharges	All discharges	0.01
Flammable liquid with flash point higher than 55 °C	All discharges	All discharges	0

7.4.8.2 Delayed Ignition Probability

Delayed ignition is the result of the build-up of a flammable vapour cloud which is ignited by a source remote from the release point. It is assumed to result in flash fires or explosions, and also to burn back to the source of the leak resulting in a jet fire and/or a pool fire. Delayed

ignition probability is assumed based on the CPR 18E - Guidelines for Quantitative Risk Assessment, developed by the Committee for the Prevention of Disasters, Netherlands.

Table 7.7 Probability of Delayed Ignition

Source Type	Ignition source	Probability of ignition
Point Source	Adjacent Process installation	0.5
	Flare	1.0
	Oven (outside)	0.9
	Oven (inside)	0.45
	Boiler (outside)	0.45
	Boiler (inside)	0.23
Line Source	High –voltage cable (per 100m)	0.2
	ship	0.5
Population Source	Household (per person)	0.01
	Offices (per person)	0.01

7.4.9 Effect of Release

When hazardous material is released, it may form a vapor cloud or liquid pool depending on its phase and containment conditions. Vapor releases disperse with wind and may ignite, causing flash fires or explosions, while liquid spills form pools that can evaporate and lead to pool fires with thermal radiation hazards. Catastrophic equipment failures may produce fragments, and toxic releases can create vapor clouds travelling long distances before dilution. The behaviour of a release depends on material properties, containment pressure and temperature, release phase, inventory, and prevailing weather conditions. Impact criteria are then applied to relate hazard effects, such as thermal radiation, to potential consequences for people and equipment. The fetal radiation level and exposure level is given in Table 7.8 and 7.9, respectively

Table 7.8 Fetal Radiation Level

Radiation Level (KW/m^2)	Fatality		
	1%	50%	99%
	Exposure in seconds		
4.0	150	370	930
12.5	30	80	200
37.5	8	20	50

Table 7.9 Fetal Radiation Exposure Level

Radiation	Damage to Equipment	Damage to People
1.2	No damage	Solar heat at noon
1.6	PVC insulated cables damaged	Minimum level of pain threshold

2.0	No damage	No damage
4.0	No damage	Causes pain if duration is longer than 20 secs. But blistering is unlikely
6.4	No damage	Pain threshold reached after 8 secs. Second degree burns after 20 secs.
12.5	Minimum energy to ignite wood with a flame; Melts plastic tubing	1% lethality in one minute. First degree burns in 10 secs
16.0	No damage	Severe burns after 5 secs.
25.0	Minimum energy to ignite wood at identifying long exposure without a flame	100% lethality in 1 minute. Significant injury in 10 secs.
37.5	Severe damage to plant	100% lethality in 1 minute. 50% lethality in 20 secs. 1% lethality in 10 secs

Reference: CCPS, Guidelines for Chemical Process Quantitative Risk Analysis

The actual results would be less severe due to the various assumptions made in the models arising out of the flame geometry, emissivity, angle of incidence, view factor and others. The radiation output of the flame would be dependent upon the fire size, extent of mixing with air and the flame temperature. Some fraction of the radiation is absorbed by carbon dioxide and water vapor in the intervening atmosphere. Finally, the incident flux at an observer location would depend upon the radiation view factor, which is a function of the distance from the flame surface, the observer's orientation and the flame geometry.

7.4.10 Overpressure Criteria

There is no simple relationship between overpressures and damage levels. The overpressure damage criteria with respect to people and equipment are provided in Table 7.10 and 7.11, respectively.

Table 7.10 Over Pressure Damage Criteria with Damage to People

Over Pressure (mbar)	Mechanical damage to equipment's	Damage to people
300	Heavy damage to plant & structure	1% death from lung damage >50% eardrum damage >50% serious wounds from flying objects

100	Repairable damage	>1% eardrum damage >1% serious wounds from flying objects
30	Major glass damage	Slight injury from flying glass
10	10% glass damage	No damage

Table 7.11 Over Pressure Damage Criteria with Damage to Equipment

Over Pressure		Mechanical damage to equipment
Bar	**K Pa**	
0.0014	0.14	Annoying noise (137 dB if of low frequency 10–15 Hz)
0.0021	0.21	Occasional breaking of large glass windows already under strain
0.0028	0.28	Loud noise (143 dB), sonic boom, glass failure
0.0069	0.69	Breakage of small windows under strain
0.0103	1.03	Typical pressure for glass breakage
0.0207	2.07	Safe distance" (probability 0.95 of no serious damage below this value);projectile limit; some damage to house ceilings; 10% window glass broken
0.0276	2.76	Limited minor structural damage
0.03-0.069	3.4-6.9	Large and small windows usually shattered; occasional damage to window frames
0.048	4.8	Minor damage to house structures
0.069	6.9	Partial demolition of houses, made uninhabitable
0.138	13.8	Corrugated asbestos shattered; corrugated steel or aluminum panels, fastenings fail, followed by buckling; wood panels (standard housing)fastenings fail, panels blown in
0.09	9.0	Steel frame of clad building slightly distorted
0.138	13.8	Partial collapse of walls and roofs of houses
0.207	20.7	Concrete or cinder block walls, not reinforced, shattered
0.158	15.8	Lower limit of serious structural damage
0.172	17.2	50% destruction of brickwork of houses
0.207	20.7	Heavy machines (3000 lb) in industrial building suffered little damage; steel frame building distorted and pulled away from foundations.
0.207-0.276	20.7-27.6	Frameless, self-framing steel panel building demolished; rupture of oil tanks
0.276	27.6	Cladding of light industrial buildings ruptured

0.345	34.5	Wooden utility poles snapped; tall hydraulic press (40,000 lb) in building slightly damaged
0.345-0.482	34.5-48.2	Nearly complete destruction of houses
0.482	48.2	Loaded, lighter weight (British) train wagons overturned
0.482-0.551	48.2-55.1	Brick panels, 8 –12 in. thick, not reinforced, fail by shearing or flexure
0.62	62.0	Loaded train boxcars completely demolished
0.689	68.9	Probable total destruction of buildings; heavy machine tools (7,000 lb) moved and badly damaged, very heavy machine tools (12,000 lb) survive

As per the guidelines of CPR 18 E Purple Book:

- The lethality of a jet fire and pool fire is assumed to be 100% for the people who are caught in the flame. Outside the flame area, the lethality depends on the heat radiation distances.
- For the flash fires lethality is taken as 100% for all the people caught outdoors and for 10% who are indoors within the flammable cloud. No fatality has been assumed outside the flash fire area.
- Overpressure more than 0.3 bar corresponds approximately with 50% lethality.
- An overpressure above 0.2 bar would result in 10% fatalities.
- An overpressure less than 0.1 bar would not cause any fatalities to the public.
- 100% lethality is assumed for all people who are present within the cloud proper.

7.5 Consequence Analysis

Consequence analysis evaluates the spread of accidental releases that may result in jet fires, pool fires, or explosions causing thermal radiation and overpressure effects. Release duration is defined by the time to detect, isolate, and discharge inventory, with 5 minutes considered in this study for valve closure after detection. Release rates are modeled using representative hole sizes, as these govern hydrocarbon mass flow and release duration. The rates are derived using PHAST, considering material properties, storage conditions, and operating pressures. Larger hole sizes and higher pressures result in proportionally higher release rates and more severe consequences.

7.5.1 Types of Outcome Events

7.5.1.1 Unignited Gas Release / Dispersion

A vapor cloud may form when flammable gas is released. If not ignited, it disperses with wind, and modeling estimates the distance at which concentration drops below the LFL.

7.5.1.2 Flash Fire

A flash fire occurs when a vapor cloud ignites at the edge and burns rapidly toward the source. It lasts only seconds, with the main hazard being direct flame impingement within the LFL boundary.

7.5.1.3 Pool Fire

Spilled flammable liquids form pools that may ignite and burn steadily. Pool fire intensity depends on surface area, fuel depth, and wind. They are less directional than jet fires but can still damage nearby equipment.

7.5.1.4 Toxic Effects

Toxic releases (e.g., CO, H_2S, SOx, NOx) form plumes that may cause acute or chronic health impacts depending on exposure concentration and duration.

The dispersion results, late pool fire results, flash fire results and explosion results are enclosed Table 7.12, 7.13, 7.14 and 7.15.

Table 7.12 Dispersion Results

Path Path	Weather	Distance to UFL [m]	Distance to LFL [m]	Distance to LFL fraction [m]
Study\IPA	Category 2/F	2.00487	4.77587	7.25438
	Category 5/D	2.30584	8.14317	14.7245
Study\Acetone	Category 2/F	4.97525	11.1484	15.2108
	Category 5/D	5.6476	19.2175	28.8772
Study\Methylene dichloride	Category 2/F	6.99662	9.07472	11.9316
	Category 5/D	6.00581	8.89905	13.8917
Study\Tetrahydro furan	Category 2/F	5.68947	12.8555	17.6815
	Category 5/D	6.86212	22.5341	33.0549
Study\n-Hexane	Category 2/F	5.68947	12.8555	17.6815
	Category 5/D	6.86212	22.5341	33.0549
Study\Toluene	Category 2/F	1.96037	5.07653	7.38436
	Category 5/D	2.26121	8.78845	15.3847
Study\Ethyl acetate	Category 2/F	4.97525	11.1484	15.2108
	Category 5/D	5.6476	19.2175	28.8772
Study\Acetonitrile	Category 2/F	2.03697	5.47893	9.06363
	Category 5/D	2.39326	7.10657	13.821
Study\Pet-ether	Category 2/F	15.3844	29.6121	39.2287
	Category 5/D	17.134	40.4343	57.0358

Table 7.13 Late Pool Fire Results

Path	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\IPA	Category 2/F	15.9286	41.25	26.1876	12.2585
	Category 5/D	15.9677	42.7043	28.4331	13.3406
Study\Acetone	Category 2/F	15.7938	47.539	29.7581	13.6493
	Category 5/D	15.6871	49.2039	32.5439	15.2482
Study\Methylene dichloride	Category 2/F	12.1305	15.0755	7.37555	Not reached at height of interest
	Category 5/D	11.9354	17.3331	7.23278	Not reached at height of interest
Study\Tetrahydrofuran	Category 2/F	17.2863	41.3424	23.4835	15.0683
	Category 5/D	17.1877	42.5397	24.3469	16.774
Study\n-Hexane	Category 2/F	17.2863	41.3424	23.4835	15.0683
	Category 5/D	17.1877	42.5397	24.3469	16.774
Study\Toluene	Category 2/F	15.1615	37.7656	18.4242	9.47347
	Category 5/D	15.2038	41.1451	20.5366	9.42809
Study\Ethyl acetate	Category 2/F	15.7938	47.539	29.7581	13.6493
	Category 5/D	15.6871	49.2039	32.5439	15.2482
Study\Acetonitrile	Category 2/F	15.8317	24.402	15.2204	Not reached at height of interest
	Category 5/D	15.8271	25.0901	17.0351	Not reached at height of interest
Study\Pet-ether	Category 2/F	17.3753	42.6	24.6981	15.7914
	Category 5/D	16.8467	43.0617	25.8374	17.8644

Table 7.14 Flash Fire Results

Path	Weather	Distance downwind to LFL [m]	Distance downwind to LFL Fraction [m]
Study\IPA	Category 2/F	4.77587	7.25438
	Category 5/D	8.14317	14.7245
Study\Acetone	Category 2/F	11.1484	15.2108
	Category 5/D	19.2175	28.8772
Study\Methylene dichloride	Category 2/F	9.07472	11.9316
	Category 5/D	8.89905	13.8917
	Category 2/F	12.8555	17.6815

Study\Tetrahydro furan	Category 5/D	22.5341	33.0549
Study\n-Hexane	Category 2/F	12.8555	17.6815
	Category 5/D	22.5341	33.0549
Study\Toluene	Category 2/F	5.07653	7.38436
	Category 5/D	8.78845	15.3847
Study\Ethyl acetate	Category 2/F	11.1484	15.2108
	Category 5/D	19.2175	28.8772
Study\Acetonitrile	Category 2/F	5.47893	9.06363
	Category 5/D	7.10657	13.821
Study\Pet-ether	Category 2/F	29.6121	39.2287
	Category 5/D	40.4343	57.0358

Table 7.15 Explosion Results

Path	Weather	Overpressure level [bar]	Maximum distance[m]	Diameter [m]
Study\IPA	Category 5/D	0.02068 0.1379 0.2068	23.9651 12.7142 12.035	27.9302 5.42842 4.07002
Study\Acetone	Category 2/F	0.02068 0.1379 0.2068	52.1964 18.2012 16.1489	84.3929 16.4023 12.2978
	Category 5/D	0.02068 0.1379 0.2068	75.8462 28.9339 26.6983	131.692 17.8677 13.3965
Study\Methylene dichloride	Category 2/F	0.02068 0.1379 0.2068	40.2279 15.875 14.4048	60.4558 11.75 8.80969
	Category 5/D	0.02068 0.1379 0.2068	51.4183 18.0499 16.0355	82.8365 16.0998 12.071
Study\Tetrahydro furan	Category 2/F	0.02068 0.1379 0.2068	57.4957 19.2311 16.9211	94.9913 18.4622 13.8423
	Category 5/D	0.02068 0.1379 0.2068	85.5083 32.732 29.546	131.017 25.464 19.0919
Study\n-Hexane	Category 2/F	0.02068 0.1379 0.2068	57.4957 19.2311 16.9211	94.9913 18.4622 13.8423

	Category 5/D	0.02068 0.1379 0.2068	85.5083 32.732 29.546	131.017 25.464 19.0919
Study\Toluene		0.02068 0.1379 0.2068	28.9678 13.6865 12.764	37.9356 7.37304 5.52802
Study\Ethyl acetate	Category 2/F	0.02068 0.1379 0.2068	52.1964 18.2012 16.1489	84.3929 16.4023 12.2978
	Category 5/D	0.02068 0.1379 0.2068	75.8462 28.9339 26.6983	131.692 17.8677 13.3965
		0.02068	No hazard	0
Study\Acetonitrile		0.1379 0.2068	No hazard No hazard	0 0
Study\Pet-ether	Category 2/F	0.02068	142.083	224.166
		0.1379 0.2068	51.7841 46.3329	43.5682 32.6658
	Category 5/D	0.02068	165.711	271.422
		0.1379 0.2068	65.7034 61.7738	31.4069 23.5477

7.6 RISK ANALYSIS

A Quantitative Risk Analysis (QRA) is a method used to determine the risk caused by the use, handling, transport and storage of hazardous substances. The results of the QRA are, for example, used to assess the acceptability of the risk in relation to the benefits of the activity, to evaluate new developments on and off-site, to estimate the benefit of risk-reducing countermeasures and to determine zoning distances around an activity for land-use planning. The LSIR was estimated based on component failure frequencies and event probability for release scenarios. Note that the LSIR levels represent the cumulative risk from all the major accident events at the project facilities without taking into account personnel exposure factor, vulnerability and probability of escape. The overall Location Specific Risk is developed considering all scenarios pertaining to all Isolatable Sections and are provided in Sections below.

7.6.1 Individual Risk Per Annum (IRPA)

Individual Risk Per Annum (IRPA) is calculated based on the presence of personnel near/within the hazardous facilities.

IRPA = ∑ LSIR x presence factor

Presence factor for this facility was calculated with the following assumptions.

No. of Days in a year 365

No of days as weekends (Sunday)	52
No. of festivals	13
No of working days	313
No of hours in a day	24
No of hours in a shift	8

$$\text{Presence Factor} = \frac{\text{No of working days}}{\text{No of days in a year}} \text{ x } \frac{\text{No of hours in a shift}}{\text{No of hours in a day}}$$

Presence Factor = (300/365)* Fraction of time spent in a day/ shift = 0.82*0.8 = 0.66

The calculated IRPA to the personnel in hazardous area i.e. for populated locations; are calculated and presented below and assessed by comparing with UK HSE risk criteria. It is clear from following table , none of the personnel are exposed to unacceptable risk i.e. risk greater than 1.0E-03 per year. The IRPA to all the personnel categories are in acceptable limits.

S.No.	Personnel located inside the facility	Presence Factor	LSIR Value	IRPA	Risk Level
1.	Canteen Block	0.66	4.14E-07	2.73E-07	**ACCEPTABLE**
2.	R&D	0.66	4.46E-06	2.93E-06	**ACCEPTABLE**
3.	Warehouse	0.66	4.84E-06	3.19E-06	**ACCEPTABLE**
4.	Production Area	0.66	5.73E-06	3.77E-06	**ACCEPTABLE**
5.	Office Block	0.66	2.54E-07	3.31E-07	**ACCEPTABLE**

7.6.2 Societal Risk

Assessment of societal risk is even more important than assessment of individual risk because it involves the likelihood of multiple fatalities. Societal risk is the risk to any person or group of persons who are not connected to project facilities and are outside the facility fence line. It's helpful to consider group risk in the demonstration that risks are ALARP. This allows consideration to be given to events, which, although low in frequency, may cause multiple injuries or fatalities. Group risk can be presented in the form of a plot of cumulative frequency versus number of fatalities (F-N curve).

where, F= frequency (experienced or predicted)
N=no. of multiple fatalities
'N' included indirect deaths caused as a result of the main event occurring and can therefore be difficult to predict. E.g. many people may die years after exposure to a toxic chemical. Risk is under ALARP zone as per UK HSE Guideline. The Societal Risk in the form of FN Curve is presented in the following Figure 7.2.

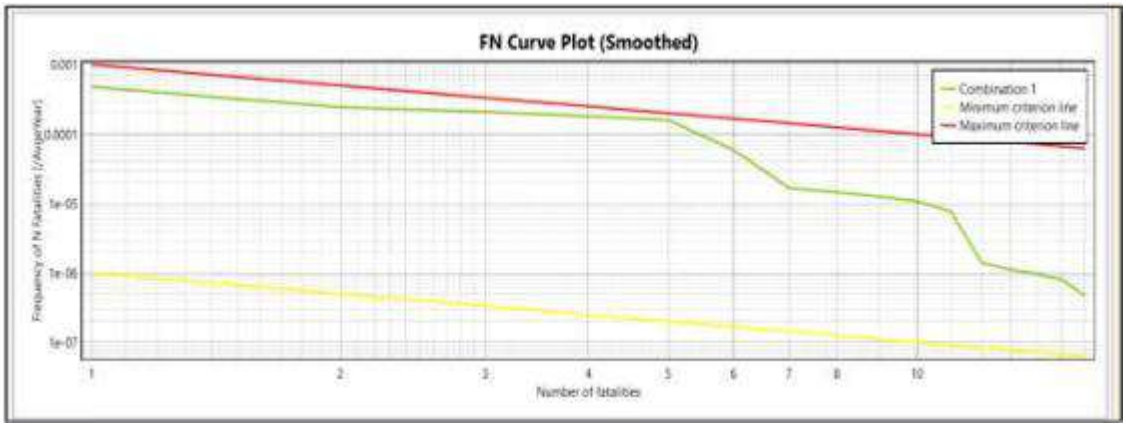


Figure 7.2 FN Curve

The facility can be operated safely if Operational Discipline is strictly maintained.
Some of the points in this regard are as follows –

No quantity of raw materials in excess of the stipulated quantities should be stored in the plant (this possibility always exists since many times 'convenience overrides safety' and to save manpower, more that required / desired quantities are brought and stored in the running plant
Considering the hazard potential, lot of thrust should be given on the instrumentation and interlocks, without compromising on the quality of the hardware used for instrumentation SOPs should be written specifically (quality of some of the existing SOPs scrutinized was very poor, not only from correctness of language point of view but these failed to convey the correct / safe meaning of the intent of doing the activity.

Strict adherence to all SOPs by all levels of employees should be ensured. Any deviation cab result in serious results and hence should be strictly reprimanded.
P.M. schedules should be drawn and followed very rigorously. A small lapse will prove to be disastrous.

All elements of Process Safety Management (particularly Process Hazard Identification, Management of Change) should be strictly adhered to.

7.7 Risk Reduction Measures

Safety Measures for Transportation and Unloading of Hazardous Chemicals

- ➢ Solvent unloading standard procedure will in place and will be implemented for safe unloading of road tanker.
- ➢ Drum handling trolleys will be used for transportation of drums up to plant and internal handling from storage to process area.
- ➢ Display Boards will be provided on all storage tanks which include the name of the chemicals and its major hazardous characteristics.
- ➢ Fire extinguishers will be provided as required.
- ➢ First aids boxes will also be provided at different places wherever required.

➢ Area will be declared as "NO SMOKE ZONE".

Safety Measures for Preventive Maintenance

The safety measures in the form of the general Do's & Don'ts for safety:

➢ Do not work on equipments without permission from plant head and maintenance head.

➢ Make sure equipment is empty and flushed with nitrogen and air.

➢ Check VOC content for flammable / toxic and make sure that no flammable / toxic vapour contents.

➢ Keep proper and adequate fire extinguisher near work area.

➢ Use proper PPE.

➢ Work in any equipment must be conducted in presence of supervisor.

Additional safety measures in form of the checklist covering Do's & Don'ts of preventive maintenance, strengthening of HSE, manufacturing utility staff for safety related measures will be updated timely and will be made available to all concern department & personnel. **Safety measures to prevent spillage/leakage of toxic chemicals**

The preventive maintenance will be planned and carried out as per plan to avoid the failure of valve, pipelines and other component of transferring line. The spillage will be confined to the dyke area underneath the vessel. The resultant splash of such chemicals will result in exposure of toxic chemicals to employees. Decontamination facilities (Safety shower and eye wash fountains) will be provided in the plant area, which can be used to decontaminate the affected employees. Suitable decontamination procedure will be used to decontaminate the spilled or leaked material. The SOP for decontamination will be available with all related department.

7.8 DISASTER MANAGEMENT PLAN

A Disaster Management Plan with a proper communication system, team members with defined roles and responsibilities, an evacuation plan and periodical training shall be prepared and placed within the facility under the control of a Head – EHS who is responsible to handle the situation during disasters. Disasters/risk is an unexpected event due to human errors or natural calamities.

a) Fire Fighting system

Fire Protection Measures:

The firefighting equipment such as Extinguisher Wet riser, Hose reel, Hydrants, Fire alarm system, Smoke Detectors, Fire Pump will met the Part IV, Fire and Life Safety Standards of Fire and Life Safety Standards of National Building Code and will be implemented as recommended by TNF and RS.

To overcome emergencies, the firefighting system shall be provided strictly in compliance with the listed reference standards:

a.	Piping System	Piping system confirming to IS: 1239 (Class-B), IS: 3589 (4.85mm thick for pipe size > 150NB) and IS 10221 M.S. Medium Class for Hydrant and sprinkler system.
b.	Firewater static Storage	Firewater static storage has been provided by NBC requirements.
c.	Fire Pumping system	A Pumping system comprising independent pumps for hydrant, sprinkler and jockey application has been provided.
d.	Hydrant system	External and internal hydrant complete with hose reel.
e.	Sprinkler system	Sprinkler rating and type shall be selected for respective areas
f.	Hand-held fire Extinguishers	Strategically placed in designated areas.

The following Fire Fighting arrangements shall also be made

- Fire Service inlet fitted with Non Return Valve at Gound Level should be provided.
- Fire Detector and the Smoke detectors will be installed at each floor level.
- Hose Reel assembly will be provided in the floor area.
- Yard Hydrants will be provided around the building.
- Smoke from any floor will not obstruct any exit serving any floors of the building.
- Do's and Dont's laminated hanging pads will be available in the prominent places of all floors.

Accessing Fire Service (Free Service):

The Fire Service can be contacted by telephone regarding fire accidents and for the rescue of people/animals caught in distress situations.

A mere phone call giving the proper address and details of the emergency will be required

Fire Control Room: 101 (Select Cities)

Ambulance Service: 108/102

Fire Stations Contact(Villupuram): 04146-222199

b. Flood Management Measures

Pre Flood Management Measures

- The assembly point will be designated in the vacant area within the premises.
- Emergency Management Committee should arrange for safe evacuation of the occupants before flooding or any emergency situations.
- Emergency Management Committee personnel Security personnel should guide the way towards Safe evacuation route of the building.

- Arrangements will be made for relief and rehabilitation space in coordination with the local body.
- Arrange for medical assistance, food in coordination with the local body.
- Occupants will be restricted from driving during floods.
- Occupants will not move closer to any electrical pole or line while evacuation process
- The main power supply of the building will be switched off during floods.
- Allottees will also be instructed to turn off electrical utilities and unplug the electrical appliances - do not touch electrical equipment if wet.
- The emergency supply kit comprising Food, Drinking Water, Torch light etc will be arranged with help of Local Body.
- All the occupants will be restricted from walking through the flowing water; instead boat will be employed for evacuation.

Post flood Management Measures:

- The technical assistance from the Risk and Hazard Expert will be taken before clearing the damage utilities and loose power lines.
- Any damage in the internal sewerage system and the water supply line will be inspected and resolved to regulate the water supply.
- The inventory will be prepared to assess the damage caused due to floods and the material will replace keeping the flaws occurred due to flood in mind.
- The maintenance team will inspect the pump, blowers, sumps and other machineries for any repair caused by the flood due to floatable matter and solids.
- Quality of the fresh water source will be strictly ensured after the water treatment to meet the Drinking Water Standards.

Emergency Evacuation Plan:

All floors shall be provided with a staircase and emergency exits shall be marked. Periodical painting of these exits shall be carried out. The evacuation plan proposed in the project activity is as follows as shown in Figure 7.3.

Emergency Evacuation Plan

a) Primary and Secondary Exits:
   The project has its primary exit to TANSIDCO Main Road.
b) Emergency Staircase
   The location of three emergency staircases is designed in line with National Building Code, 2016, Part IV, Fire and Life Safety. The population during the emergency situation will be diverted across the three staircases during emergency situation. The plan showing the location of staircases and diversion of inside population among the three staircases is illustrated in the Emergency Evacuation Plan.

c) Public Address System

The Public Address system with Speaker, Microphone arrangements in all floors will be installed to make announcements and to allow the occupants to respond to announcements at the emergency situation.

d) Safe assembly points inside and outside the building.

e) Sign boards

Safety sign "Glow Type" images of the following will be displayed in the escape route drive ways, internal corridors to point out hazards, to aware the employees during emergency situation.



Figure 7.3: Signage

a) Communication System

An efficient communication system is essential for the success of any disaster management plan.

- All emergency contact numbers shall be displayed on the floor
- A Telephone directory comprising contact numbers of government institutions shall be placed
- Providing wireless communication tools to the security and personnel handling disasters.
- Placing of equipment and first aid kids on all floors of the plant.

b) Emergency Action Committee:

This section deals with identification of the Managing Committee – Safety for handling disasters with clearly enumerated functions

To tackle any disaster, it is important to form a team of line authority who will take charge during any disaster occurrence. The line authority will guide and manage the situation to provide or assist to the occupants during the disaster. Line of authority and their responsibility are defined below

To ensure coordinated action, an Emergency Action Committee shall be constituted. The active participation of occupants shall be ensured in the committee. The committee shall comprise of the following as in Table 7.3:

Table 7.3: Emergency Action Committee - Responsibility

S. No.	Authority	Responsibility
1.	Head – HSE	To lead the service staff during disaster to take actions to protect the employees. Will contact local Police, Hospital, Fire Brigade, NGOs and other relief agencies
2.	Head – HSE (Health and Saftey)	To provide help to the head to decide actions during disaster. To train and educate the workers and rescue team. To supervise the relief and rehabilitation process
3.	Assistant Managers/Engineers	They will be trained on Dos and Don't's during any disaster. Will guide the occupants during disaster occurrence as directed by the Managing Committee. Will ensure safety and security of the society members and belongings during the disaster

It is apparent that the Emergency Evacuation Plan is designed as per the present need and the strategies considering response to any unexpected situation. Thus, with reference to this plan, emergency situations can be handled efficiently without any damage by adopting the various measures stated in this report.

7.4 LIFE CYCLE STUDY

Life Cycle Assessment (LCA) is undertaken to evaluate the potential environmental impacts associated with the proposed API and Intermediate manufacturing facility. The study considers the entire cycle of activities including raw material procurement, manufacturing operations, utilities, waste management and product use/disposal.

Raw Material Stage: The project involves the use of various organic and inorganic chemicals, solvents and reagents. Impacts are associated with transportation, storage hazard and packaging waste. These are minimized by sourcing from approved vendors, adopting safe storage practices and ensuring spill control measures.

Manufacturing Stage: API synthesis involves multi-step reactions such as hydrolysis, condensation, crystallization and purification. This stage is resource-intensive, with higher contributions to energy demand, solvent emissions, and effluent generation. Closed reactors solvent recovery systems and optimized reaction conditions are adopted to minimize emissions and waste load.

Utilities and Resource Use: The facility requires 16.24 KLD of fresh water supplied by TANSIDCO, primarily for process, cooling, and domestic use. An Effluent Treatment Plant (ETP) of 5 KLD with RO system is provided. Treated water is reused for gardening and utilities, while RO reject is sent to the common ETP within the estate, ensuring zero untreated discharge.

Waste Management: Hazardous wastes such as spent solvents, process residues, and ETP sludge are collected, stored on impervious flooring, and sent to authorized TSDF/recyclers. The solid waste will be handed over to the TANSIDCO daily waste collection system. Construction debris is reused within the site for road formation and levelling.

Product Use and Disposal: The APIs are supplied to formulation units for downstream processing into finished dosages. Direct environmental impact during the use phase is minimal. Packaging materials such as HDPE drums and cartons are recyclable, thereby reducing disposal burden.

Overall Findings: The manufacturing stage contributes the most significant impacts, primarily through energy use and solvent handling. However, adoption of solvent recovery, ETP-RO integration, waste minimization measures, and green chemistry approaches ensure sustainable production. Continuous monitoring and resource efficiency initiatives will further reduce life cycle impacts and align the project with environmentally responsible pharmaceutical manufacturing practices.

CHAPTER 8
PROJECT BENEFITS

- The project will comply with all applicable environmental regulations, minimizing impacts on the surrounding environment.
- Generation of direct and indirect employment opportunities during both construction and operational phases.
- Reduction in dependency on imported pharmaceutical drugs, promoting self-reliance.
- Promotion of substantial growth in the State's pharmaceutical sector.
- Revenue generation for local body resulting in improvement of local infrastructure facilities.
- Corporate Environmental Responsibility (CER) initiatives resulting in socio-economic development activities in the surrounding areas.

CHAPTER 9
ENVIRONMENTAL COST BENEFIT ANALYSIS

Environmental cost benefit analysis assists the regulators to evaluate the benefits and challenges imposed by the upcoming project activity in commercial terms with respective to the impact on the environmental scenario such as human well-being, quality of life and environmental well-being.

9.1 COST BENEFIT ANALYSIS

The total cost of the project includes the cost of land, building, plant and machinery and utilities/ other infrastructure is 4.52 Crores. The proposed unit adopts continuous manufacturing with flow chemistry and reactors for high efficiency, quality control, reduced cost and time.

The project proponent has proposed the following environmental management measures to abate pollution:

- Piped Natural Gas (PNG) will be used as fuel for Boilers and Low sulphur diesel for Thermo pack heater and DG set.
- Rain water harvesting sump is provided for the storage and reuse of storm water runoff
- The effluent will be treated in the ETP with RO system and the treated effluent will be sent to Greenbelt development after the RO process.
- The hazardous waste generated from the project will be handled as per the Hazardous waste (Management and Handling) Rules 2016.
- Solar Panels will be provided in the available roof top area and the power generated will be utilized for the illuminating lights in the common areas

The environmental budgetary allocation for the capital cost and recurring cost (per annum) during the construction phase is 7.5 lakhs and 5.5 lakhs, respectively. The environmental budgetary allocation for the capital cost and recurring cost (per annum) during the operation phase is 75.5 lakhs and 13.08 lakhs, respectively. The environmental budgetary allocation for the construction and operation phase is provided in Table 9.1 and 9.2, respectively.

Table 9.1 Environmental Budgetary Allocation – Construction Phase

S.No.	Description	Budgetary Allocation (Rs. In Lakhs)	
		Capital Expenses	Operational Expenses (Per Annum)
1.	Drinking Water and Sanitation (Temporary Toilet) Facilities	2	2
2.	Storm Water Management	2	0.5
3.	Solid Waste/Debris Management	1	1

4.	Environmental Monitoring	-	1
5.	Dust Suppression Measures	1.5	0.5
6.	Occupational Health and Safety	1	0.5
Total		**7.5**	**5.5**

Table 9.2 Environmental Budgetary Allocation – Operation Phase

S.No.	Description	Budgetary Allocation (Rs. In Lakhs)	
		Capital Expenses	Operational Expenses (Per Annum)
8.	Effluent Treatment Plant	**5**	**2.5**
9.	Rain Water Harvesting System	**30**	**1**
10.	Air Pollution Control Measures	**9**	**1.5**
11.	Solid Waste Management	**1.5**	**0.5**
12.	Environmental Monitoring	**-**	**5.08**
13.	Energy Conservation	**25**	**0.5**
14.	Greenbelt Development	**5**	**2**
	Total	**75.5**	**13.08**

CHAPTER 10
ENVIRONMENTAL MANAGEMENT PLAN

10.1 INTRODUCTION

The Chapter outlines the key environmental management measures and safeguards that will be initiated by the project proponent to address the project's key environmental concerns and issues. The Environmental Management Plan (EMP) is the mechanism to ensure that environmental considerations are integrated into the project design. These are tools for mitigating or offsetting the potential adverse environmental impacts resulting from various activities of the project. The proposed management plans associated with each stage of the project development are described here. The primary objective of this proposed environmental management and monitoring programme is to mitigate environmental impacts to levels within the acceptable standard. Also, it is very important to highlight here that such environmental mitigation measures shall be used in conjunction with good management practices and good engineering design, construction and operation practices. The EMP will be a working document that personnel on-site need to both understand and undertake the activities. It shall be ensured that the required personnel are in a position to understand its responsibilities, adequately manage the environmental concerns of the site and effectively monitor for and mitigate impacts.

10.2 ENVIRONMENT MANAGEMENT SYSTEMS

The following components will be part of the EMS:

- Environmental Management Cell - Structure and Responsibility
- Operation and Maintenance of Environmental Management Facilities like ETP, Rain water harvesting, Solar Systems, greenbelt development, Solid waste management system
- Environmental Monitoring Program
- Short-term and long-term budgetary provisions for the EMP
- Emergency Planning

10.3 ENVIRONMENTAL MANAGEMENT PLAN FOR THE CONSTRUCTION PHASE

The team comprise of 5 members exclusively for the implementation of mitigation measures proposed. The team composition who will report directly to the head of the management is as follows:

- Chief Plant and Project Manager
- Head Utility & Maintenance – Water and Wastewater Management
- Head Material Management – Waste Management
- Head HSE – Air environment and Noise
- Head HSE – Health and Safety

The responsibilities of the Site personnel during the construction phase are as follows:

10.3.1 Head HSE

- Interactive with a head of management for effective implementation of an environmental management plan
- Overview the Environmental, Health & Safety Measures of project
- Monthly safety & Environmental assessment to review and course correct
- Ensure compliance with conditions stipulated in the environmental approvals issued for the project.
- Maintaining the records for implementation of EMP suggested
- Environmental Monitoring through external NABL accredited laboratory
- Overviews the EMP Expenditure in nationalized bank shall be made and head wise expense statement on EMP shall be maintained.
- Submission of six monthly compliance reports as stipulated in the EIA Notification 2006

10.3.2 Head Utilities & Maintenance– APC, Waste water treatment

- Fresh water supply will be supplied from TANSIDCO.
- Adequate Sanitation facilities will be provided adjacent to site.
- Sewage generated will be treated trough septic tank with soak pit.
- Maintenance of records of water usage and sewage generation within the site premises

Effective water management in construction with the involvement of construction teams is as follows:

- Reduce on-site water consumption by using ready mix concrete.
- Curing water will be sprayed on concrete structures; free-flow water should be avoided.
- Participation in EHS Audits & address the non-conformities

10.3.3 Head Material Management – Waste Management

- Designated waste debris collection area: 1 Location (75 m^2)
- Construction debris will be used for laying-internal roads and backfilling purposes as per PWD recommendations.
- During excavation, the top soil shall be kept separate and used in the gardening area for the development of the greenbelt.
- Building materials shall be stored on a platform within a covered area.
- Designated waste collection areas will be chosen within the project site. Excess concrete will be dumped within this designated area.
- The solid waste generated from the domestic shall be collected, Segregated and disposed to TANSIDCO daily waste collection system.
- Responsible for Corrective & Preventive Action Plan
- Participation in EHS Audits & address the Non –conformities 1

10.3.4 Head HSE- Air and Noise environment

- Water will be exclusively for dust suppression
- Water truck fitted with sprinkling/spraying facility will traverse the site 2 times a day.
- Regular maintenance of vehicle & equipment to reduce gaseous emission. Only PUC certificate obtained vehicles shall be engaged for construction activity.
- The vehicles carrying loose and fine particles shall be covered with tarpaulin to reduce spills on roads.
- Dry loose materials like bulk cement will be stored within the closed structures.
- Vehicular speed shall be limited to 15 kmph within the project site.
- Regular monitoring of ambient air quality through accredited laboratories especially during summer and windy seasons.
- Temporary diesel generators used for the construction activity shall be installed with stack height as per TNPCB norms for discharge of gaseous emission.
- Internal combustion engines must be fitted with silencers.
- Construction equipment shall be maintained properly and regularly for smooth functioning and less noise.
- Vehicles without a valid Pollution Under Control (PUC) Certificate will not be allowed to the project site.
- Construction activities shall be limited to daytime only.
- Noise pollution attenuating greenbelts, especially along the boundaries of the project site shall be developed to reduce the impact of noise during the construction activities.
- Participation in EHS Audits & address the Non -conformities

10.3.5 Head HSE – Health and Safety

- Routine health checkups on regular basis
- Pre-health screening for all employees shall be ensured.
- Mock drill for fire safety measures shall be conducted.
- First Aid facilities (with trained personnel & Ambulance)
- PPE for all laborers/ employees will be made mandatory in construction activities – Helmet, Shoes, Goggles, and Visibility Jackets
- Responsible for Corrective & Preventive Action Plan
- Participation in EHS Audits & address the Non –conformities

10.4 COVID’19 HEALTH MANAGEMENT PLAN

Due to the COVID’19 outburst in the state, the proponent is committed to protect the health and safety of construction workers during these unprecedented times. The following health measures will be taken to ensure the health of the construction labours and to reduce the risk of exposure during the construction of the project.

10.4.1 Pre-screening & Medical Examination

- Mandatory Thermal Scanning of everyone entering and exiting a construction site will be done for fever with thermal scanners.
- If anyone leaves and re-enters the site during the shift, re-screening of the individual will be done before re-entry into the work site.
- Measurement of the employee's temperature and assessment of symptoms before to starting work temperature checks will happen before the employee enters the facility.
- Sick employees diagnosed with COVID-19 shouldn't return to work until the criteria to discontinue home isolation are met, in consultation with healthcare providers and state and local health departments.
- A doctor will be present periodically at the site on allotted time for any medical assistance
- Workers shall be encouraged to stay home if they are sick.
- Encourage workers to report any safety and health concerns.

10.4.2 Social distancing

- The employee will maintain a distance of six feet from other workers and practice social distancing as work duties permit while in the workplace.
- Food should be consumed in designated areas only ensuring social distancing. Common sitting arrangements should be removed. Post lunch, waste should be disposed of in designated bins and the area should remain clean.
- During attendance, training and other sessions, social distancing guidelines will be followed along with the provision of no-touch attendance.
- Tool sharing shall be limited to the extent possible.

10.4.3 Cleaning and disinfecting work spaces

- Clean and disinfect all equipment and areas such as trailers, bathrooms, common areas and shared tools.
- Approved cleaning chemicals or that have label claims against the coronavirus shall be procured
- The entire construction site including the site office, labour camp, canteens, pathways, toilets, entry/exit gates will be disinfected on daily basis.

10.4.4 Personal Protective Equipment

Mandatory use of PPEs (face mask, hand gloves and others as applicable) by everyone entering the premise. Re-usable PPEs should be thoroughly cleaned and should not be shared with others. All employees will be provided with facemask. They will be made to wear it at all times while in the workplace to prevent the spread of the virus.

10.4.5 Sanitization & Personal Hygiene

Workers should follow the hand washing practices:

- Upon arriving at the workplace and before going home at the end of the day
- Before and after eating & Between tasks
- After using the toilet
- Before putting on and after taking off work gloves
- After putting on, touching, or removing cloth face coverings
- Before donning or doffing eye or face protection (safety glasses, goggles, etc.)
- Provision for hand wash and sanitizer (alcohol-based hand rubs containing at least 60 percent alcohol) will be made at all entry and exit points and common areas.
- Everyone will be required to wash and sanitize his/her hands before entering the site and using PPEs. Same procedure is to be followed after removing PPEs and exiting the premise. Sufficient quantities of all the items should be available at the site.
- There will be a strict ban on Gutka, Tambaku, Paan etc. on site and spitting shall be strictly prohibited.

10.4.6 Quarantine

If any worker shows symptoms or is diagnosed positive for COVID

- The workers will be quarantined for at least 15 days with the support of the State Government
- The labours staying at the site will not be allowed to go outside. All the essential items will be made available to labours at the site only. If necessary, the workers can go out wearing PPEs, after informing the supervisor. Similarly, no outside labour will be allowed at the site without following proper procedure and instructions.
- As long as the employee remains asymptomatic, the employee will self-monitor and be under supervision.

10.4.7 Emergency Contacts

- Hospitals/clinics in the nearby area, which are authorized to treat COVID-19 patients, should be identified and the list should be available at the site all the time.

10.4.8 Awareness& Sign Boards

- Appropriate signage at construction sites spelling out safety practices in a language that is understood by all.
- The workers will be trained to practice & work with social distancing norms.

10.4.9 Vaccination

- Mandatory vaccination for construction labourers.

10.5 Pest Control Strategies

Pest exclusion problems are notices at doorways and windows. Heating, air conditioning, plumbing, electrical service, and fire sprinklers provide other pest entry points as well. The following guidelines and practices will be followed in pest prevention.

- Exclusion - Eliminate gaps or flaws in foundations and slabs
- Eliminate sources of chronic moisture in and around the structure.
- Slope all exterior grades away from the structure to provide drainage;
- Harborage reduction
- Adequate clearance to allow access for inspection and control if needed

10.6 Environmental Management Plan for Operation Phase

The Environmental Management Plan in the Operation Phase will be implemented by the EMP Cell for the different aspects as follows:

10.6.1 Air Environment

- Water shall be sprinkled in the driveways to suppress dust during summer and windy seasons
- DG set will be provided with Stack height as per CPCB norms.
- The process reactor stack will be provided with APC measures and stack height as per CPCB norms.
- Combustion efficiency of the DG sets shall be verified and regular periodical maintenance of DG sets shall be carried out.
- Tree plantation will be done along the periphery of the project site

10.6.2 Water Environment

- The ETP with RO system shall be operated and continuously to meet the prescribed discharge standards of TNPCB.
- Treated effluent shall be recycled for gardening
- Plumbing fixtures, sensors, auto valves, etc. shall be adopted to reduce water consumption and increase water usage efficiency.
- Ensure water-tight plumbing arrangements and recycling arrangements such that no water leaks.
- Installation of water-saving equipment in lavatories, such as low-flow toilets.

The occupants of the facility shall be encouraged towards effective use of potable water.

- Regular cleaning and maintenance of all overhead and underground water reservoirs will be done.
- Groundwater level and its quality shall be periodically monitored and records shall be maintained and reviewed on regular basis.

10.6.3 Noise Control

- Adequate trees shall be planted along the peripheral boundary walls, which will act as an acoustic screen or vegetative barrier against the propagation of noise.
- DG sets shall be provided with acoustic enclosures to control noise level as per norms.
- Vehicles with silencers shall be operated within the campus.
- Noise-producing instrument/appliances, loudspeakers etc., shall not be allowed beyond prescribed limits and timings.

10.6.4 Solid Waste Management

- Solid Wastes generated from different sources need to be properly collected and source segregated within the campus.
- The Solid Waste generated from the development shall be collected and separated as biodegradable and non-biodegradable. Designated bins shall be placed at earmarked locations for the collection of segregated waste and handed over to the TANSIDCO daily waste collection system
- The garbage collection procedure is to be conducted during the early morning hours of the day.
- Accumulations of garbage in the storage bin have to be avoided for more than 24 hours.
- Sludge from ETP after drying shall be disposed as per TNPCB norms.
- The Hazardous Wastes and E-wastes shall be stored in the designated area having impervious flooring and a covered roof. The generation, storage, and disposal per annum shall be recorded.
- TNPCB-authorized recyclers shall only be engaged to handle the hazardous waste in compliance with Hazardous Waste Management Rules 2016.

10.6.5 Health and Safety Management

Firefighting system comprising of:

- Hose Reel
- Extinguisher
- Manual operated electric fire alarm system
- Underground Static tank
- Terrace Tank
- Terrace pump
- Maintenance of the systems should be carried out regularly to ensure proper functioning during emergencies.
- The safe evacuation routes for building occupants should be cleared and marked to ensure the safety of occupants during any emergency.
- The alarming/siren system shall be adopted to make people aware during an emergency.
- Sinanges will be placed showing way to emergency assembly point/refuge point will be earmarked.

10.6.6 Greenbelt Development:

- A greenbelt development is proposed around an industrial site to capture fugitive emissions, to minimize noise pollution, and to enhance aesthetics. It may also be built to make up for habitat loss brought on by the development of the proposed development. A progressive greenbelt development plan aims at an overall improvement in the environmental conditions of the region. To improve the ecological and environmental integrity of the surrounding areas, data obtained after the intensive studies for the proposed project were used to suggest species for greenbelt development plan.

The major purposes for greenbelt development are:

- To absorb pollutants and to aid in effective pollution control
- Retention of soil moisture and to prevent erosion
- Recharge of groundwater as well as to improve the microclimate
- Beneficial to preserve the biodiversity and thus preventing desertification of the area
- The green belt to the tune of 2054 m^2 will be developed with total of 469 Nos. of native species.

Table 10.1: List of species proposed to be planted within the development

S.No.	Common Name (Trees)	Botanical Name (Tree)
10.	*Pongamia glabra*	Pungan
11.	*Michelia champaca*	Shenbagam
12.	*Ficus religiosa*	Arasu
13.	*Azadirachta indica*	Vembu
14.	*Terminalia arjuna*	Neermardhu
15.	*Calophyllum inophyllum*	Punnai
16.	*Syzygium cumini*	Naval
17.	*Madhuca longifolia*	IIipai
18.	*Mimusops elengi*	Magilam

The Greenbelt plan earmarked around the site area is depicted below in the Figure 10.1.

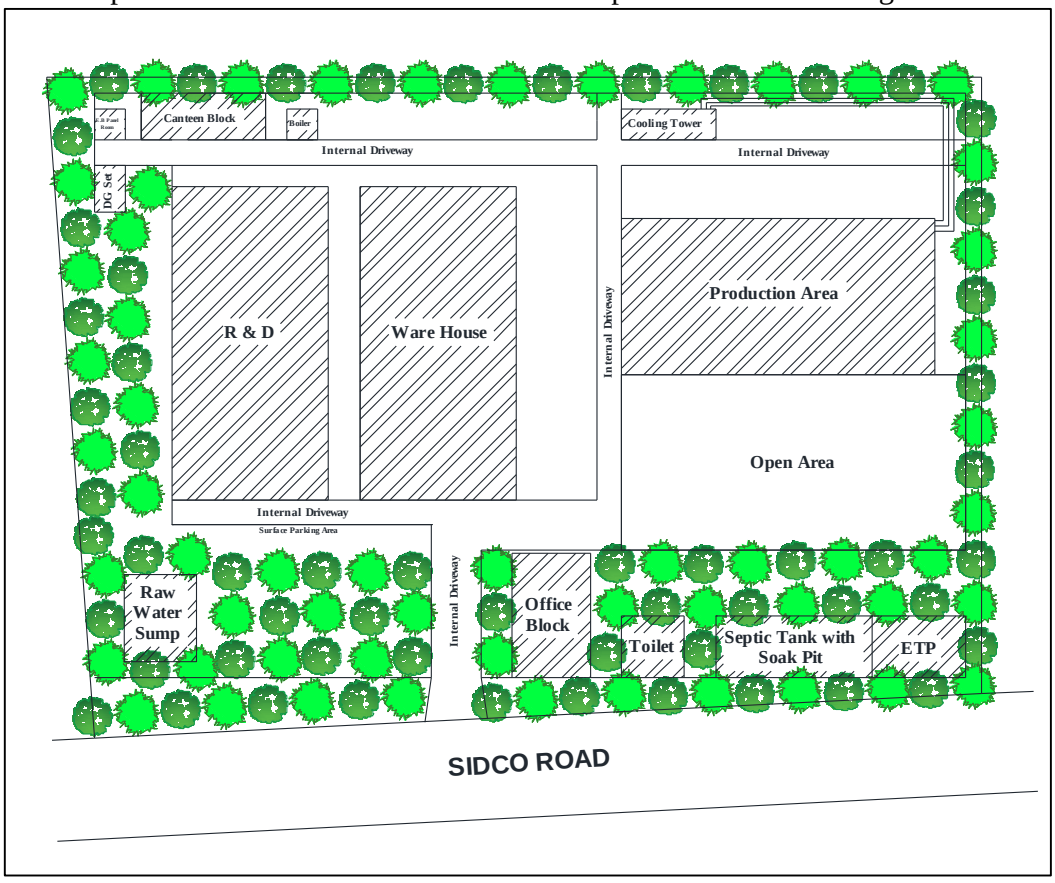


Figure 10.1: Greenbelt Plan

10.7 Energy Saving Practices

Energy conservation will be one of the focuses during the project planning and operation stages.

- Air Conditioning and Ventilation System will be provided in the office block
- Selection of chillers with a good coefficient of performance to save energy
- VFD drives for air handling units.
- Heat recovery wheels are incorporated to achieve energy savings through pre-cooling of fresh air.
- Thermal comfort will be maintained at 23+/-2ºC and relative humidity shall be 55+/-5% as per ASHRAE standard 55.
- All motor efficiencies will be a minimum of 90% and pump efficiencies shall be a minimum of 65%.
- All AHU fan power will not exceed 0.0006 bhp/cfm and all ventilation fans (fresh air and exhaust) will not exceed 0.0006 bhp/cfm
- Building is oriented in the most feasible orientation to conserve energy and also to permit the required light with limited solar heat entering into the occupied space or interior.
- The building facade is designed in a stepped manner which acts as a positive design element that provides shading by itself. Thereby the facade limits the entry of solar heat to the possible extent without an external shading device.
- Day lighting is harvested to the possible extent to make use of the natural sunlight.
- High-performance glazing whose SHGC value ranges between 0.22 and 0.3 will be used in the building envelope.
- Emissivity & Thermal Characteristics of Roof, Walls, Glass etc:
- Thermal characteristics of Roof: The RCC roof will be provided with 2-inch-thick XPS under deck insulation of R-value – 8.011ft^2hr/BTU and the roof will be provided with solar reflective paints/tile with a Solar reflective index of more than 79.
- Thermal characteristics Wall: The Wall material for the building envelope would be Aerocon blocks with U-value of 0.087 Btu/hrft^2
- Thermal characteristics of Glass: The proposed glass for the Building facade will be with SHGC between 0.22 and 0.3 and VLT with a minimum of 50%.

10.7.1 Following energy-saving measures will be incorporated

- Energy Efficient Technologies - high-efficiency chillers, use of variable frequency drives for AHUs and pumps, heat recovery units and other systems to reduce overall energy consumption compared to regular buildings
- High-performance facade, and excellent natural daylighting to minimize artificial lighting used during the day.
- Lighting: Energy-efficient internal and external lighting luminaries (as
- applicable) which are at least Three Star rated under BEE labelling Programme or luminaries which are more efficient will be installed.
- Lighting Power Density (LPD): Interior and exterior LPD (as applicable) which is 20% lower than baseline values will be maintained.

10.8 Rainwater Harvesting

- Regular periodical i.e., before and after monsoon maintenance of drains to avoid choking.
- Internal storm water network to collect the rainwater from the drain and divert it to a peripheral drain.
- The environmental management cell (Hierarchy Chart) towards implementation of the Environmental Management Plan is provided below in Figure 10.2.

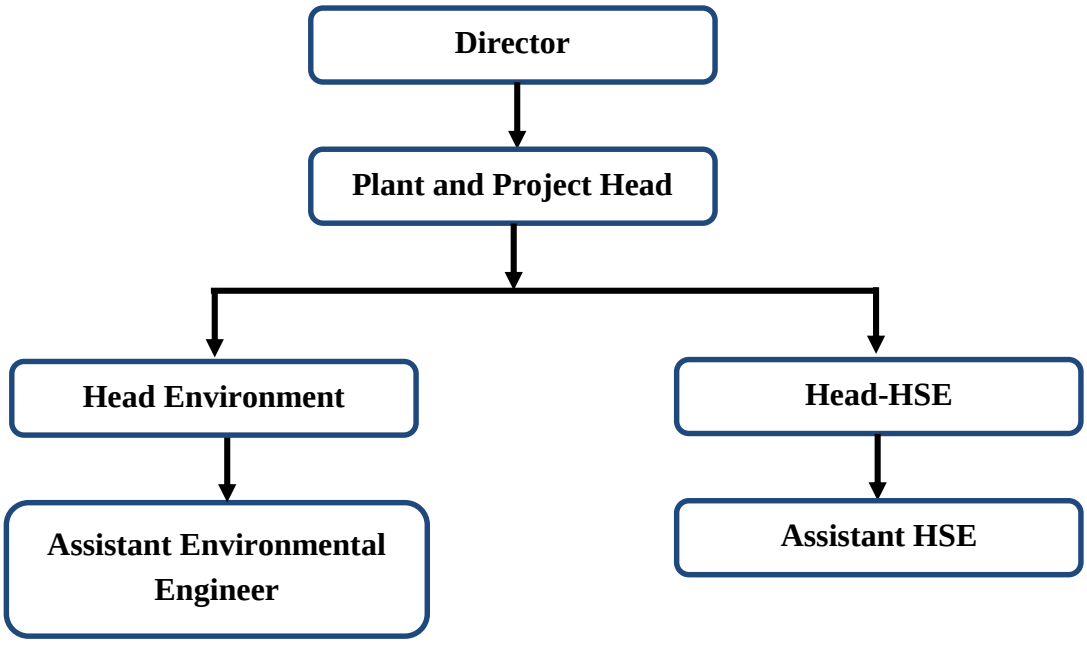


Figure 10.2: Environmental Management Cell proposed for the project activity during Operation phase

CHAPTER 11
SUMMARY AND CONCLUSION

11.1 PROJECT DESCRIPTION

M/s. Juvenus Drugs has proposed to develop an Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit at Plot No. 38, Survey No. 16 & 17, TANSIDCO, Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu. The proposed project falls under 5(f) B1 as per MoEFandCC, EIA Notification dated 14th September 2006.

The project site is well connected by road and rail networks. The project site lies in the Directorate of Town and Country Planning (DTCP) jurisdiction. The land use classification of the projet site is Industrial Use zone. The parking area allotted for the proposed project is xxx m^2 for parking two wheelers (xxx nos.) and four wheelers (xxx nos.). The power requirement during operation is about 80kVA and it will be sourced from the nearby TNEB grid. DG set of 110kVA will be provided as back power supply. The estimated project cost is 4.52 Crores.

11.2 AIR ENVIRONMENT

It is observed that the air quality monitoring results for all the parameters that were monitored are within the permissible limits specified by Central Pollution Control Board (CPCB) for National Ambient Air Quality Standard (NAAQS). It is also noted that the concentration of sulphur dioxide, nitrogen dioxide and carbon dioxide in the monitored locations are very low with respect to the limits specified in NAAQ standard. The Air Quality Index (AQI) values are satisfactory level at 7 locations including the project site and Good at 1 location during the study period and lies in the range of 40-70 which means that there is impact of Minor breathing discomfort to sensitive people.

The main source of air emissions from the project activity during the operation will be from the Diesel Generator Sets and process emissions provided with air control measures and stack as per CPCB norms.

11.3 NOISE & VIBRATION

The source of noise from the proposed project site is mainly from DG sets which will be controlled by providing acoustic enclosures and silencers. The source of vibration is from mainly from the process equipment and machinery which will be arrested by providing isolation pads.

11.4 WATER ENVIRONMENT

The estimated fresh water requirement is about 16.24 KLD will be sourced from the TANSIDCO water supply distribution system. The fresh water requirement for the project activity is 16.24 KLD (Domestic purpose: 1.84 KLD, R.O Process: 10.00 KLD, Cooling Tower: 2.00 KLD and Gardening: 2.20 KLD). 3.00 KLD of R.O rejection (<600 PPM) will be sent to Gardening.

The sewage generation from the domestic activity is estimated to be 1.64 KLD which is treated in bio septic tank and soak pit arrangements. The effluent from wet scrubber 0.20 KLD and 3.37 KLD from the process and 0.90 KLD RO reject after ETP treatment will be sent straightaway to Solar pan / Heating pan since it will have high TDS.

The total quantity of the effluent generated from the other activity is 3.23 KLD (Process washing: 2.63 KLD, Boiler blow down: 0.50 KLD and Cooling tower blow down: 0.10 KLD) which will be treated in an Effluent Treatment Plant of 5 KLD capacity.

The treated effluent of 2.00 KLD after the RO process will be utilized for gardening and landscape development within the premises.

The storm water drain is proposed to be laid all along the periphery of the project site. The drain will collect the excess runoff after recharge and storage to the external storm water drain maintained by TANSIDCO.

11.5 SOLID WASTE MANAGEMENT

The solid waste generated from the campus will be collected, segregated and stored in coloured bin and handed over the TANSIDCO waste collection system.

The hazardous waste from the project will be stored in under covered roof and impervious flooring. The same will be disposed through TNPCB authorized recyclers/TSDF facility.

11.6 MITIGATION MEASURES FOR ANTICIPATED IMPACTS

- Regular monitoring of ambient air and water quality through accredited laboratories especially during summer and windy season.
- Regular soil conservation practices and providing drain and storm water pipe or channel to let out storm or excess rainwater.
- Conjunctive use of water, reuse of sewage, effluent and set up of rainwater collection system for sustainable water table condition.
- Sustaining biological environment by preserving topsoil and development of green belt.
- Supply of adequate and potable drinking water, providing adequate numbers of latrines and urinals, and lighting facilities are proposed to sustain the better socioeconomic conditions in the surroundings.
- Disaster management plan, effective communication system and emergency action committee and also emergency evacuation plan for safety of occupants has been addressed in detail.

11.7 ENVIRONMENTAL MANAGEMENT PLAN

The dedicated Environmental Management Team during construction and Environmental Management Cell in Operation phase shall implement the responsibilities under water, waste water management, solid waste management, green belt development, health and safety etc.

11.8 CONCLUSION

This EIA report of this site study addressed the benefits occurring to the locality, neighbourhood, region and nation as a whole by the way of development in pharmaceutical sector. Increase in revenue to the local government by tax generation. In this way the project will provide a positive impact on the economic as well as infrastructure development of the region. The project does not involve any displacement of habitats and so issues like resettlement or any is not involved. On proper implementation and periodic monitoring of the Environmental Management Plan the anticipated impacts can be mitigated in an efficient manner.

CHAPTER 12
DISCLOSURE OF EIA CONSULTANT ENGAGED

Name of the Organization	:	Eco Services India Pvt. Ltd.
Contact Person:		
Name	:	Dr. P. Kalaiselvan
Designation	:	Director
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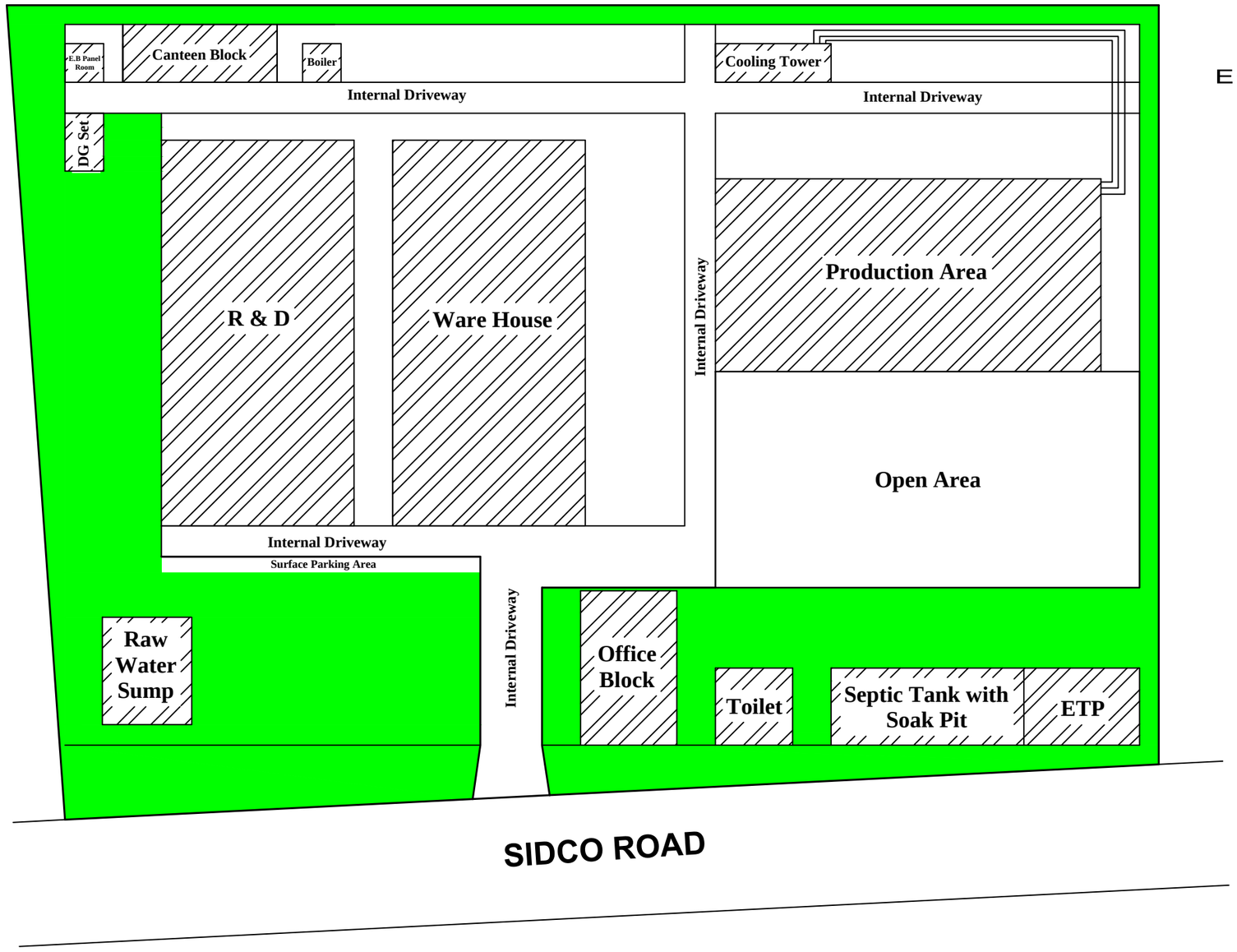
Status of Accreditation:

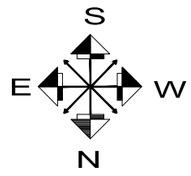
M/s. Eco Services India Pvt. Ltd. is accredited by NABET/QCI for handling projects in the Sector Nos. 4, 8, 21, 29, 31, 38 and 39 (i.e., Item Nos. 1(d), 3(a), 5(f), 7(a), 7(c), 8(a) and 8(b) of the Schedule to EIA Notification, 2006). Please refer to the List of Accredited Consultant Organizations with their Certificate / Extension Letter no. as updated by NABET every month. The NABET Accreditation certificate is enclosed as Annexure - XVIII.

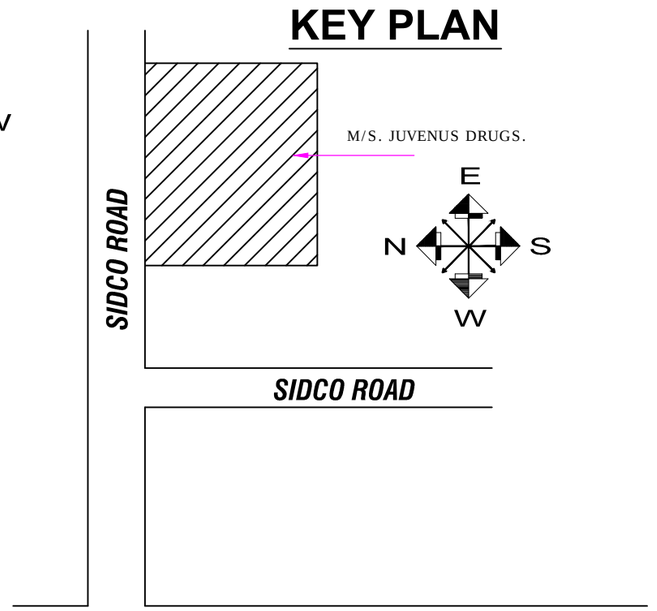
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ANNEXURE – I
MASTER PLAN

Layout Showing the Master Plan for the Proposed Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit at Plot No. 38, Survey No. 16 & 17, TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu by M/s. Juvenus Drugs







Land Area Breakup Details

S. No.	Description	Area in (Sq.m)	Percentage (%)
1	Total Area	5,867.95	100
2	Process Building Area (Production and R&D)	930	16
3	Non Process Building Area (Ware house, Office Building, Canteen Block & Toilets)	744	13
4	Internal Road Area & Pavement	533	9
5	Surface Parking Area	80	1
6	Greenbelt	2,054	35
7	Vacant Land Area	1,446	25
8	Other Utilities (Boiler Room, E.B Panel Room, UG Sump, RWH, Septic Tank & Soak Pit, ETP area, Solid waste handling area, Hazardous waste storage area, Security room)	80.95	1

ANNEXURE – II
TANSIDCO LAYOUT



N

SCALE - 1 : 1600

ALL DIMENSIONS ARE IN METER

Plot Details	Area in Acres
Plot No.1	1.477
Plot No.2	1.659
Plot No.3	1.712
Plot No.4	1.712
Plot No.5	1.696
Plot No.6	1.698
Plot No.7	1.712
Plot No.7A	1.712
Plot No.9	1.738
Plot No.10	1.738
Plot No.11	1.723
Plot No.12	1.722
Plot No.12A	1.738
Plot No.14	1.738
Plot No.15	1.738
Plot No.16	1.738
Plot No.16A	1.722
Plot No.18	1.723
Plot No.19	1.738
Plot No.20	1.738
Plot No.21	1.424
Plot No.22	1.377
Plot No.23	1.376
Plot No.24	1.588
Plot No.25	1.454
Plot No.25A	1.451
Plot No.27	1.883
Plot No.28	1.863
Plot No.29	1.86
Plot No.30	2.321
Plot No.31	2.926
Plot No.32	0.663
Plot No.33	3.491
Plot No.34	2.321
Plot No.34A	1.86
Plot No.36	1.863
Plot No.37	1.883
Plot No.38	1.451
Plot No.39	1.454
Plot No.40	0.995
Plot No.41	0.706
Plot No.42	1.908
Plot No.43	2.251
Plot No.43A	2.364
Plot No.45	2.367
Plot No.46	2.367

TAMILNADU SMALL INDUSTRIES DEVELOPMENT CORPORATION LTD
CHENNAI - 600 032

LAYOUT PLAN OF TANSIDCO PHARMA INDUSTRIAL PARK AT PELLAKUPPAM, KOLLAR & VENMANIYATHUR VILLAGE TINDIVANAM TALUK VILUPURAM DISTRICT

GENERAL NOTES

TOTAL EXTENT	:	113.00Acres
D / F ROAD PORTION AREA SIPCOT LAND A - 18	:	(-) 1.53 Acres
EXTENT AFTER Deduct SIPCOT Road	:	111.47 Acres
ROAD AREA	:	15.70 Acres (14.08%)
Extent After ROAD AREA	:	95.77 Acres
PUBLIC PURPOSE (PP)	:	1.37 Acres (1.23%)
COMMERCIAL PURPOSE (CMP)	:	3.73Acres (3.35%)
ETP & STP PLOTS	:	5.07 Acres (4.55%)
WTP	:	1.20 Acres (1.08%)
FACILITIES	:	2.76 Acres (2.48%)
SALEABLE INDUSTRIAL AREA	:	81.64 Acres (73.23%)

NUMBER OF PLOTS

INDUSTRIAL PLOTS	:	46 NOS.
COMMERCIAL PURPOSE PLOTS(SHOP)	:	12 NOS.
PUBLIC PURPOSE PLOTS (PP)	:	1 NO.
ETP & STP PLOTS	:	1 NO
WTP	:	1 NO
FACILITIES	:	1 NO
TOTAL NO OF PLOTS	:	62 NOS.

OPEN SPACE RESERVATION LAND

PUBLIC PURPOSE LAND

SL.NO.	PP No.	EXTENT IN ACRES
1	PP - 1	1.37 AC
TOTAL		1.37 AC

COMMERCIAL PURPOSE LAND

SL.NO.	CMP No.	EXTENT IN ACRES
1	CMP - 1	0.46 AC
2	CMP - 2	0.40 AC
3	CMP - 3	0.34 AC
4	CMP - 4	0.27 AC
5	CMP - 5	0.21 AC
6	CMP - 6	0.15 AC
7	CMP - 7	0.24 AC
8	CMP - 8	0.20 AC
9	CMP - 9	0.16 AC
10	CMP - 10	0.42 AC
11	CMP - 11	0.62 AC
12	CMP - 12	0.26 AC
TOTAL		3.73 AC

INDEX:

- BOUNDARY
- INTERNAL ROADS
- COMMERCIAL PLOTS
- OPEN SPACE RESERVATION
- PUBLIC PURPOSE
- EXISTING VILLAGE ROAD

ANNEXURE – III

SIPCOT PLOT ALLOTMENT LETTER TO TANSIDCO

SIPCOT

STATE INDUSTRIES PROMOTION CORPORATION OF TAMIL NADU LIMITED
19-A, RUKMANI LAKSHMIPATHY ROAD, EGMORE, CHENNAI-600 008.

OFFICE ORDER

O.O. No.31/2022 **Date: 14.09.2022**

Sub: SIPCOT Industrial Park, Tindivanam – Fixation of plot allotment rate for M/s.TANSIDCO – Revision of plot allotment rate for other allottees - Board's approval – Communication – reg.

Ref: 1. Circular No.40/2021 dated 12.04.2021
2. O.O.No.64/2021 dated 01.11.2021
3. Minutes of the Board meeting dated 24.08.2022

The Board of SIPCOT at its meeting held on 24.08.2022 has approved to fix the plot allotment rate for bulk allotment of 113 acres of undeveloped land to M/s.Tamil Nadu Small Industries Development Corporation Ltd. (TANSIDCO) at SIPCOT Industrial Park, Tindivanam at Rs.74.00 lakhs per acre and to allot the land to M/s.TANSIDCO without subsidy on outright sale basis by including clauses in the allotment order and sale deed that

(i) the enhanced compensation, if any, incurred by SIPCOT for M/s.TANSIDCO land of 113 acres, will be claimed from M/s.TANSIDCO.

(ii) the cost of infrastructure facilities, if any, provided for M/s.TANSIDCO should be borne by M/s.TANSIDCO.

Further, the Board has approved to revise the rate of allotment at Rs.150.00 lakhs per acre for other allottees (Developed land) and allot at the subsidized rate at Rs.75.00 lakhs per acre to eligible industries in SIPCOT Industrial Park, Tindivanam as Villupuram District comes under "C" District.

.2.

SIPCOT

Accordingly, the fixation of plot allotment rate for other allottees (developed land) in SIPCOT Industrial Park, Tindivanam is given below:

Name of the SIPCOT Industrial Park	Plot Allotment Rate per acre	Chargeable allotment rate per acre in allotment order (after adjustment of land cost incentive @ 25% of plot allotment rate per acre extended by SIPCOT)	(LESS) Land Cost Subsidy per acre to be reimbursed by Government (@ 25% of plot allotment rate per acre)	Subsidised plot allotment rate per acre
	(Rupees in lakhs)			
Tindivanam	**150.00**	112.50	37.50	75.00

The above plot allotment rate is applicable for all other allottees at SIPCOT Industrial Park, Tindivanam for the allotments made with effect from 24.08.2022.

Further, the Board has approved to demand 50% capital cost on water supply system in addition to the plot allotment rate as and when the external water supply scheme is funded by SIPCOT.

Sd/-xxx
MANAGING DIRECTOR

To
All General Managers
All HODs
PA to MD
PA to ED
IT Department – for necessary action

Copy to
All the Project Officers,
SIPCOT Industrial Parks.

/Forwarded by Order/

S. R. 14/8/22
GENERAL MANAGER (F)

ANNEXURE – IV

ENVIRONMENTAL CLEARANCE FOR THE TANSIDCO INDUSTRIAL PARK OBTAINED BY SIPCOT

Dr. JAYANTHI. M, I.F.S
MEMBER SECRETARY

STATE LEVEL ENVIRONMENT IMPACT
ASSESSMENT AUTHORITY – TAMIL NADU
3rd Floor, Panagal Maaligai,
No.1 Jeenis Road, Saidapet,
Chennai-15.
Phone No.044-24359973
Fax No. 044-24359975

ENVIRONMENTAL CLEARANCE (EC)

Letter No. SEIAA-TN/F. 6497/EC/ 8(b)/ 681/2019 dated: 27.11.2019.

To

The Managing Director
M/s. State Industries Promotion Corporation of Tamil Nadu Limited.
19-A, Rukmani Lakshmipathy Road
Post Box No.7223
Egmore
Chennai-600 008

Sir,

Sub: SEIAA, TN - Environmental Clearance – Proposed establishment of Industrial Park at Thindivanam by M/s. State Industries Promotion Corporation of Tamil Nadu Limited at S.F. No. 1, 2, 3, 4, 5, 6, 10pt, 13pt, 14, 15, 16, 17, 18, 19, 20, 21pt, 22/1, 2, 32, 33, 34, 35, 36, 37, 38pt, 39, 40, 41,42,43/1pt, 2, 45, 46, 47, 48/1, 49, 50, 51, 52, 53, 54, 55, 56, 57, 60, 61/1, 2,3pt, 62, 63, 64, 118, 120, 121, 123, 125, 126, 129 of Pelakuppam Village, 46pt, 47pt, 48pt, 50pt, 51, 52pt, 53pt, 55pt of Venmaniyathoor Village, 181pt, 182, 183, 184, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 212, 213pt, 214, 237, 244, 245 & 246pt of Kollar Village, Thindivanam Taluk, Villupuram District, Tamil Nadu - Issued – Regarding.

Ref: 1. Your application for Terms of Reference dated: 01.02.2018

2. ToR Issued by SEIAA-TN Vide Lr.No.SEIAA-TN/F.No.6497/2018/8(b)/ToR-506/2018 dated: 16.07.2018

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3. EIA report submitted to SEIAA-TN on 05.04.2019
4. Minutes of the 133rd SEAC Meeting held on 25.07.2019
5. Proponent reply dated: 30.10.2019
6. Minutes of the 139th SEAC Meeting held on 23.11.2019
7. Minutes of the 362nd SEIAA Meeting held on 27.11.2019

*****

This has reference to your application 1st cited, the proposal is for obtaining Environmental Clearance to establish a construction project under Category B2 and Schedule S.No. 8(b) under the Environment Impact Assessment Notification, 2006, as amended.

The Competent Authority and Authorized signatory furnished detailed information in Form 1 and Form 1A and liquidate enclosures are as Annexures:

Annexure 1

PROJECT DETAILS		
SL No	**Description**	**Details**
1)	Name of the Project proponent and address	The Managing Director M/s. State Industries Promotion Corporation of Tamil Nadu Limited. 19-A, Rukmani Lakshmipathy Road Post Box no.7223 Egmore Chennai-600 008
2)	Proposed Activity	Proposed establishment of Industrial Park at Thindivanam
3)	Schedule No.	8(b)
4)	**Project Location**	
	i)Survey No	1, 2, 3, 4, 5, 6, 10pt, 13pt, 14, 15, 16, 17, 18, 19, 20, 21pt, 22/1, 2, 32, 33, 34, 35, 36, 37, 38pt, 39, 40, 41,42,43/1pt, 2, 45, 46, 47, 48/1, 49, 50, 51, 52, 53, 54, 55,

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		56, 57, 60, 61/1, 2, 3pt, 62, 63, 64, 118, 120, 121, 123, 125, 126, 129 of Pelakuppam Village, 46pt, 47pt, 48pt, 50pt, 51, 52pt, 53pt, 55pt of Venmaniyathoor Village, 181pt, 182, 183, 184, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 212, 213pt, 214, 237, 244, 245 & 246pt of Kollar
	ii)Revenue Village	Pelakuppam, Venmaniyathoor, Kollar Village
	iii)Taluk	Thindivanam
	iv)District	Villupuram
5)	Area of the Land	291.60.5 Hectares
6)	Built up Area	

Sl.No.	Description	Area (Hectares)
1	Plot area	195.29
2	Roads and Storm water drainage	13.56
3	Common amenities (EB, Water storage, Fire Services, Administrative Office, etc.)	4.37
4	Commercial activities	14.57
5	Green Belt outside plot area (OSR)	26.81
6	Green Belt along roadside	3.51
7	Solid Waste Management	10.00
	Total developable area	**268.11**
	Water bodies (which will not be encroached)	23.49
	Total IP area	**291.60**

7)	Brief description of the project The proposal is an infrastructure development project. It involves development of roads, water supply, storm water drainage, street lights, green belt

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<table>
<tr><td></td><td colspan="2">development, and such other amenities.
Industrial Park will house industries which do not fall under EIA Notification 2009 and amendments thereof. The proposed industries include the following:
• All General Engineering units such as fabrication, machining, forging, castings etc.,
• Auto components Industries.
• Food Processing Industries.
• Packaging units.
Any other industries that are not under the purview of EIA Notification,2006</td></tr>
<tr><td>8)</td><td>Land Use Classification</td><td>Patta dry land & Govt Poramboke Land</td></tr>
<tr><td>9)</td><td colspan="2">Green Belt
<table>
<tr><th>Sl.No.</th><th>Description</th><th>Area (Hectares)</th></tr>
<tr><td>1.</td><td>By SIPCOT outside the plot area</td><td>58.59</td></tr>
<tr><td>2.</td><td>By SIPCOT along the Road sides and Central meridian</td><td>26.81</td></tr>
<tr><td>3.</td><td>By Member Industries (30 % of the total plot area
allotted to Member Industries) i.e 30% of 195.29 Ha</td><td>3.51</td></tr>
<tr><td></td><td>Total</td><td>88.91</td></tr>
<tr><td></td><td>Percentage of Green Belt among Total developable Area of Industrial Park i.e 268.11 hectares</td><td>33.16%</td></tr>
</table></td></tr>
<tr><td>10)</td><td>UTILITIES-WATER</td><td></td></tr>
<tr><td></td><td>a) Total Water Requirements</td><td>4 MLD</td></tr>
<tr><td></td><td>b) Source from where the water is proposed to be drawn</td><td>3 MLD Tertiary Treatment Reverse Osmosis (TTRO) water from Thindivanam Municipality

1 MLD for drinking water from Tamil Nadu Water Supply and Drainage Board (TWAD)</td></tr>
<tr><td></td><td>c) Sewage system</td><td>All member units will be mandated to</td></tr>
</table>

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		install "Zero Liquid Discharge" based Effluent Treatment Plants to reclaim water for recycle/reuse in their utilities and green belt development. The quantity of sewage that will be generated from SIPCOT administrative office will be managed in septic tank followed by soak pit .
	d) ETP & Recycle line	All member units will be mandated to install "Zero Liquid Discharge" based Effluent Treatment Plants to reclaim water for recycle/reuse in their utilities and green belt development.
11)	Solid Waste Management	Area of 10Ha has been earmarked for establishing a solid waste management facility SIPCOT will identify a TSDF provider and facilitate to establish such a treatment, storage and disposal facility(TSDF) in line with guidelines of CPCB & MoEF & CC Solid waste generated will be disposed to the approved Municipal Solid Waste Management or else SIPCOT will set up its facility through renowned agencies by outsourcing their services on annual contract basis
12)	Power requirement	50MW from TANGEDCO
13)	Project Cost	Rs. 300 Crores
14)	EMP Cost	For Operation Phase: Capital Cost –1 Crores,

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		Operation cost- 50 Lakhs per annum

Annexure 2- Affidavit

The Proponent has furnished affidavit in Twenty Rupees stamp paper attested by the Notary stating that

I Thiru. J.Kumargurubaran,IAS, Managing Director, Authorised Signatory, represent M/s. State Industries Promotion Corporation of Tamilnadu Limited (SIPCOT), 19-A, Rukmani Lakshmipathy Road, Egmore, Chennai - 600008.

We have proposed to establish an industrial park over an extent of 291.605 hetctares at Pelakuppam, Kollar & Venmaniyathur villages of Tindivanam taluk, Villupuram district. An application submitted by us seeking Environmental Clearance under the EIA Notification, 2006 is under scrutiny in the Authority. I am furnishing the following undertaking to the Authority, hereby solemnly affirm and state as follows:-

1. we will develop Green belt in OSR areas and along the roadsides in 11.31 % of the total developable area of 268.11 hectares i.e 30.32 hectares. Further, we will also ensure the development of green belt in 30% of the allotted area by the member units i.e 58.59 hectares, which is 21.85% of total developable area. It will be made as a mandatory condition in the land allotment order as well as the lease deed to be executed between SIPCOT and allottees. The net area of green belt of the proposed industrial park in the post project scenario will be 88.91 hectares, which is 33.16% of the total developable area of the park.
2. We commit to SEIAA that the total water requirement for the park is 4 MLD out of which potable water would be around I MLD and the balance 3 MLD would be for non potable purposes. The required potable water will be obtained from Tamil Nadu Water Supply and Drainage Board (TWAD) and non potable water from Tertiary Treatment Reverse Osmosis (TTRO) plant to be setup at Tindivanam. SIPCOT is already in discussion with Commissioner of Municipal Administration (CMA) for setting up of TTRO plant. We assure that the required permission from the competent Authority for supply of water for entire period of operation will be obtained before applying for Consent for Operation (CTO) from Tamilnadu Pollution Control Board (TNPCB).

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3. We commit to SEIAA that all member units will be mandated to install "Zero Liquid Discharge" based Effluent Treatment Plants to reclaim water for recycle/reuse in their utilities and green belt development. We will mandate to member units to manage the sewage as per TNPCB norms. The solid waste stream will be sent to TNPCB approved vendors/TSDF for proper and ultimate disposal. The quantity of sewage that will be generated from SIPCOT administrative office will only be 1000 litres/day and it will be managed in septic tank followed by soak pit as onsite construction.
4. We commit to SEIAA that all member units will be mandated to provide rain water harvesting structures as per norms. SIPCOT will construct percolation tanks for harvesting the rainwater in the project office.
5. We commit to SEIAA that we will provide storm water drainage system as open concrete channels, all along the road side for ensuring proper collection of storm water and will let out in the nearby water bodies. We also assure that the storm water drain would not carry any untreated or treated sewage.
6. We commit to SEIAA that we will undertake CER activities as per norms with the approval of board of SIPCOT.
7. We also assure that our project site does not encroach any water bodies such as rivers, canals, nallas, lakes, ponds, tanks, etc., from its original boundary.
8. We are aware that we can be prosecuted under relevant Act and Rules, if we are not ensuring the adherence of the above commitment.

Commitment signed by me as an Authorized signatory of the Project Proponent before the SEIAA, Tamil Nadu.

The project activity is covered in 8(b) of the Schedule and is of B2 category. It does not require Public Consultation as per Para 7 III Stage (3) (i) (d) of EIA Notification, 2006.

The Authority after consideration all the requisite documents with status and data and based on SEAC appraisal and recommendations for issue of Environmental Clearance in its 139th meeting held on 23.11.2019, SEIAA placed the proposal in the

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362nd SEIAA meeting held on 27.11.2019 hereby conveyed Environmental Clearance along with the conditions containing four parts namely

Part - A –Common conditions applicable for Pre-construction, Construction and Operational Phases

Part - B –Specific Conditions – Pre construction phase

Part - C - Specific Conditions – Construction phase

Part – D - Specific Conditions – Operational Phase/Post constructional Phase / Entire life of the project.

Validity:

The SEIAA hereby accords Environmental Clearance to the above project under the provisions of EIA Notification dated 14th September, 2006 as amended, with validity for Seven years from the date of issue of EC, subject to the compliance of the terms and conditions stipulated below:

Part - A – Common conditions applicable for Pre-construction, Construction and Operational Phases:

1. Any appeal against this environmental clearance shall lie with the Hon'ble National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
2. The construction of STP, Solid Waste Management facility, E-waste management facility, DG sets, etc., should be made in the earmarked area only. In any case, the location of these utilities should not be changed later on.
3. The Environmental safeguards contained in the application of the proponent /mentioned during the presentation before the State Level Environment Impact Assessment Authority / State Level Expert Appraisal Committee should be implemented in the letter and spirit.
4. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire and Rescue Services Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wild Life (Protection) Act, 1972, State / Central Ground Water Authority, Coastal Regulatory Zone

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Authority, other statutory and other authorities as applicable to the project shall be obtained by project proponent from the concerned competent authorities.

5. The SEIAA reserves the right to add additional safeguard measures subsequently, if non-compliance of any of the EC conditions is found and to take action, including revoking of this Environmental Clearance as the case may be.
6. A proper record showing compliance of all the conditions of Environmental Clearance shall be maintained and made available at all the times.
7. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company. The status of compliance of environmental clearance conditions and shall also be sent to the Regional Office of the Ministry of Environment and Forests, Chennai by e-mail.
8. The Regional Office of the Ministry located at Chennai shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports.
9. "Consent for Establishment" shall be obtained from the Tamil Nadu Pollution Control Board and a copy shall be submitted to the SEIAA, Tamil Nadu.
10. In the case of any change(s) in the scope of the project, a fresh appraisal by the SEAC/SEIAA shall be obtained before implementation.
11. The conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Public Liability Insurance Act, 1991, along with their amendments ,draft Minor Mineral Conservation & Development Rules , 2010 framed under MMDR Act 1957,National Commission for protection of Child Right Rules ,2006 and rules made there under and also any other orders passed by the Hon'ble Supreme

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Court of India/Hon'ble High Court of Madras and any other Courts of Law, including the Hon'ble National Green Tribunal relating to the subject matter.

12. The Environmental Clearance shall not be cited for relaxing the other applicable rules to this project.
13. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.
14. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, Chennai, the respective Zonal Office of CPCB, Bengaluru and the TNPCB. The criteria pollutant levels namely; PM10, PM2.5, SO2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored.
15. The SEIAA, TN may cancel the environmental clearance granted to this project under the provisions of EIA Notification, 2006, if, at any stage of the validity of this environmental clearance, if it is found or if it comes to the knowledge of this SEIAA, TN that the project proponent has deliberately concealed and/or submitted false or misleading information or inadequate data for obtaining the environmental clearance.
16. The Environmental Clearance does not imply that the other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would be considering the project on merits and be taking decisions independently of the Environmental Clearance.
17. The SEIAA, TN may alter/modify the above conditions or stipulate any further condition in the interest of environment protection, even during the subsequent period.
18. The Environmental Clearance does not absolve the applicant/proponent of his obligation/requirement to obtain other statutory and administrative clearances from other statutory and administrative authorities.

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19. Where the trees need to be cut, compensation plantation in the ratio of 1:10 (i.e. planting of 10 trees for every one tree that is cut) should be done with the obligation to continue maintenance.
20. A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive who will report directly to the Head of the Organization and the shortfall shall be strictly reviewed and addressed.
21. The EMP cost of Rs.1.5 Crores shall be deposited in a Nationalized bank by opening separate account and the head wise expenses statement shall be submitted to TNPCB with a copy to SEIAA annually.
22. The project activity should not cause any disturbance & deterioration of the local bio diversity.
23. The project activity should not impact the water bodies. A detailed inventory of the water bodies and forest should be evaluated and fact reported to the Forest Department & PWD for monitoring.
24. All the assessed flora & fauna should be conserved and protected.
25. The proponent should strictly comply with, Tamil Nadu Government Order (Ms) No.84 Environment and forests (EC.2) Department dated 25.06.2018 regarding ban on one time use and throwaway plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986.
26. As per MoEF & CC, GoI, Office Memorandum dated 30.03.2015, prior clearance from Forestry & Wildlife angle including clearance from obtaining committee of the National Board for Wildlife as applicable shall be obtained before starting the quarrying operation, if the project site is located within 10KM from National Park and Sanctuaries.
27. Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided.
28. The safety measures proposed in the report should be strictly followed.
29. The Developer shall ensure that no allotment letter/ sale deed in any form shall be made to house category A or category B industry as prescribed in the

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schedule of EIA notification 2006. However, in case any category A or category B type of industry as prescribed in the schedule of EIA notification 2006 is proposed then the individual unit shall apply and seek Environmental Clearance under the EIA notification 2006.

30. The Developer shall mandate the member industries of the Industrial Park to allot 33% of the plot area for green belt development and to install RWH structures.
31. The Developer has to ensure that all the member industries within the Industrial Park shall make their own arrangements to achieve zero discharge of the trade effluents, solid waste & E waste management, gaseous emission and noise control measures to achieve the standards prescribed by the TNPCB.
32. The project proponent shall ensure that the individual member units will not be allowed to carry out manufacturing of products stipulated in G.O. (Ms) No. 84 dated 25/06/2018 on banning of one time use on and throwaway plastics.
33. The project proponent must submit the permissible land use classification certificate obtained from competent authority for the proposed project before obtain the CTE from TNPCB.
34. The proponent shall obtain the necessary permission/ NOC of water supply from the TWAD Board/competent Authority.
35. The CER fund shall be utilized as per the office memorandum of MoEF & CC dated 01.05.2018 before obtaining CTO from TNPCB.
36. The allotted industrial units shall obtain consent from the TNPCB separately for their establishment & operation in this industrial estate.
37. The project proponent shall ensure that 33% of the total area of the project site should be covered with green belt.
38. The proponent shall provide Rain Water Harvesting pits so as to recharge the ground water table.
39. Discharge of treated sewage shall conform to the norms & standards prescribed by the Tamil Nadu Pollution Control Board.

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40. It is the sole responsibility of the proponent that the treated sewage disposed for green belt development/ avenue plantation should not pollute the soil/ ground water/ adjacent canals/ lakes/ ponds, etc.
41. The Developer has to ensure that all the member industries within the Industrial Park shall make their own arrangements to achieve zero discharge of the trade effluents,
42. The project proponent shall ensure that all the member units should treat and dispose solid waste & E-waste as per the Solid Waste Management Rule2016 as amended and E-Waste Management Rules, 2016
43. There shall be no discharge of effluent outside the Industrial Park at any time.
44. The Developer shall mandate the member units of the Industrial Park to install adequate APC measures/Acoustic to achieve air emissions standards within permissible limits prescribed by the CPCB.

Part - B – Specific Conditions – Pre construction phase:

1. The project authorities should advertise with basic details at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of clearance. The press releases also mention that a copy of the clearance letter is available with the State Pollution Control Board and also at website of SEIAA, TN. The copy of the press release should be forwarded to the Regional Office of the Ministry of Environment and Forests located at Chennai and SEIAA-TN.
2. In the case of any change(s) in the scope of the project, a fresh appraisal by the SEAC/SEIAA shall be obtained before implementation.
3. A copy of the clearance letter shall be sent by the proponent to the Local Body. The clearance letter shall also be put on the website of the Proponent.
4. The approval of the competent authority shall be obtained for structural safety of the buildings during earthquake, adequacy of fire fighting equipments, etc as per National Building Code including protection measures from lightning etc before commencement of the work.

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5. All required sanitary and hygienic measures for the workers should be in place before starting construction activities and they have to be maintained throughout the construction phase.
6. Design of buildings should be in conformity with the Seismic Zone Classifications.
7. The Construction of the structures should be undertaken as per the plans approved by the concerned local authorities/local administration.
8. No construction activity of any kind shall be taken up in the OSR area.
9. Consent of the local body concerned should be obtained for using the treated sewage in the OSR area for gardening purpose. The quality of treated sewage shall satisfy the bathing quality prescribed by the CPCB.
10. The height and coverage of the constructions shall be in accordance with the existing FSI/FAR norms as per Coastal Regulation Zone Notification, 2011.
11. The Project Proponent shall provide car parking exclusively for the visiting guest in the proposed residential apartments as per CMDA norms.
12. The project proponent shall ensure the level of basement shall be above maximum flood level.
13. The proponent shall prepare completion plans showing Separate pipelines marked with different colours with the following details
    i. Location of STP, compost system, underground sewer line.
    ii. Pipe Line conveying the treated effluent for green belt development.
    iii. Pipe Line conveying the treated effluent for toilet flushing
    iv. Water supply pipeline
    v. Gas supply pipe line, if proposed
    vi. Telephone cable
    vii. Power cable
    viii. Strom water drains, and
    ix. Rain water harvesting system, etc.,. and it shall be made available to the owners

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14. A First Aid Room shall be provided in the project site during the entire construction and operation phases of the project.
15. The present land use surrounding the project site shall not be disturbed at any point of time.
16. The green belt area shall be planted with indigenous native trees.
17. Natural vegetation listed particularly the trees shall not be removed during the construction/operation phase. In case any trees are likely to be disturbed, shall be replanted.
18. During the construction and operation phase, there should be no disturbance to the aquatic eco-system within and outside the area.
19. The Provisions of Forest conservation Act 1980, Wild Life Protection Act 1972 & Bio diversity Act 2002 should not be violated.
20. There should be Fire fighting plan and all required safety plan.
21. Regular fire drills should be held to create awareness among owners/ residents.

Part - C - Specific Conditions – Construction phase:

1. **Construction Schedule:**
   i) The Project proponent shall have to furnish the probable date of commissioning of the project supported with necessary bar charts to SEIAA-TN.
2. **Labour Welfare:**
   i) All the labourers to be engaged for construction should be screened for health and adequately treated before and during their employment on the work at the site.
   ii) Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Occupational health surveillance program of the workers should be undertaken periodically to observe any contradictions due to exposure to dust and take corrective measures, if needed.

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iii) Periodical medical examination of the workers engaged in the project shall be carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly. The workers shall be provided with personnel protective measures such as masks, gloves, boots etc.

3. Water Supply:

i) The entire water requirement during construction phase may be met from ground water source from the source with approval of the PWD Department of water resources/ may be out sourced.

ii) Provision shall be made for the housing labour within the site with all necessary infrastructures and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

iii) Adequate drinking water and sanitary facilities should be provided for construction workers at the site. The treatment and disposal of waste water shall be through dispersion trench after treatment through septic tank. The MSW generated shall be disposed through Local Body and the identified dumpsite only.

iv) Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices prevalent.

v) Fixtures for showers, toilet flushing and drinking water should be of low flow type by adopting the use of aerators / pressure reducing devises / sensor based control.

4. Solid Waste Management:

i) In the solid waste management plan, the STP sludge management plan for direct use as manure for gardens is not acceptable; it must be co-composted with biodegradables.

ii) House hold hazardous waste such as batteries, small electronics, CFL bulbs, expired medicines and used cleaning solvent bottles should be

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segregated at source, collected once in a month from residences and disposed as per the SWM rules 2016.

iii) Domestic solid wastes to be regularly collected in bins or waste handling receptacles and disposed as per the solid waste management rules 2016.

iv) No waste of any type to be disposed of in any watercourse including drains, canals and the surrounding environment.

v) E-waste shall be disposed through Authorized vendor as per E-waste (Management and Handling) Rules, 2016 and subsequent amendment.

5. **Top Soil Management:**

i) All the top soil excavated during construction activities should be stored for use in horticulture/ landscape development within the project site.

6. **Construction Debris disposal:**

i) Disposal of construction debris during construction phase should not create any adverse effect on the neighboring communities and be disposed off only in approved sites, with the approval of Competent Authority with necessary precautions for general safety and health aspects of the people. The construction and demolition waste shall be managed as per Construction & Demolition Waste Management Rules, 2016.

ii) Construction spoils, including bituminous materials and other hazardous materials, must not be allowed to contaminate watercourses. The dump sites for such materials must be secured so that they should not leach into the adjacent land/ lake/ stream etc.

7. **Diesel Generator sets:**

i) Low Sulphur Diesel shall be used for operating diesel generator sets to be used during construction phase. The air and noise emission shall conform to the standards prescribed in the Rules under the Environment (Protection) Act, 1986, and the Rules framed thereon.

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ii) The diesel required for operating stand by DG sets shall be stored in underground tanks fulfilling the safety norms and if required, clearance from Chief Controller of Explosives shall be taken.

iii) The acoustic enclosures shall be installed at all noise generating equipments such as DG sets, air conditioning systems, cooling water tower etc.

8. Air & Noise Pollution Control:

i) Vehicles hired for bringing construction materials to the site should be in good condition and should conform to air and noise emission standards, prescribed by TNPCB/CPCB. The vehicles should be operated only during non-peak hours.

ii) Ambient air and noise levels should conform to residential standards prescribed by the TNPCB, both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during the construction phase. The pollution abatement measures shall be strictly implemented.

iii) Traffic congestion near the entry and exit points from the roads adjoining the proposed project site shall be avoided. Parking shall be fully internalized and no public space should be utilized. Parking plan to be as per DTCP norms. The traffic department shall be consulted and any cost effective traffic regulative facility shall be met before commissioning.

iv) The buildings should have adequate distance between them to allow free movement of fresh air and passage of natural light, air and ventilation.

9. Building material:

i) Fly-ash blocks should be used as building material in the construction as per the provision of Fly ash Notification of September, 1999 and amended as on 27th August, 2003 and Notification No. S.O. 2807 (E) dated: 03.11.2009.

ii) Ready-mix concrete shall alone be used in building construction and necessary cube-tests should be conducted to ascertain their quality.

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iii) Use of glass shall be reduced up to 40% to reduce the electricity consumption and load on air conditioning. If necessary, high quality double glass with special reflecting coating shall be used in windows.

10. Storm Water Drainage:

i) Storm water management around the site and on site shall be established by following the guidelines laid down by the storm water manual.

ii) Storm water management plan shall be obtained by engaging the services of Anna University/IIT.

11. Energy Conservation Measures:

i) Roof should meet prescriptive requirement as per Energy Conservation Building Code by using appropriate thermal insulation material, to fulfill the requirement.

ii) Opaque wall should meet prescribed requirement as per Energy Conservation Building Code which is mandatory for all air conditioned spaces by use of appropriate thermal insulation material to fulfill the requirement.

iii) All norms of Energy Conservation Building Code (ECBC) and National Building Code, 2005 as energy conservation have to be adopted Solar lights shall be provided for illumination of common areas.

iv) Application of solar energy should be incorporated for illumination of common areas, lighting for gardens and street lighting. A hybrids system or fully solar system for a portion of the apartments shall be provided.

v) A report on the energy conservation measures conforming to energy conservation norms prescribed by the Bureau of Energy Efficiency shall be prepared incorporating details about building materials & technology; R & U factors etc and submitted to the SEIAA in three month's time.

vi) Energy conservation measures like installation of CFLs/TFLs for lighting the areas outside the building should be integral part of the project design and should be in place before project commissioning.

12. Fire Safety:

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i) Adequate fire protection equipments and rescue arrangements should be made as per the prescribed standards.

ii) Proper and free approach road for fire-fighting vehicles upto the buildings and for rescue operations in the event of emergency shall be made.

13. Green Belt Development:

i) The Project Proponent shall plant tree species with large potential for carbon capture in the proposed green belt area based on the recommendation of the Forest department well before the project is completed.

ii) The purpose of Green belt around the project is to capture the fugitive emissions and to attenuate the noise generated, in addition to the improvement in the aesthetics. A wild range of indigenous plants species should be planted in and around the premise in consultation with the DFO, Viluppuram District / State Agriculture University. The plants species should have thick canopy cover, perennial green nature, native origin and large leaf areas. Medium size trees and small trees alternating with shrubs shall be planted. If possible Miyawaki method of planting i.e planting different types of trees at very close escapement may be tried which will give a good green cover. A total of 15% of the plot area should be designated for green belt which should be raised along the boundaries of the plot and in between blocks in an organized manner

iii) The proponent shall develop the green belt as per the plan furnished and area earmarked for the greenbelt shall not be alter at any point of time for any other purpose.

iv) The proponent has to earmark the greenbelt area with dimension and GPS coordinates for the green belt area and the same shall be included in the layout out plan to be submitted for DTCP approval

14. Sewage Treatment Plant:

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i) The Sewage Treatment Plant (STP) installed should be certified by an independent expert/ reputed Academic institutions for its adequacy and a report in this regard should be submitted to the SEIAA, TN before the project is commissioned for operation. Explore the less power consuming systems viz baffle reactor, etc., for the treatment of sewage.

ii) The Proponent shall install STP as furnished. Any alteration to satisfy the bathing quality shall be informed to SEIAA-TN.

iii) The project proponent shall operate and maintain the Sewage treatment Plant effectively to meet out the standards prescribed by the CPCB.

iv) The project proponent shall continuously operate and maintain the Sewage treatment plant to achieve the standards prescribed by the CPCB.

v) The project proponent has to ensure the complete recycling of treated sewage after achieving the standards prescribed by the CPCB.

vi) The project proponent has to provide separate standby D.G set for the STP for the continuous operation of the STP in case of power failure.

15. Rain Water Harvesting:

i) The proponent/ Owner of the Flats shall ensure that roof rain water collected from the covered roof of the buildings, etc shall be harvested so as to ensure the maximum beneficiation of rain water harvesting by constructing adequate sumps so that 100% of the harvested water shall be reused.

ii) Rain water harvesting for surface run-off, as per plan submitted should be implemented. Before recharging the surface run off, pre-treatment with screens, settlers etc. must be done to remove suspended matter, oil and grease, etc.

iii) The project activity should not cause any disturbance & deterioration of the local bio diversity.

16. Building Safety:

Lightning arrester shall be properly designed and installed at top of the building and where it is necessary.

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Part – D - Specific Conditions – Operational Phase/Post constructional phase/Entire life of the project:

1. There should be Fire fighting plan and all required safety plan.
2. Regular fire drills should be held to create awareness among owners/ residents.
3. House hold hazardous waste such as batteries, small electronics, CFL bulbs, expired medicines and used cleaning solvent bottles should be segregated at source, collected once in a month from residences and disposed as per the SWM rules 2016.
4. The building should not spoil the green views and aesthetics of surroundings and should provide enough clean air space.
5. The project proponent has to furnish the certificate stating that the proposed site had not encroached any water body (rivers, canals, lakes, ponds, tanks, etc) from its original boundary shall be obtained from the competent authority before obtaining CTE from TNPCB.
6. The project proponent shall obtain the necessary permission for drawl of ground water / surface water required for the project from the competent authority.
7. Solar energy saving shall be increased to atleast10% of total energy utilization.
8. The project proponent shall comply with the provisions contained in this Ministry's OM vide F.No. 22-65/2017-IA.III dated 1st May 2018, as applicable, regarding Corporate Environment Responsibility.
9. The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest / wildlife norms / conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF & CC as a part of six-monthly report.

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10. The EMP cost shall be printed in the Brochure / Pamphlet for the preparation of the sale of the property and should also mention the component involved.
11. The Project proponent shall get due permission from the wetland Authority before the commencement of the work, if applicable.
12. The project activities should in no way disturb the manmade structures.
13. The Proponent shall do afforestation/ restoration programme contemplated to strengthen the open spaces shall preferably include native species along with the financial forecast for planting and maintenance for 5 years.
14. "Consent to Operate" should be obtained from the Tamil Nadu pollution Control Board before the start of the operation of the project and copy shall be submitted to the SEIAA-TN.
15. Raw water quality to be checked for portability and if necessary RO plant shall be provided.
16. The Proponent should be responsible for the maintenance of common facilities including greening, rain water harvesting, sewage treatment and disposal, solid waste disposal and environmental monitoring including terrace gardening for a period of 3 years. Within one year after handing over the flats to all allottees a viable society or an association among the allottees shall be formed to take responsibility of continuous maintenance of all facilities with required agreements for compliance of all conditions furnished in Environment Clearance (EC) order issued by the SEIAA-TN or the Proponent himself shall maintain all the above facilities for the entire period. The copy of MOU between the buyers Association and proponent shall be communicated to SEIAA-TN.
17. The ground water level and its quality should be monitored and recorded regularly in consultation with Ground Water Authority.
18. Treated effluent emanating from STP shall be recycled / reused to the maximum extent possible. The treated sewage shall conform to the norms and standards for bathing quality laid down by CPCB irrespective of any use. Necessary measures should be made to mitigate the odour and mosquito problem from STP.

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19. The Proponent shall operate STP continuously by providing stand by DG set in case of power failure.
20. Adequate measures should be taken to prevent odour emanating from solid waste processing plant and STP.
21. The E - waste generated should be collected and disposed to a nearby authorized e-waste centre as per E- waste (Management & Handling), Rules 2016 as amended.
22. Diesel power generating sets proposed as source of back-up power during operation phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets.
23. The noise level shall be maintained as per MoEF/CPCB/TNPCB guidelines/norms both during day and night time.
24. Spent oil from D.G sets should be stored in HDPE drums in an isolated covered facility and disposed as per the Hazardous & other Wastes (Management & Transboundary Movement) Rules 2016. Spent oil from D.G sets should be disposed off through registered recyclers.
25. The proponent is required to provide a house hold hazardous waste / E-waste collection and disposal mechanism.
26. The proponent/ Owner of the Flats shall ensure that storm water drain provided at the project site shall be maintained without choking or without causing stagnation and should also ensure that the storm water shall be properly disposed off in the natural drainage / channels without disrupting the adjacent public. Adequate harvesting of the storm water should also be ensured.
27. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/rules of the regulatory authority to avoid mercury contamination.
28. A copy of the Environmental clearance (EC) letter shall be made available to all the allottees along with the agreement letter / sale deed.

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29. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.

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Copy to:

1. The Principal Secretary to Government, Environment & Forests Dept, Govt. of Tamil Nadu, Fort St. George, Chennai - 9.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD Cum-Office Complex, East Arjun Nagar, New Delhi 110032.
3. The Member Secretary, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai-600 032.
4. The APCCF (C), Regional Office, Ministry of Environment & Forest (SZ), 34, HEPC Building, 1st& 2nd Floor, Cathedral Garden Road, Nungambakkam, Chennai - 34.
5. Monitoring Cell, I A Division, Ministry of Environment & Forests, Paryavaran Bhavan, CGO Complex, New Delhi 110003.
6. The District Collector, Viluppuram District
7. Stock File.

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ANNEXURE – V

TANSIDCO ALLOTMENT LETTER FOR PLOT NO. 38, PLOT ALLOTMENT CHARGES, PAYMENT TO PLOT ALLOTMENT AND PARTNERSHIP DEED

TAMIL NADU SMALL INDUSTRIES DEVELOPMENT CORPORATION LIMITED(TANSIDCO)
Regd. Office: SIDCO Corporate Office Building, Thiru-Vi-Ka Industrial Estate,
Guindy, Chennai - 600 032
CIN : U74999TN1970SGC005821
Phone: 2250 1461 / 2250 1422 / 2250 1210 Fax: 2250 0792
E-mail: ho.sidco@nic.in website : www.tansidco.tn.gov.in

Rc.No. 9599/EG2/2023-I-31 Date : 01-09-2023.

ALLOTMENT ORDER FOR PLOT - OUTRIGHT SALE BASIS

To **By RPAD**
Tmt LAKSHMI S,
M/s. JUVENUS DRUGS,
Plot no 55Raji flat Near ring road
ponniammanmedu chennai-600110
pincode:600110
Mobile No 9840173074

Sub : TANSIDCO – Industrial Estate at **Tindivanam Mega Pharma Cluster** – Allotment of Plot bearing **No. 38,** to **M/s. JUVENUS DRUGS** on OUTRIGHT SALE BASIS – Provisional Allotment Orders – Issued.

Ref : 1.Your Online Application No TANSIDCO/2023/440 dated 03-08-2023.

2. Screening Committee held on dated 16-08-2023.

****

1.

1.1 The following Plot in TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster is allotted to M/s. JUVENUS DRUGS on Outright Sale basis for setting up an Industry thereon for the line of activity of BULK DRUG INTERMEDIATES MANUFACTUING.

S.No.	Description	Particulars
a)	Plot No.	38(1.450),
b)	Total Extent of the Plot (in Sq.m)	5867.950
c)	Total Extent of the Plot (in Acres)	1.450

1.2 The Allotment Order is issued to the Partnership Concern consisting of the following Partners:

JUVENUS DRUGS Chennai 600103

S.No.	Name	Shareholding (%)
1	Tmt.LAKSHMI S	50
2	Thiru.KANNAN P	50
		100

2. Plot Cost and Terms of Payment :

2.1 The cost of the Plot is **Rs. 15274600/- [10534200 * 1.450 and rounded off to nearest 100/-] (Rupees One Crore Fifty Two Lakhs Seventy Four Thousand Six Hundred only)** at the rate of Rs. 10534200/- per Acre which is inclusive of land cost of Rs.8476200/- per acre and SPV contribution of Rs.2058000/- per acre towards the development of common facilities in Mega Pharma Park at Tindivanam.

2.2 The cost of the Plot shall be paid in the manner indicated below:

(i) The initial payment of 50% of the Plot cost amounting to **Rs.7637300/- (Rupees Seventy Six Lakhs Thirty Seven Thousand Three Hundred Only)** shall be paid within 2 months from the date of Allotment Order i.e. on or before **31-10-2023** failing which the Allotment shall stand automatically cancelled and the Earnest Money Deposit (EMD) will be forfeited.

(ii) The balance payment of 50% of the Plot cost after adjusting the EMD (Rs.10000/-) amounting to **Rs.7627300/- (Rupees Seventy Six Lakhs Twenty Seven Thousand Three Hundred Only)** shall be paid within 4 months from the date of Allotment Order i.e. on or before **31-12-2023** failing which the Allotment shall stand automatically cancelled and the EMD will be forfeited. The initial payment will be refunded within a period of 30 days without interest.

(iii) All payments shall be made by means of online payment through TANSIDCO website.

JUVENUS DR Chennai 600103

3. Handing over and taking possession of the Plot :

3.1 The possession of the Plot shall be handed over only after the payment of the entire Plot cost and execution of a Memorandum of Understanding (MoU) with the Branch Manager concerned in the prescribed Format. The Allottee shall take possession of the Plot in **"as is where is condition"**.

3.2 The Plot would be deemed to have been cancelled automatically if

(i) The entire Plot cost is paid but the MoU is not executed by the Allottee within a period of 30 days from the date of payment of entire Plot cost.

(ii) The Plot is not taken possession within a period of 30 days from the date of execution of MoU.

In such circumstances, only Plot cost paid by the Allottee will be refunded without any interest after deducting the EMD and Administrative charges.

4. Utilization / Commencement of production :

4.1 The Plot shall be utilized only for the purpose for which it was allotted.

4.2 The construction of the industrial building on the Plot shall be commenced within 3 months from the date of taking possession of the Plot by obtaining the necessary Approvals from the Competent Authorities.

4.3 The Allottee shall submit the plan of action towards the utilization of the plot to TANSIDCO and TANSIDCO will monitor the work in progress as per the Plan of action at the intervals of three months time till the utilization of the Industrial plot.

4.4 The production shall be commenced within 24 months from the date of taking over the possession of the Plot.

4.5 The Allottee should obtain the requisite approval / license / permission of the Competent Authorities under the law for the time being in force relating to the proposed industry.

4.6 The building constructed in the Plot shall be in conformity with the by-laws of the local body / or Development Control Regulation (DCR), building regulations in force from time to time. Any building constructed on the Plot without obtaining the approval of the local authorities concerned or in violation of the terms and conditions of such approval shall be demolished if so directed by TANSIDCO or the Authorities concerned or will be demolished by TANSIDCO at the cost of the Allottee.

4.7 The Allottee should provide a culvert in front of the entrance of the Plot at his own cost without obstructing drainage so as to have a free flow of storm water.

JUVENUS DRUGS Chennai 600103

4.8 If the production is not commenced by the Allottee within the stipulated time specified in Clause 4.4, an extension period of 12 months shall be given, subject to payment of 10% penalty on the prevailing cost of the Plot.

4.9 If the production is not commenced by the Allottee within the extension period specified in Clause 4.8, a further extension period of 12 months shall be given, subject to payment of 20% penalty on the prevailing cost of the Plot. No further extension will be granted and action will be taken by TANSIDCO to cancel the Allotment Order.

4.10 The Allottee shall not dig any well/ bore well/ tube well within the Plot allotted except with the prior permission of TANSIDCO subject to the conditions as applicable.

4.11 The Allottee shall not draw water from bore wells / open wells / tube wells sunk in private lands adjacent to the Industrial Estate unauthorisedly trespassing the premises of the Industrial Estate. If any time, such trespass is found by TANSIDCO, the trespassed waterline shall be removed by TANSIDCO and the expenditure will be recovered from the Allottee.

4.12 Even though the Allottee obtained permission from TANSIDCO as in Clause 4.10, the Allottee shall not be allowed to sell the drawn water from the Industrial Plot allotted to them. The water drawn from the well/ bore well/ tube well within the Industrial Plot shall be utilized only for their industrial purpose in the allotted plot and not for any other purposes.

5. Change in Name / Line of Activity / Constitution / Ownership :

5.1 Change in the name of the Unit / LLP / Partnership firm / Company or Line of Activity in any manner whatsoever shall be made only with the prior approval of TANSIDCO in writing. Any application made by the Allottee for such approval will be considered by TANSIDCO subject to the terms and conditions and on payment of the fees prescribed by TANSIDCO from time to time.

5.2 (i) Change of constitution /Change in Constitution / Lease of allotted land / transfer of ownership of the allottee or legal statusof the Plot shall be permitted only after minimum 50% utilization of Plot area by the original Allottee for the purpose for which it was allotted and execution of Sale Deed on payment of the fees prescribed by TANSIDCO from time to time subject to the terms and conditions.

(ii) Change of constitution means any change of the constitution such as proprietorship firm into a partnership firm or LLP or company and vice versa.

(iii) Change in constitution of an Allottee means a change in the ownership pattern of the Allottee in such a way that the ownership of more than 50% of the Allottee(Unit / LLP / Partnership firm / Company)is acquired by a new party.

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5.3 In case the Change of constitution / Change in constitution / lease of allotted land / transfer of allotted land / transfer of ownership of the allottee or legal status is necessitated before execution of Sale Deed due to exigencies like technical collaboration, demise of the Proprietor / Partners / Shareholders,the same shall be considered on merits of the case subject to collection of difference in Plot cost between the allotted cost and the prevailing cost.

5.4 Where the Change of constitution / Change in constitution/lease of allotted land / transfer of allotted land / transfer of ownership of the allottee or legal status is required among the family members before execution of Sale Deed due to demise of the Proprietor / Partners / Shareholders, and / or induction of new Partners / Shareholders from the blood relatives of the Proprietor / Partners / Shareholders, the samemay be permitted without collecting difference in Plot cost.

6. Mortgage of the Plot :

6.1 Creation of charge over the Plot to raise Term Loan or working capital or other financial assistance from any Banks/ Financial Institution / Non Banking Financial companies (NBFCs) for the proposed industry shall be made only after obtaining No Objection Certificates (NOC) from TANSIDCO. Such financial assistance shall be utilized only for the purpose of setting up / operation of the industry in the allotted Plot.

7. Surrender of the Plot :

7.1 As and when the Allottee decides that Plot or Part thereof is no longer required by the Allottee for the purposes for which it was allotted, the Allottee shall surrender the Plot or Part thereof to TANSIDCO so as to enable the utilization by allotting to needy entrepreneurs. However, TANSIDCO reserves the right to accept the part surrender of the Plot. On acceptance of the surrender, only proportionate Plot cost estimated on the basis of the Plot cost paid by the Allotteefor the surrendered extent will be refunded without any interest after deducting the EMD, Administrative charges and dues payable to TANSIDCO. No compensation will be paid for any structures created / development works undertaken in the Plot by the Allottee.

8. Cancellation of Allotment :

8.1 TANSIDCO reserves the right to serve 45 days show cause notice for cancellation of the Allotment, if it is found that the Allottee has not put to use the Plot for the purpose for which it was allotted and is in non-compliance of the terms and conditions of the Allotment Order including non-implementation of the project and / or having unutilized extent of the allotted Plot and/or non-payment of dues.

JUVENUS DRUGS Chennai 600103

8.2 Unless it is rectified by the Allottee within a period of 45 days from the date of show cause notice, TANSIDCO reserves the right to cancel the Allotment and initiate proceedings for resumption of the Plot or Part thereof under the provisions of the Tamil Nadu Public Premises (Eviction of Unauthorized Occupants) Act, 1975 (Tamil Nadu Act 1 of 1976) or under any Statute for time being in force for eviction against the Allottee as well as for any other mode of recovery in force at that point of time as prescribed by law. In such circumstances, only Plot cost paid by the Allottee will be refunded without any interest after deducting the EMD, Administrative charges and dues payable to TANSIDCO.No compensation will be paid for any structures created / development works undertaken by the Allottee. Further, any damages payable to TANSIDCO under the provisions of the said Act will be recovered from the Allottee.

9. Payment of charges and taxes :

9.1 Subject to availability, TANSIDCO will provide water supply from common source on payment of the charges as fixed by TANSIDCO from time to time. Failure to pay the water charges will lead to disconnection of water supply without any prior intimation.

9.2 Maintenance expenditure incurred towards the common amenities/facilities such as roads, drainage, sewerage, street lights, avenue plants etc. shall be apportioned among the Allottees of the Industrial Estate. The Allottee shall pay the same without any demur within the prescribed time. TANSIDCO reserves the right to take any action as it may deem fit including disconnection of EB supply, water supply, other basic amenities and withholdingof No Objection Certificates (NOC) to recover the dues.Further necessary legal action will be initiated under the provisions of the Transfer of Property Act, 1882(Act IV of 1882), Indian Contract Act, 1872(Act IX of 1872), the Registration Act, 1908(Act XVI of 1908) and the Specific Relief Act, 1963 (Act 47 of 1963) which constitute the Civil Code of India and govern the transfer of immovable property.

9.3 Property tax and other applicable taxes and charges payable now or hereafter become payable in respect of the Plot shall be paid by the Allottee to the Concerned Authorities.

10. Execution of Sale Deed :

10.1 Sale Deed in respect of the Plot will be executed in the name of the Unit / LLP / Partnership firm / Company subject to fulfilling the following conditions:

(i) Commencement of production certified by the concerned Branch Manager.

(ii) Utilization of atleast 50% of the allotted extent certified by the concerned Branch Manager.

(iii) Payment of all dues including water charges, maintenance charges etc.

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(iv) Submission of copy of Statutory Approvals / Permissions / No Objection Certificates (NOC) relevant to the proposed industry.

(v) Uploading the geotagged photo with time stamp.

10.2 The Allottee shall produce the following documents to TANSIDCO for the execution of Sale Deed in respect of the Plot allotted to them subject to the applicability of the concern Unit / LLP / Partnership firm / Company:

(i) Copy of EB receipt (proof of electricity consumption).

(ii) Copy of Udyam Registration certificate.

(iii) List of machineries erected.

(iv) Copy of Demand order/Job order.

(v) Copy of Purchase invoice of raw material.

(vi) Copy of sale invoice where the sale have been made.

(vii) Copy of GST registration.

(viii) Any other evidential documents as may be demanded by TANSIDCO in support of commencement of production.

11. General Conditions :

11.1 The Allottee shall keep TANSIDCO indemnified against any and all claims for damages which may be caused to any adjoining buildings or other premises as a consequence of the erection of the buildings and industrial installations by the Allottee. The Allottee shall also keep TANSIDCO indemnified against all payments whatsoever which, during the progress of work, may become payable or be demanded by the Local Authority in respect of the said works, or of anything done under the authority herein contained.

11.2 No temporary or semi-permanent structures shall be built on the Plot except during the period of construction.

11.3 TANSIDCO or persons authorized by TANSIDCO shall have the right to enter upon and inspect the Plot at any time without any prior notice.

11.4 TANSIDCO shall have the right of having access into and utilizing any portion of the Plot as required at all times for the limited purpose of laying pipelines, cables, underground drainage, channels, etc.

11.5 The Allottee shall not dump debris or any waste materials within the premises of the Industrial Estate.

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11.6 TANSIDCO is not liable or under no obligation to provide electrical energy required for the industry and it is the responsibility of the Allottee to obtain the required power supply from the TNEB.

11.7 The Allottee shall not carry out any other activity like residential, commercial unless specifically permitted in the allotted Plot other than the industrial purposes which is prejudicial to the preservation of characteristics and homogeneity of the Industrial Estate or which is punishable under any law.

11.8 The Allottee may be allowed to set up a display center in the allotted Plot wherever necessary with a prior permission of TANSIDCO along with a condition to display the product which is manufactured in the industrial plot and not for any other product. No retail outlet will be permitted in the allotted plot. If it is found that he is using the display center//retail outletfor any other product other than the product manufactured in the industrial plot ,TANSIDCO will initiate necessary legal action for the same.

11.9 The Allottee is allowed to utilize only a maximum of 20% of the Industrial plot area for the display center for which the Allottee must get No Objection Certificate (NOC) from the TANSIDCO for converting the portion of allotted Industrial Plot to Display center of their own product subject to collection of difference in prevailing plot cost for commercial purpose.

11.10 The Allottee shall comply with all conditions stipulated in the statutory approvals / clearances / No Objection Certificates (NOC) obtained from the Competent Authorities from time to time.In case of non-compliance, the same will be intimated to the Competent Authorities for remedial action.

11.11 Industrial effluent should not be let out into the sewer lines of the Industrial Estate. Separate effluent treatment plant (solid / liquid / gas) and equipment to prevent noise, vibrations and fire, health hazards, etc. shall be erected or installed at the industrial premises by the Allottee at his cost in accordance with the standards prescribed by the Tamil Nadu Pollution Control Board or other Authorities concerned and necessary clearance should be obtained from the said Board or other Authorities concerned before commencement of production and a copy thereof to be produced to TANSIDCO.

11.12 Any change in the address of the Registered Office or Administrative Office of the Allottee shall be informed to TANSIDCO failing which any communication, demand, notice intended and required to be served on the Allottee will be addressed to the last known address and the same shall be deemed to have been sufficiently served on the Allottee.

11.13 If TANSIDCO found that the allotment is obtained by the Allottee by misrepresentation or fraud, TANSIDCO shall be at liberty to immediately cancel the Allotment.

11.14 The Allottee shall not close, modify or alter the sewage / water lines inside the allotted plot without the permission of TANSIDCO and TANSIDCO shall be entitled to enter upon the Plot to carry out such repairs / modifications / alterations in sewage/water lines as the TANSIDCO may consider necessary.

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11.15 On matters not specifically stipulated in this Order, TANSIDCO shall be entitled to give directions to the Allottee and the Allottee shall comply with such directions from time to time as per the existing guidelines of the government. Any default in carrying out such directions will be a breach of the conditions of Allotment.

12. The Allottee irrevocably agrees that the appropriate judicial forums of Tamil Nadu shall have jurisdiction to hear, settle and/or determine any dispute,controversy or claim (including any non-contractual dispute, controversy or claim) arising out of or in connection with this allotment, including any question regarding its existence, validity, formation or termination.

13. The Allottee shall furnish the name of the product, export details if any, annual turnover and GST invoice copy to TANSIDCO on or before 1st June of every year.

14. The Allottee must forward the duly signed copy of the Allotment Order No.**Rc.No. 9599/EG2/2023-I-31** dated **01-09-2023** by acknowledging the terms and conditions specified therein and by affixing the seal of the Unit / Partnership firm / LLP / Company to this Office as a token of having accepted the terms and conditions contained herein within 15 days from the date of this Allotment Order, failing which it will be construed that the Allottee accepted the terms and conditions of the Allotment Order.

15. You are requested to make plot cost payment through the portal **"www.tansidco.org/client"** with your Login Id and Password given below
Login ID: **tansidco2023440**
Password: **9840173074**

Yours faithfully
For TANSIDCO LTD.,

Digitally signed by ANNAMALAI REKHA
Date: 2023.09.02 12:42:17 IST
Location: Head Office
Company: Tamil Nadu Small Industries Development Corporation Limited

General Manager

Copy to:
The Branch Manager,
SIDCO Branch Office,
Villupuram

JUVENUS DRUGS Chennai 600103

TAMILNADU SMALL INDUSTRIES DEVELOPMENT CORPORATION LTD.,
(A GOVERNMENT OF TAMILNADU UNDERTAKING)
TANSIDCO PHARMA INDUSTRIAL PARK
TINDIVANAM TALUK, VILLUPURAM DISTRICT

PLOT HANDING OVER CHARGE PAPER

Plot No.	:	**38**
Name of Allottee	:	**Tmt.S.Lakshmi,** **Thiru.P.Kannan** Partners, **M/s.JUVENUS DRUGS,** Plot No.55, Raji flat Near ring Road, Ponniammanmedu, Chennai – 600 110.
Survey No.	:	16 (Part) & 17 (Part).
Name of Village	:	Pellakuppam
Name of Taluk	:	Tindivanam
Name of District	:	Villupuram.
Allottment order H.O Lr No.	:	9599/EG2/2023-I-31, dt.01.09.2023
Branch Office Reference	:	Rc No.202/A/2023, Dt.15.04.2024.
Date of Plot Handing Over	:	**07.05.2024**

Area Statement

Area in Acres	:	5872.32 Sqm or 63209 Sqft or **1.45 acre**

Linear Measurements

North to South on East	:	64.55m
North to South on West	:	6.36m Splay + 60.05m
East to West on North	:	86.63m
East to West on South	:	91.13m

Boundaries

North by	:-	SIDCO 20m Road
South by	:-	Plot No.25A
East by	:-	Plot No.39
West by	:-	SIDCO 20m Road

HANDED OVER

K.GANESAN

ASSISTANT EXECUTIVE ENGINEER (HQ)
SIDCO HEAD OFFICE
THIRU-VI-KA INDUSTRIAL ESTATE,
GUINDY, CHENNAI-600 032.

TAKEN OVER

For JUVENUS DRUGS

Partner

TAMILNADU SMALL INDUSTRIES DEVELOPMENT CORPORATION LTD.,
(A Government of Tamilnadu Undertaking)
Branch Office: Master plan complex, D.I.C. Upstar, Villupuram – 605 602

A.Muhamadha Begum, B.E ,
Branch Manager,

RC No. 202/A/2023
Date:15.04.2024

To
The Assistant Executive Engineer,
SIDCO, Corporate Office
Chennai - 32.

Sir,

Sub: SIDCO – Industrial Estate – Tindivanam Mega Pharma Cluster - Plot No. 38 Allotted to M/s. Juvenus Drugs - MOU executed on .02.2024- handing over of Plot – Reg.

Ref: 1. H.O Allotment Order No. 9599/EG2/2023- I – 31 dt. 01.09.2023
2. H.O. Payment confirmation letter No.12233/IE4-2/2023 dt. 18.01.2024

*****

The Plot No. 38 with an extent of 1.450 acres (approx) at Industrial Estate, Tindivanam mega Pharma cluster was allotted to M/s. Juvenus Drugs with Partnership Firm 1. Tmt.S.Lakshmi 2. Thiru.P.Kannan as its Partners The allottee has paid the plot cost and MOU executed on .02.2024

Hence, I request to hand over the Plot No.38 having a land area of 1.450 acres to M/s. M/s. Juvenus Drugs and furnish the charge paper in duplicate to this office. In case, if the land area available in the plot is more than 1.450 acres, I request not to hand over the plot and inform the exact land area available in the plot along with sketch, so as to get Executive Engineer, Chennai consent to hand over the excess land,as per the Head Office Circular No.2081/P1/2009-4 dt 7.09.2010

After getting Executive Engineer's consent to hand over the excess land area, the land cost for the excess area will be collected and communicated to you and then the plot may be handed over. The allottee's contact Number is 9840173074

BRANCH MANAGER,
SIDCO / VILLUPURAM

Copy to: M/s JUVENUS DRUGS
Plot no 55, Raji flat Near ring road
Ponniammanmedu
Chennai-600110

15/04/24

For JUVENUS DRUGS

Partner

2 The allottee should pay the property Tax for the said property.

2. The allottee should pay water charges, maintenance charge & other demands that may be raised on them by the TANSIDCO or the agencies concerned.

3. In case of any default on repayment of the loan TANSIDCO's dues will have the first priority over your dues for the plot.

4. The allottee should not violate the terms and conditions of the Allotment order, Memorandum of Understanding and the sale deed to be executed with TANSIDCO.

5. **This NOC should be utilized only for the loan to be sanctioned and disbursed for the term loan from TANSIDCO for the Developed Plot No. 38 at SIDCO Industrial Estate, Tindivanam Mega Pharma Cluster towards the mortgage of the plot.**

6. Any document mortgaging this property with Bank Of Baroda, Puduchery should be furnished to TANSIDCO within 3 months otherwise this **NO OBJECTION CERTIFICATE** will lapse automatically. Also, for any reason if, the loan has not been sanctioned the same also to be informed to this office for our reference and records.

7. It should be ensured by M/s. Bank of Baroda, Puduchery that in case of any default on repayment of the loan amount by the allottee 1.Tmt.S.Lakshmi 2. Thiru.P.Kannan and it is decided to recover the loan amount by transfer/sale the said plot through auction under the provisions of Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act (SARFAESI Act), 2002 (Act No.54 of 2002), the same has to be communicated to TANSIDCO before the auction.

8 It should be ensured by the Bank of Baroda, Puduchery that in case of any default on repayment of the loan amount by the allottee 1.Tmt.S.Lakshmi 2. Thiru.P.Kannan and it is decided recover the loan amount by transfer/sale the said plot through auction under the provisions of the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act (SARFAESI Act), 2002 (Act No.54 of 2002) to any person/firm/unit who shall undertake to carry out the approved Industrial activity (manufacturing activity) only as per MSME Department Regulations.

Kindly acknowledge the receipt of this letter.

Yours faithfully
For TANSIDCO Ltd.,

26/10/2023

Branch Manager
SIDCO/Villupuram

Ramya
26/10/23

Copy Submitted to:

The General Manager, TANSIDCO, Corporate Office, Guindy, Chennai – 600 032.
-- submitted for kind information.

Copy to:

M/s. Juvenus Drugs
Plot No.38, SIDCO Industrial Estate
Tindivanam Mega Pharma Cluster, Tindivnam, Villupuram

SCAN AnyScanner



தமிழ்நாடு तमिलनाडु TAMILNADU 18.5.2020

PARTNERSHIP DEED

This deed of partnership executed on this 18th day of May month 2020 year among:

1. **Mr. Kannan**.P, S/o.Mr.Iyyakannu Ponnusamy, aged about 43years, residing at, No.55, Raj Flat, First Floor, F-4, Near Ring Road, Devakainagar, Ponniamanmedu, Chennai-600 110 Hereinafter called the party of the First Part.

2. **Mrs. Lakshmi**.A, D/o,Mr.Arunachalam. aged about 39 years, residing at, No.3, Nadu Mudukku Street, Melagaram, Tenkasi, Tamil Nadu-627 818. Hereinafter called the party of the Second Part.

भारतीय गैर न्यायिक

एक सौ रुपये

Rs. 100

रु. 100

ONE HUNDRED RUPEES

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

தமிழ்நாடு तमिलनाडु TAMILNADU 18.5.2020

Whereas the above mentioned parties are interested to form a partnership firm to carry on the business thereunder specified in the name and style of **"Juvenus Drugs"**.

And whereas it is deemed expedient and necessary to reduce into writing the terms and conditions of this Deed of Partnership.

NOW THIS DEED OF PARTNERSHIP WITNESS AS FOLLOWS:

1. This Deed shall have come into effect on and from **18th day May month 2020 year**.

2. The Name of the firm shall be **"Juvenus Drugs"** having business place at Plot No.99A. Sidco Industrial Estate, Phase-II, Vichoor, Manali New Town, Chennai-600 103 or at any other place or placed as may be mutually between agreed upon time to time.

3. The duration of Partnership shall be "AT Will".

भारतीय गैर न्यायिक

एक सौ रुपये

Rs. 100

ONE HUNDRED RUPEES

रु. 100

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

தமிழ்நாடு तमिलनाडु TAMILNADU 18.5.2020

BY 332992

4. The nature of business of the firm shall be to deal with Human Pharma Products. The firm shall also do any other business either in addition to the above or in substitution thereof as may be mutually agreed between the partners from time to time.

5. The total capital of the partnership firm shall be **Rs. 2,00,000/- (Rupees Two Lakhs Only)** and the same shall be contributed by the partners as under:

1.	Mr. Kannan P	Rs.1,00,000/-
2.	Mrs. Lakshmi A	Rs.1,00,000/-
		Rs.2,00,000/-

Such amount contributed by the partners, as capital shall bear interest @ 14% per annum. The partners may contribute any further sum for the purpose of business of the firm, which shall bear interest at 14% per annum.

6. No partners shall, during the continuance of the partnership without the consent of the other partners in writing, do any of the following acts;

    - Give any security or undertaking of payments of money on account of the partnership.
    - Release or compound any debt owing to the firm or diminish security to the firm without receiving full amount thereof.
    - Borrow in his individual capacity for the firm's business nor shall execute his individual capacity any documents with the credit facilities availed for.

7. If the firm requires any additional funds, any partner may advance such funds, and or may also borrow from out siders Financial Institutions, Scheduled/Nationalized Banks, etc., at such rate of interest any may be agreed upon by the partners. All the necessary documents shall be executed by the party of the First and Second Part jointly. The loan taken any of the Partner(s) individually shall not bind the firm or other partners.

8. The part of the First Part is authorized to sign the necessary form with the government bodies like Bank, Goods and Service Tax, Income Tax, TNEB, Labour Office, ESI, PF and other statutory bodies on behalf of the firm.

9. No Goodwill shall accure/arise at any times either during the partnership or at disruption of partnership.

10. Proper books of accounts as are usual and necessary in the business of like nature shall be maintained and the firm shall be closed on the last day of every financial year and the same shall be audited by a "Chartered Accountant".

11. The profit and loss would be divided and borne by the partners in the ratio as follows:

Name of the partner	Share of profit/Loss
• Mr. Kannan P	50%
• Mrs. Lakshmi A	50%
	100%

12. The firm shall be entitled to open a bank account with any Nationalized/Scheduled bank, in the name of the firm and same shall be operated by party of the First Part Mr. Kannan P, "INDIVIDUALLY".

13. The party of the First part Mr. Kannan P shall be working partner of the firm and can actively engage in conducting the affairs of the business for which monthly remuneration of Rs.25,000/- (Rupees Twenty Five thousands only) per month of the first party and Rs. 25,000/- (Rupees Twenty Five thousands only) for the second party. The amount of remuneration shall be modified by the partners by mutual consent as and when necessary.

14. The partners shall by mutual consent in writing admit a new partner/partners to the firm.

15. Death, Retirement, Lunacy or Insolvency of the partner shall not dissolve the firm unless the minimum numbers of partners or less than statutory limit.

16. If any time any dispute, doubts, questions shall arise between the partners either on the construction of these clauses or respecting the accounts, transaction, profits or losses of the business or otherwise in relation to the partnership, then every such dispute, doubts or questions shall be referred to an arbitrator appointed by them and such reference shall confirm to the provisions in that behalf contained in the arbitration Act,1940, or any statutory modification thereof.

17. Except to the extent provided in the foregoing clauses all the other provisions of the Indian Partnership Act, 1932. Shall apply to this partnership.

In witness, whereof, we, the above – mentioned parties have hereunto set our hands on this 18th day May month 2020 year.

P. Kan

Party of the First Part

Party of the Second Part

WITNESS:

1. S. Subash (S. SUBASHINI)
2. B. Vaishnavi (B. VAISHNAVI)

ANNEXURE – VI

GRANTED TERMS OF REFERENCE (TOR)

File No: 12030
Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), TAMIL NADU)
***

Dated **16/06/2025**

To,

Thiru.P Kannan
Juvenus drugs
No.55, 1st Floor F-4, Raj Flat, Near Ring Road, Devakainagar, Ponniamanmedu, Chennai 600110, Chennai, CHENNAI, TAMIL NADU, 600110
juvenusdrugs@gmail.com

Subject: Grant of Terms of Reference under the provision of the EIA Notification 2006-as amended regarding.

Sir/Madam,

Sub:SEIAA-TN – Terms of Reference for the Proposed Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit Plot No. 38, Survey Nos. 16 & 17, TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu by M/s. Juvenus Drugs – under Category "B1" and Schedule Sl. No. 5(f) - "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)" of EIA Notification 2006 – ToR issued – Preparation of EIA Report – Regarding.

Ref:

1. Online Application No. SIA/TN/IND3/532831/2025, Dated: 04/04/2025
2. Your application for Terms of Reference dated: 05.04.2025.
3. Minutes of the 563rd SEAC meeting held on 12.05.2025.
4. Minutes of the 835th SEIAA meeting held on 05.06.2025.

2. The particulars of the proposal are as below :

(i) TOR Identification No.	TO25B2405TN5666099N
(ii) File No.	12030
(iii) Clearance Type	TOR
(iv) Category	B1
(v) Project/Activity Included Schedule No.	5(f) Synthetic organic chemicals industry
(vii) Name of Project	Proposed Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit by M/s. Juvenus

	Drugs
(viii) Name of Company/Organization	Juvenus drugs
(ix) Location of Project (District, State)	VILLUPURAM, TAMIL NADU
(x) Issuing Authority	SEIAA
(xii) Applicability of General Conditions	no
(xiii) Applicability of Specific Conditions	no

3. In view of the particulars given in the Para 1 above, the project proposal interalia including Form-1(Part A and B) were submitted to the SEIAA for an appraisal by the SEAC under the provision of EIA notification 2006 and its subsequent amendments.

4. The above-mentioned proposal has been considered by SEIAA in the meeting held on 05.06.2025. The minutes of the meeting and all the Application and documents submitted [(viz. Form-1 Part A, Part B,] are available on PARIVESH portal which can be accessed by scanning the QR Code above.

5. The State Expert Appraisal Committee (SEAC), based on the information & clarifications provided by the project proponent and after detailed deliberations on all technical aspects recommended the proposal for grant of Terms of Reference under the provision of EIA Notification, 2006 and as amended thereof subject to the stipulation of specific and general conditions as detailed in Annexure (2).

6. The SEIAA has examined the proposal in accordance with the Environment Impact Assessment (EIA) Notification, 2006 & further amendments thereto and after accepting the recommendations of the SEAC hereby decided to issue the following Terms of Reference for instant proposal of M/s. Juvenus Drugs under the provisions of EIA Notification, 2006 and as amended thereof.

7. The Ministry/SEIAA-TN reserves the right to stipulate additional conditions, if found necessary.

8. The Terms of Reference to the aforementioned project is under provisions of EIA Notification, 2006. It does not tantamount to approvals/consent/permissions etc. required to be obtained under any other Act/Rule/regulation. The Project Proponent is under obligation to obtain approvals /clearances under any other Acts/ Regulations or Statutes, as applicable, to the project.

9. This issues with the approval of the Competent Authority.

10. The TORs prescribed shall be **valid for a period of three years** from the date of issue, for submission of the EIA/EMP report as per OMNo.J-11013/41/2006-IA-II(I)(part) dated 29th August 2017.

Copy To

1. The Additional Chief Secretary to Government, Environment, Climate Change and Forests Department, Govt. of Tamil Nadu, Fort St. George, Chennai - 9.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD Cum-Office Complex, East Arjun Nagar, New Delhi - 110 032.
3. The Chairman, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032.
4. The APCCF (C), Regional Office, MoEF & CC (SZ), 34, HEPC Building, 1st & 2nd Floor, Cathedral Garden Road, Nungambakkam, Chennai - 34.
5. Monitoring Cell, IA Division, Ministry of Environment, Forests & CC,
6. Paryavaran Bhavan, CGO Complex, New Delhi - 110 003.
7. Stock File.

Annexure 1

Specific Terms of Reference for (Synthetic Organic Chemicals Industry)

1. Seiaa Specific Conditions:

S. No	Terms of Reference
1.1	1. The toxic fumes anticipated due to the project activities. 2. The Persistent Organic Pollutants (POPs) anticipated and their quantities. 3. The possibilities of biomagnification. 4. Impact on human health, biodiversity, food chain, atmosphere and water resources because of the POPs emitted from project activity. 5. Impact on soil, soil biota and vegetation. 6. Impact on climate change. 7. Carbon sequestration strategies adopted. 8. Smart technologies adopted to improve energy efficiency. 9. Occupational Health & safety details shall be furnished. 10. Impact on wildlife, mammals, fishes and possibilities of behavioural change because of the pollutants emitted. 11. CO2 emission and action for containing it. 12. Anticipated Green House Gas emissions and mitigation strategies

2. Seac Conditions - Site Specific

S. No	Terms of Reference
2.1	1. The PP shall submit details regarding the suitability of the proposed activity, along with a report that includes information on the machinery, flow chart of the operation, storage of raw materials, storage of products, air pollution, water pollution, fugitive emissions and their control, and waste management. 2. The PP shall conduct a soil test at the proposed site and submit a report on any potential leaching of harmful / heavy chemicals due to the proposed activity. 3. The PP shall furnish the mass balance for the product. 4. The PP shall provide the commercial names of the raw materials and specify the form in which the raw materials will be purchased. 5. The PP shall furnish the MSDS along with chemical structure for each raw material to be utilized for manufacturing the product. 6. The PP shall generate/buy green energy for a minimum of 50% of its total power consumption. 7. The PP shall provide roof top solar panel to cover 75% of its roof area. 8. The PP shall develop 33% green belt with native tree species all along the periphery of project boundary with geo reference and furnish the details with photographs in the EIA report. 9. The PP shall furnish a comparative study of energy efficiency in its plant vis a vis the global standards. 10. The PP shall furnish the details of all Air pollution control measures to be provided to control the emissions to be generated from its manufacturing process at various stages. 11. The PP shall furnish the emergency/disaster management plan. 12. The PP shall furnish the fire license obtained from the competent authority. 13. The PP shall provide the DG set details with eco-friendly alternate fuel other than diesel.

S. No	Terms of Reference
	14. The PP shall furnish all the Hazardous wastes and Non-hazardous solid wastes to be generated from its manufacturing process and how its disposed scientifically.

Standard Terms of Reference for (Synthetic organic chemicals industry)

1. Executive Summary

S. No	Terms of Reference
1.1	Executive Summary

2. Introduction

S. No	Terms of Reference
2.1	Details of the EIA Consultant including NABET accreditation
2.2	Information about the project proponent
2.3	Importance and benefits of the project

3. Project Description

S. No	Terms of Reference
3.1	Cost of project and time of completion.
3.2	Products with capacities for the proposed project.
3.3	If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.
3.4	Details of existing products and production, if any, along with present product/production details in tabular format, to verify the compliance of the EIA Notifications.
3.5	Details of existing products and production, if any, along with present product/production details in tabular format, to verify the compliance of the EIA Notifications.
3.6	List of raw materials required and their source along with mode of transportation.
3.7	Other chemicals and materials required with quantities and storage capacities
3.8	Details of Emission, effluents, hazardous waste generation and their management.
3.9	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)

S. No	Terms of Reference
3.10	Details of boiler/gensets (including stacks/exhausts) and fuels to be used
3.11	Process description along with major equipment's and machineries, process flow sheet (quantitative) from raw materials to products to be provided
3.12	Hazard identification and details of proposed safety systems.
3.13	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 Integrated Regional Office of the Ministry of Environment, Forest and Climate Change 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, copy of the latest CTO and 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. 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.

4. Site Details

S. No	Terms of Reference
4.1	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.
4.2	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)
4.3	Details w.r.t. option analysis for selection of site
4.4	Co-ordinates (lat-long) of all four corners of the site.
4.5	Google map-Earth download of the project site.
4.6	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.
4.7	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.
4.8	Land-use break-up of total land of the project site (identified and acquired), government/private -

S. No	Terms of Reference
	agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)
4.9	A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area
4.10	Geological features and Geo-hydrological status of the study area shall be included.
4.11	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)
4.12	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land. Documents related to conversion of land for Industrial purpose.
4.13	R&R details in respect of land in line with state Government policy.

5. Forest, Wildlife And Crz Related Issues (If Applicable):

S. No	Terms of Reference
5.1	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)
5.2	Land-use map based on High resolution satellite imagery of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha)
5.3	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.
5.4	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 Wardenthereon
5.5	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
5.6	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife
5.7	Recommendations and NOC from the concerned State/UT Coastal Zone Management Authority on CRZ angle

6. Environmental Status

S. No	Terms of Reference
6.1	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.P • 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. Study should indicate minimum, maximum value of different parameters for the period (3 months) collected. Collected data should be supported by the reference data of either CPCB or SPCB. AAQ data & GLC of pollutants from stack emissions should suggest technology/ measures- Best Practiced Technology (BPT) indicating best achieved results.
6.2	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.
6.3	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.
6.4	Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.
6.5	Ground water monitoring at minimum at 8 locations shall be included.
6.6	Noise levels monitoring at 8 locations within the study area.
6.7	Soil Characteristic as per CPCB guidelines.
6.8	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.
6.9	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.
6.10	Socio-economic status of the study area.

7. Environment Impact And Environment Management Plan

S. No	Terms of Reference
7.1	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.

S. No	Terms of Reference
7.2	Water Quality Modelling – in case of discharge in water body
7.3	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.
7.4	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 1986.
7.5	Details of stack emission and action plan for control of emissions to meet standards
7.6	Measures for fugitive emission control
7.7	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.
7.8	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.
7.9	Action plan for the green belt development plan in 33 % area i.e. land with not less than 2,500 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.
7.10	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.
7.11	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.
7.12	Action plan for post-project environmental monitoring shall be submitted.
7.13	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

S. No	Terms of Reference
8.1	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers

S. No	Terms of Reference
8.2	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 preplacement 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.
8.3	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,
8.4	Annual report of health status of workers with special reference to Occupational Health and Safety.

9. Corporate Environment Policy

S. No	Terms of Reference
9.1	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.
9.2	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.
9.3	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.
9.4	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
9.5	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.

10. Corporate Environmental Responsibility (Cer)

S. No	Terms of Reference
10.1	Adequate funds, as per the Ministry's OM/Guidelines, shall be earmarked towards the Corporate Environmental Responsibility based on Public Hearing issues/socioeconomic issues and item-wise details along with time bound action plan shall be included (CER activities shall be related to environment). Socio-economic development activities need to be elaborated upon. For the projects where public hearing is not conducted, CER plan shall be provided based on socio-economic study of the area.

11. Additional Studies/measures To Be Considered

S. No	Terms of Reference
11.1	Provide latest and ecofriendly technology for product manufacturing.
11.2	Emphasize on Green chemistry/Clean Manufacturing
11.3	Provide CAS No. of products along with product list.
11.4	Provide details of amount of carbon sequestered in their unit through greenbelt/other modes, in case of expansion project.
11.5	Life structure and sustainability for carbon and water foot print.
11.6	Detailed pollution Load estimation.
11.7	Transportation of Hazardous substance, effluents etc shall be carriedout through authorized and GPS enable vehicles/Trucks only.
11.8	Category of Hazardous Wastes shall be mentioned in the EIA/EMP report and in presentation.
11.9	Details of greenhouse gases and emissions shall be provided.
11.10	Greenbelt shall be developed in the first year of the project and wind breaks shall be erected.
11.11	Study area map shall be overlapped with all the associated features.
11.12	Emphasize on green fuels.
11.13	The project from NCR shall not use Coal as fuel. Further, PP shall avoid use of Coal in the CPAs and elsewhere also if alternatives are available.
11.14	Provide the Cost-Benefit analysis with respect to the environment due to the project.
11.15	Details of carbon foot prints and carbon sequestration study w.r.t. proposed project needs to spelled out. Proposed mitigation measures also needs to be analyzed and submitted for further appraisal of the EAC
11.16	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.
11.17	A tabular chart with index for point wise compliance of above TORs and its details needs to be submitted in the EIA/EMP Report.

12. Specific Condition

S. No	Terms of Reference
12.1	Details on solvents to be used, measures for solvent recovery and for emissions control.
12.2	Details of process emissions from the proposed unit and its arrangement to control.
12.3	Ambient air quality data should include VOC, other process-specific pollutants* like NH3*,chlorine*,HCl*,HBr*,H2S*,HF*,etc.,(*-as applicable)
12.4	Work zone monitoring arrangements for hazardous chemicals.
12.5	Detailed effluent treatment scheme including segregation of effluent streams for units adopting 'Zero' liquid discharge.
12.6	Action plan for odour control to be submitted.
12.7	A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic solid/hazardous waste generated.
12.8	Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF, if any.
12.9	Action plan for utilization of MEE/dryers salts.
12.10	Material Safety Data Sheet for all the Chemicals are being used/will be used.
12.11	Authorization/Membership for the disposal of solid/hazardous waste in TSDF.
12.12	Details of incinerator if to be installed.
12.13	Risk assessment for storage and handling of hazardous chemicals/solvents. Action plan for handling & safety system to be incorporated.
12.14	Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.
12.15	Details of carbon foot prints and carbon sequestration study w.r.t. proposed project needs to spelled out. Proposed mitigation measures also needs to be analysed and submitted for further appraisal of the EAC.

SEIAA STANDARD CONDITIONS:

1. Impacts on Energy requirement.
2. Impacts on living System (air, water ,soil & micro-organisms).
3. Impacts on terrestrial & aquatic within and surrounding areas.
4. As per the MoEF& CC office memorandum F.No.22-65/2017-IA.III dated: 30.09.2020 and 20.10.2020 the proponent shall furnish the detailed EMP mentioning all the CER activities as committed with the action plan.
5. The proponent shall provide details on the adequate parking facility provided including vehicles of all the workers & visitors and a clean traffic plan.
6. The project proponent shall furnish the action taken to improve water usage efficiency in the building.
7. The project proponent shall conduct detailed study of biodiversity flora & fauna including invasives /endemic vulnerable species.
8. The project proponent shall furnish NOC obtained from competent authority that there is no encroachment of water bodies (including canals).
9. The project proponent shall conduct detailed soil investigation including microflora/fauna.
10. The project proponent shall study impact on livelihoods of locals.
11. The project proponent shall furnish List of trees available in the project area.
12. The project proponent shall study impact of activities on water bodies/wetlands.
13. The proponent shall furnish details on the measures taken to make the Buildings energy efficient confirming to green building norms.
14. The disaster management and disaster mitigation plan shall be furnished and should be seriously adhered to avoid of calamities.
15. The project proponent shall conduct studies on the presence of invasive and alien species around the project the area and shall furnish mitigate measures to prevent their spread.
16. The proponent shall furnish details on the actions taken to reduce anthropogenic GHGs such as CO_2, CH_4, nitrous oxide, etc., resulting from human activities.
17. The proponent shall furnish details on the strategies adopted to decarbonize the

building.

18. The proponent shall furnish measures taken to mitigate the impact on critically endangered species, biodiversity, etc., due to the modification of the habitat.
19. The proponent shall develop emergency response plan in addition to the disaster management plan.
20. The proponent shall furnish details on building-friendly pest control strategies developed using non chemical measures so as to control the pest population thereby not losing beneficial organisms.
21. The proponent shall furnish details on strategies developed to ensure the buildings in blocks don't trap heat and become local urban heat islands.
22. The proponent shall develop detailed evacuation plan for disabled people and safety evacuation plan during emergencies.
23. The proponent shall explain the methodology adopted to control thermal Environment and other shocks in the building.
24. The proponent shall provide details on the provisions for controlled ventilation and lighting systems.

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) PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

A. STANDARD TERMS OF REFERENCE (TOR)

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:

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.

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.

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

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.

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 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 heath 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

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.
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.

In addition to the above, the following shall be furnished: -

The Executive summary of the EIA/EMP report in about 8-10 pages should be prepared incorporating the information on following points:

1) Project name and location (Village, District, State, Industrial Estate (if applicable).
2) Products and capacities. If expansion proposal then existing products with capacities and reference to earlier EC.
3) Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative)
4) Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous wastes.
5) Measures for mitigating the impact on the environment and mode of discharge or disposal.
6) Capital cost of the project, estimated time of completion.
7) Site selected for the project - Nature of land - Agricultural (single/double crop), barren, Govt/ private land, status of is acquisition, nearby (in 2-3 km.) water body, population, with in 10km other industries, forest, eco-sensitive zones, accessibility, (note - in case of industrial estate this information may not be necessary)
8) Baseline environmental data - air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population
9) Identification of hazards in handling, processing and storage of hazardous material and

safety system provided to mitigate the risk.

10) Likely impact of the project on air, water, land, flora-fauna and nearby population
11) Emergency preparedness plan in case of natural or in plant emergencies
12) Issues raised during public hearing (if applicable) and response given
13) CER plan with proposed expenditure.
14) Occupational Health Measures
15) Post project monitoring plan

Besides the above, the below mentioned general points should also be followed: -

a. A note confirming compliance of the TOR, with cross referencing of the relevant sections / pages of the EIA report should be provided.
b. All documents may be properly referenced with index, page numbers and continuous page numbering.
c. Copy of permission related to Port facility, Desalination plant, wind mill /solar power plant from competent Authority.
d. Where data are presented in the report especially in tables, the period in which the data were collected and the sources should be indicated.
e. Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.
f. Where the documents provided are in a language other than English, an English translation should be provided.
g. Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.
h. As per the circular no. J-11011/618/2010-IA. II(I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable
i. While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MoEF& CC vide O.M. No. J-11013/41/2006-IA. II(I) dated

4th August, 2009, which are available on the website of this Ministry should also be followed.

j. The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India (QCI)/National Accreditation Board of Education and Training (NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organization/Laboratories including their status of approvals etc. In this regard circular no F. No.J -l1013/77/2004-IA-II(I) dated 2nd December 2009, 18th March 2010, 28th May 2010, 28th June 2010, 31st December 2010 & 30th September 2011 posted on the Ministry's website http://www.moef.nic.in/ may be referred.

- After preparing the EIA (as per the generic structure prescribed in Appendix-III of the EIA Notification, 2006) covering the above mentioned points, the proponent willtake further necessary action for obtaining environmental clearance in accordance with the procedure prescribed under the EIA Notification, 2006.
- The final EIA report shall be submitted to the SEIAA, Tamil Nadu for obtaining Environmental Clearance.
- The TORs prescribed shall be **valid for a period of three years** from the date of issue, for submission of the EIA/EMP report as per OM No.J-11013/41/2006-IA-II(I)(part) dated 29th August 2017.

Signature valid

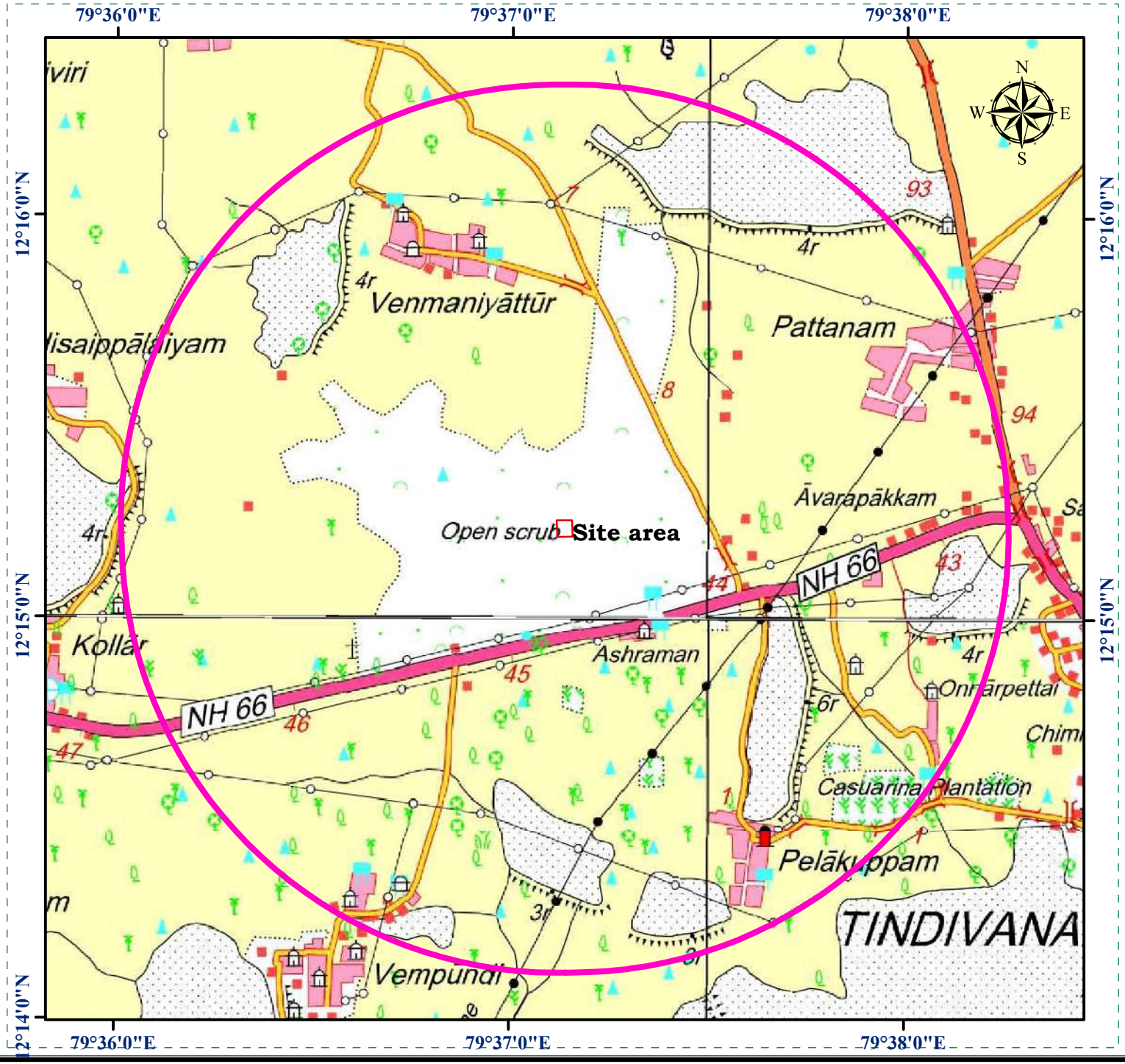
Digitally Signed by : A R Rahul Nadh IAS
Member Secretary, SEIAA

Date: 16/06/2025

ANNEXURE – VII

TOPO MAP (2KM, 5KM & 10KM)

GEOREFERENCE TOPO MAP SHOWING 2 KM RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM

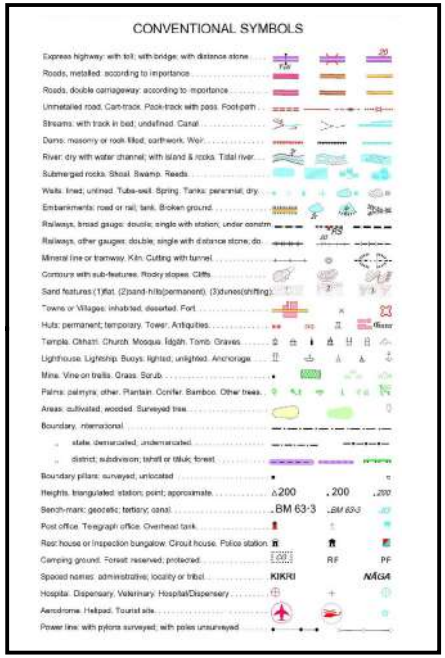
MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location

Buffer

2 km Radius

Site Boundary



Prepared by

Eco Services India Private Limited

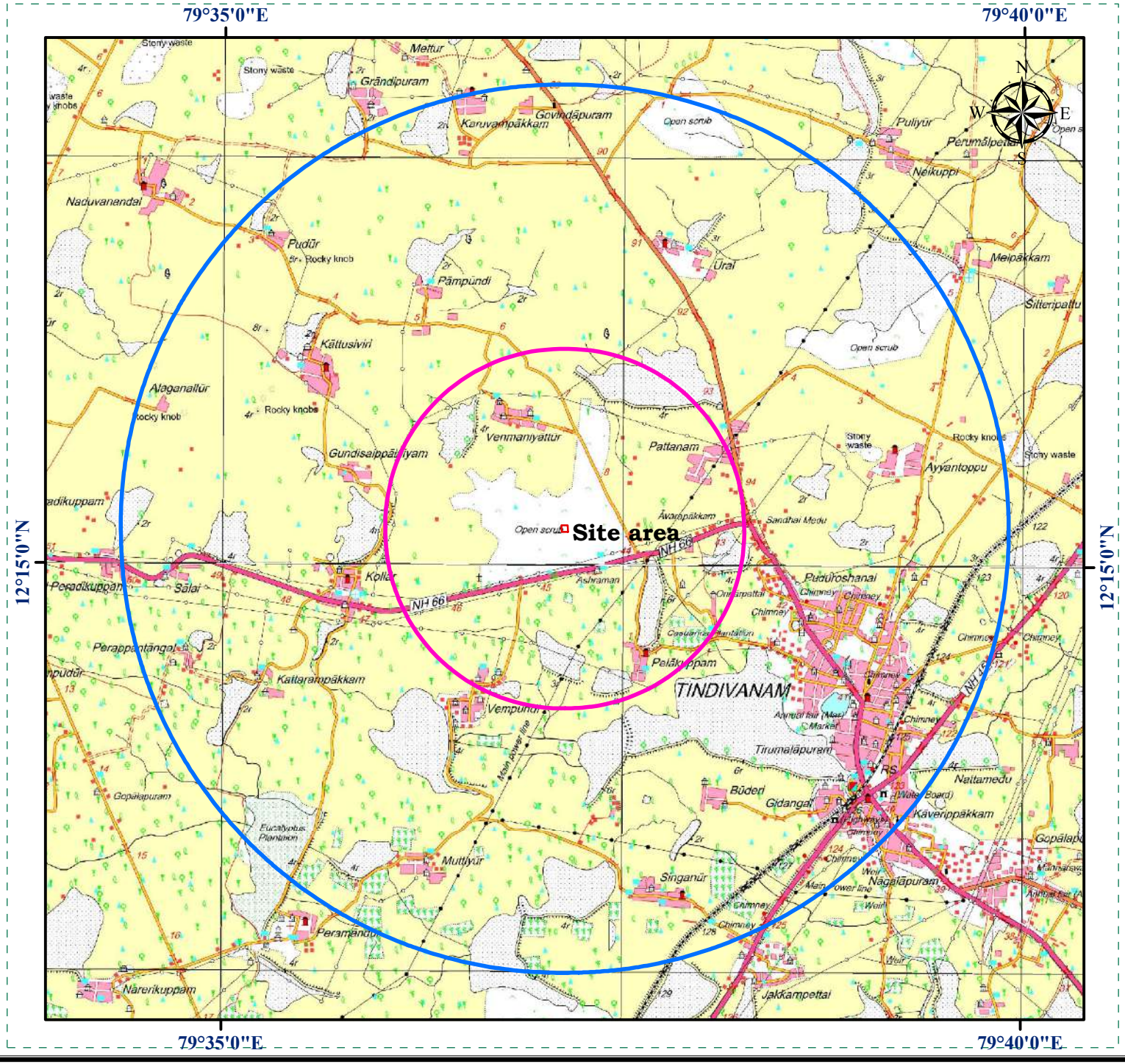
Open source-Toposheet information

57-P/11, 57-P/12

Scale

0 0.4 0.8 1.6 Km

GEOREFERENCE TOPO MAP SHOWING 2 KM AND 5 KM RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM

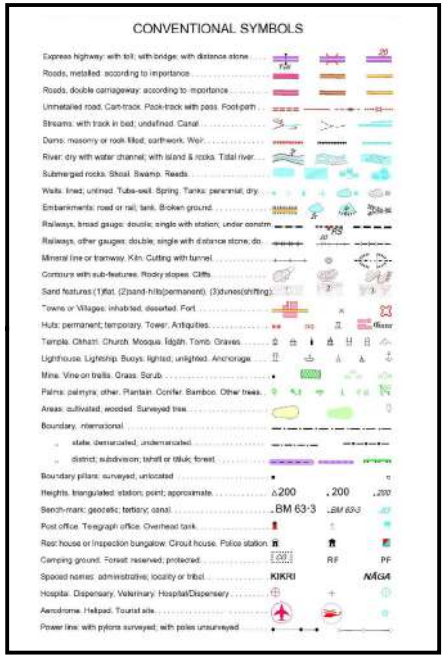
MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location

Buffer

5 km Radius **2 km Radius**

Site Boundary



Prepared by

Eco Services India Private Limited

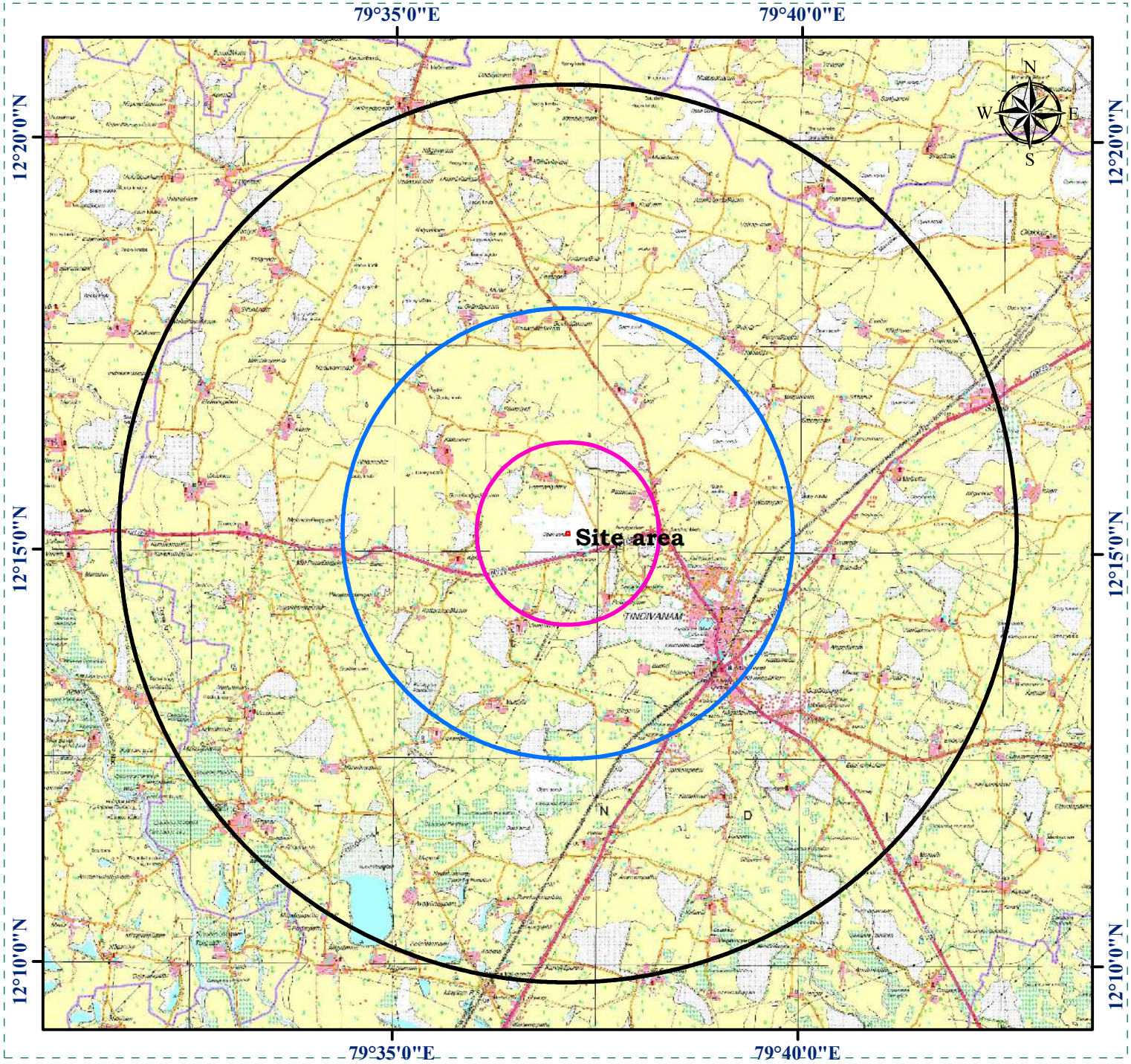
Open source-Toposheet information

57-P/11, 57-P/12

Scale

0 1 2 4 Km

GEOREFERENCE TOPO MAP SHOWING 2,5,10 KM RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

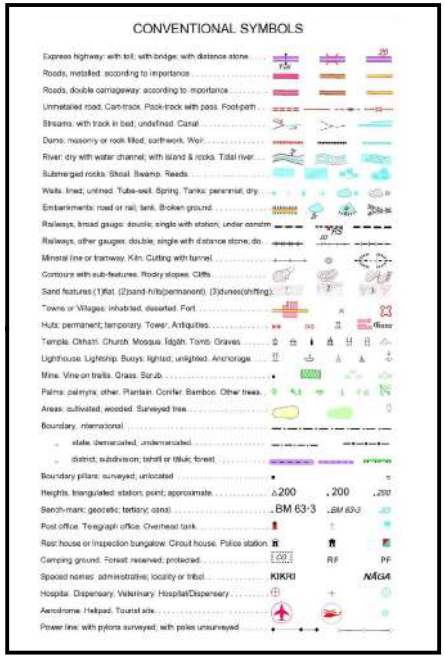
PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM

MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location

Buffer

- 10 km Radius
- 2 km Radius
- 5 km Radius
- Site Boundary



Prepared by

Eco Services India Private Limited

Open source-Toposheet information

57-P/07, 57-P/08, 57-P/11, 57-P/12

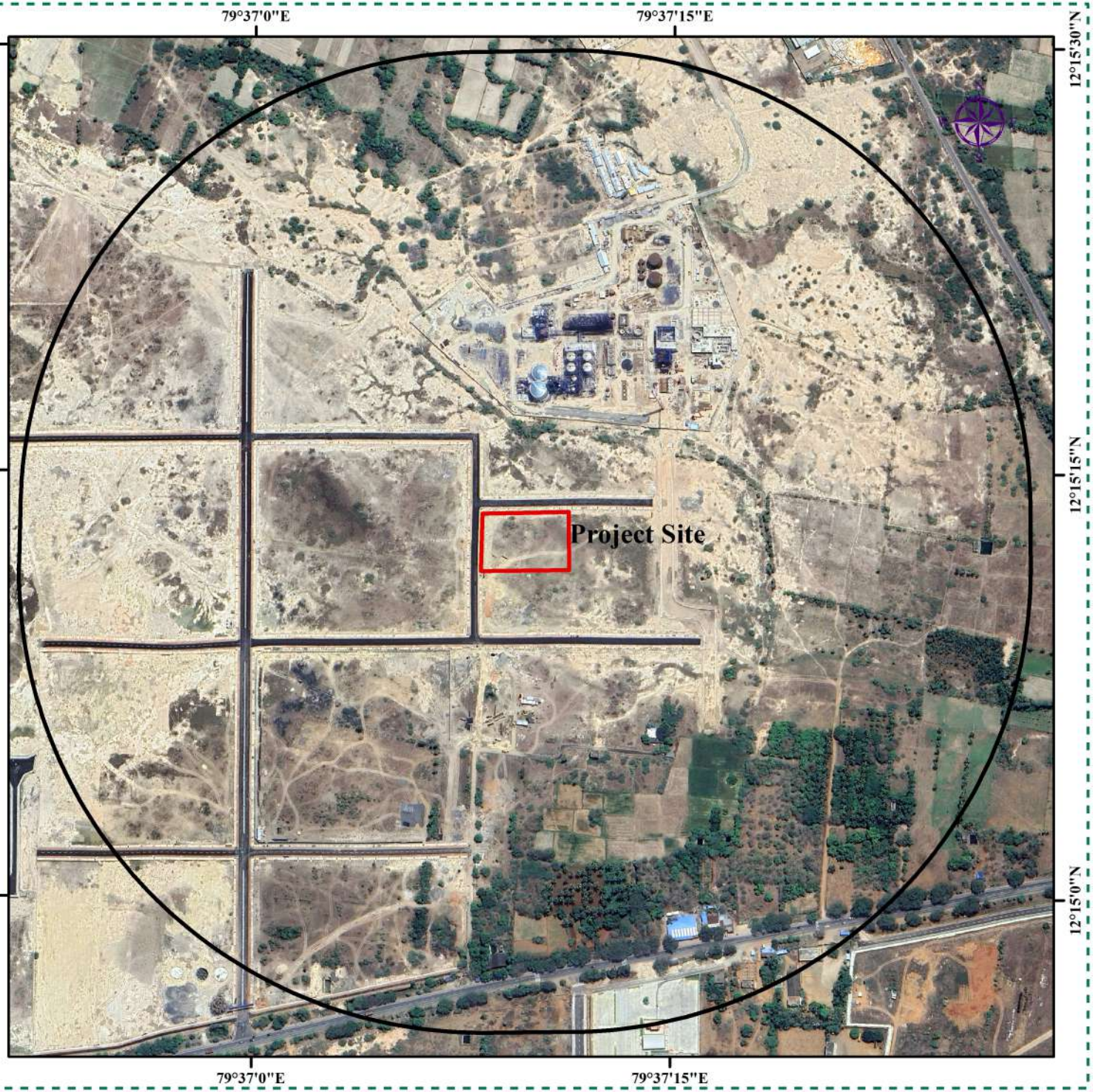
Scale

0 2 4 8 Km

ANNEXURE – VIII

SATELLITE IMAGE (500M, 1KM & 10KM)

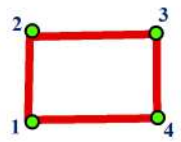
HIGH RESOLUTION SATELLITE IMAGERY SHOWING 500M RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM
MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location



Sno	Latitude	Longitude
1	12°15'11.49"N	79°37'8.29"E
2	12°15'13.54"N	79°37'8.32"E
3	12°15'13.60"N	79°37'11.37"E
4	12°15'11.54"N	79°37'11.40"E

Buffer

500m Radius

Project Site Boundary

Satellite Product information

High Resolution Satellite Imagery



Date of Imagery

10/05/2025

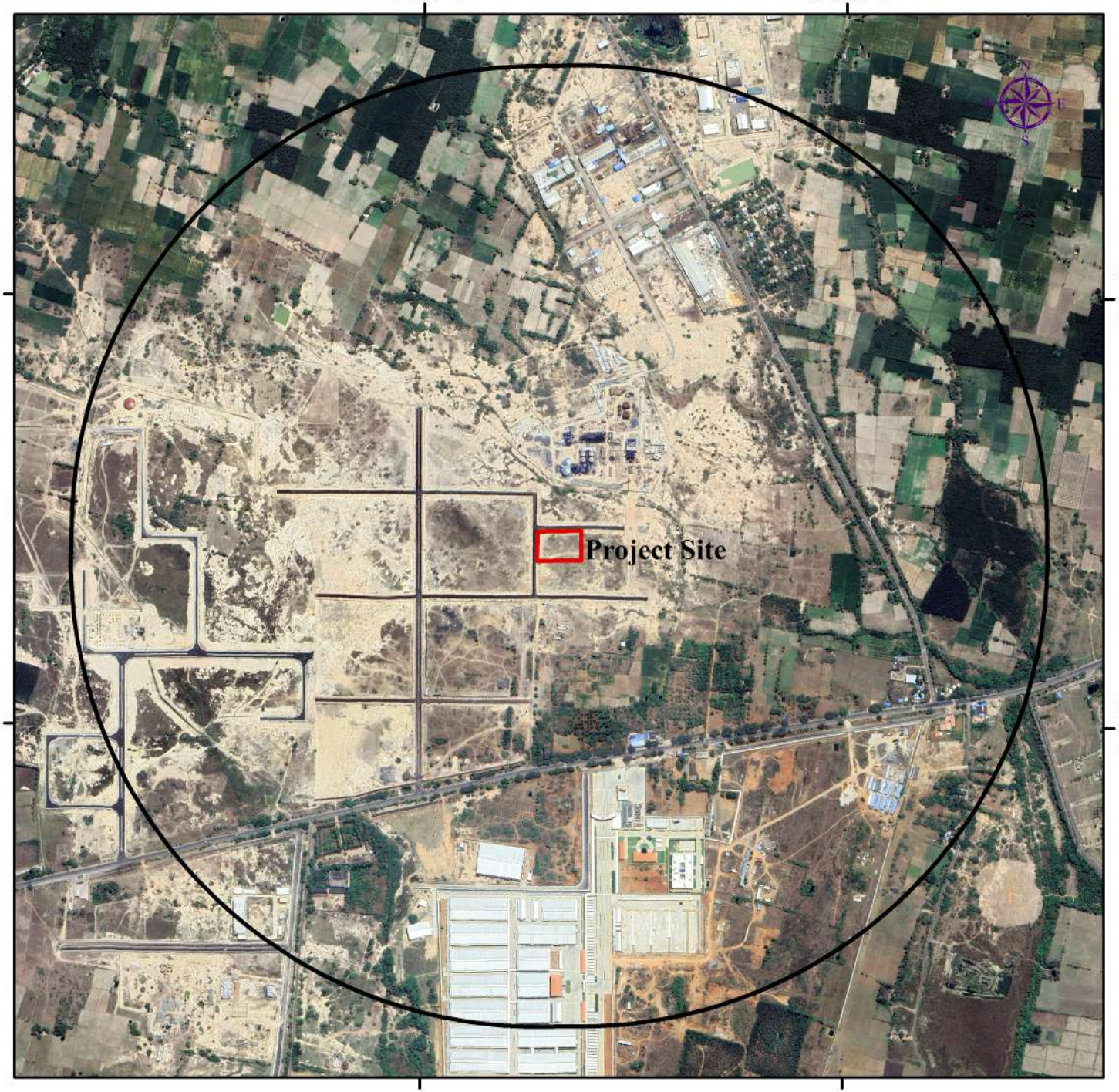
Prepared by

Eco Services India Private Limited

Scale

80 40 0 80 160 240 m

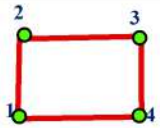
HIGH RESOLUTION SATELLITE IMAGERY SHOWING 1 KM RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM
MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location



Sno	Latitude	Longitude
1	12°15'11.49"N	79°37'8.29"E
2	12°15'13.54"N	79°37'8.32"E
3	12°15'13.60"N	79°37'11.37"E
4	12°15'11.54"N	79°37'11.40"E

Buffer

1Km Radius

Project Site Boundary

Satellite Product information

High Resolution Satellite Imagery



Date of Imagery

10/05/2025

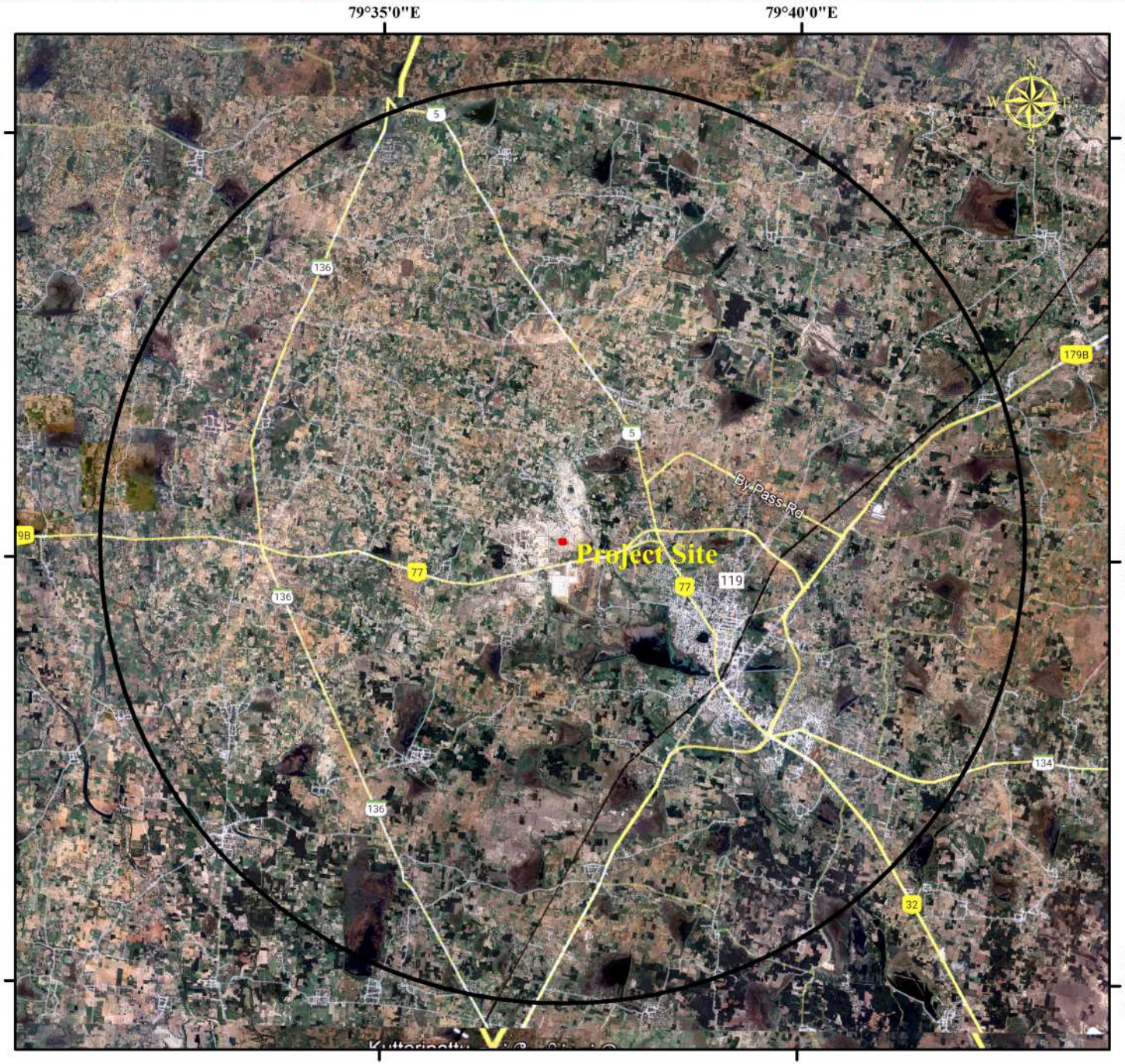
Prepared by

Eco Services India Private Limited

Scale

170 85 0 170 340 510 m

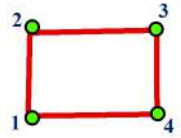
HIGH RESOLUTION SATELLITE IMAGERY SHOWING 10 KM RADIUS DISTANCE FROM THE PROJECT BOUNDARY



JUVENUS DRUGS

PLOT NO. 38, SURVEY NO.16 & 17,
TANSIDCO INDUSTRIAL ESTATE AT TINDIVANAM
MEGA PHARMA CLUSTER, PELAKUPPAM,
TINDIVANAM, VILLUPURAM (DT) -
TAMIL NADU 604001.

Project site Location



Sno	Latitude	Longitude
1	12°15'11.49"N	79°37'8.29"E
2	12°15'13.54"N	79°37'8.32"E
3	12°15'13.60"N	79°37'11.37"E
4	12°15'11.54"N	79°37'11.40"E

Buffer

500m Radius

Project Site Boundary

Satellite Product information

High Resolution Satellite Imagery



Date of Imagery

10/05/2025

Prepared by

Eco Services India Private Limited

Scale

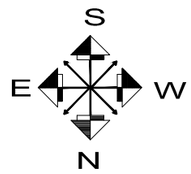
1,700 850 0 1,700 3,400 5,100 m

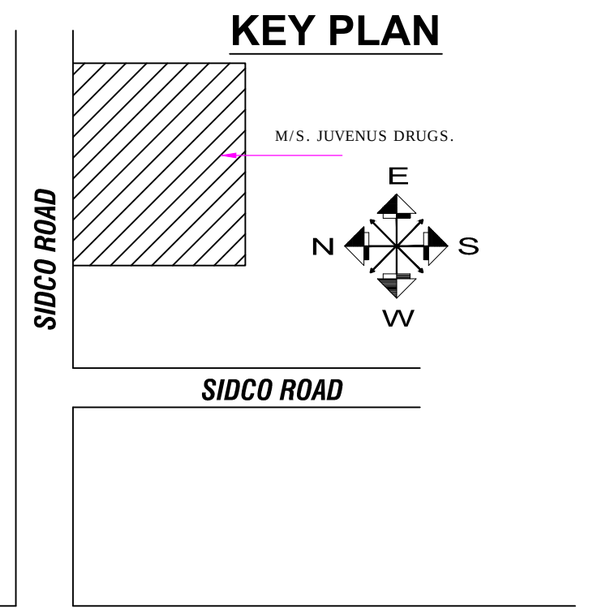
ANNEXURE – IX

GREENBELT DEVELOPMENT PLAN

Layout Showing the Proposed Greenbelt Development Plan for the Proposed Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit at Plot No. 38, Survey No. 16 & 17, TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu by M/s. Juvenus Drugs







Total Land Area - 5,867.95 Sq.m
Total Greenbelt Area - 2,054 Sq.m
(35% of Total Land Area)

Google Coordinates

Greenbelt		Latitude	Longitude	Area in Sq.m
Greenbelt Area 1	A1	12°15'11.63"N	79°37'8.41"E	413
	A2	12°15'13.39"N	79°37'8.40"E	
Greenbelt Area 2	B1	12°15'13.43"N	79°37'8.56"E	397
	B2	12°15'13.49"N	79°37'11.17"E	
Greenbelt Area 3	C1	12°15'13.39"N	79°37'11.23"E	376
	C2	12°15'11.65"N	79°37'11.29"E	
Greenbelt Area 4	D1	12°15'11.59"N	79°37'11.05"E	312
	D2	12°15'11.55"N	79°37'10.15"E	
Greenbelt Area 5	E1	12°15'11.53"N	79°37'9.27"E	215
	E2	12°15'11.87"N	79°37'8.75"E	
Greenbelt Area 6	F1	12°15'12.01"N	79°37'10.11"E	341
	F2	12°15'12.02"N	79°37'11.00"E	
Total Greenbelt Area				2054

ANNEXURE – X

MSDS OF RAW MATERIALS

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: Diethyl Malonate
CAS Number: 105-53-3
Synonyms: DEM, Malonic acid diethyl ester
Recommended Use: Laboratory chemicals, Industrial & for professional use only

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

GHS Classification:
- Flammable liquids (Category 3)
- Acute toxicity, oral (Category 4)
- Eye irritation (Category 2A)

Label Elements:
Signal Word: Warning
Hazard Statements:
- H226: Flammable liquid and vapor
- H302: Harmful if swallowed
- H319: Causes serious eye irritation

Precautionary Statements:
- P210: Keep away from heat/sparks/open flames/hot surfaces. – No smoking
- P264: Wash hands thoroughly after handling
- P280: Wear protective gloves/protective clothing/eye protection/face protection

3. Composition/Information on Ingredients

Substance: Diethyl Malonate
CAS No: 105-53-3
EC No: 203-305-9
Purity: ≥ 99%

4. First-Aid Measures

General advice: Consult a physician. Show this MSDS to the doctor in attendance.
If inhaled: Move to fresh air. If not breathing, give artificial respiration.

In case of skin contact: Wash off with soap and plenty of water.
In case of eye contact: Rinse thoroughly with plenty of water for at least 15 minutes.

If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Special protective equipment: Wear self-contained breathing apparatus for firefighting if necessary.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Avoid breathing vapors, mist or gas.
Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.
Methods for cleaning up: Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal.

7. Handling and Storage

Precautions for safe handling: Avoid contact with skin and eyes. Avoid inhalation of vapor or mist. Keep away from sources of ignition.
Conditions for safe storage: Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

8. Exposure Controls/Personal Protection

Engineering controls: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels.
Personal protective equipment:
- Eye/face protection: Safety goggles
- Skin protection: Protective gloves and clothing
- Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate, use a full-face respirator.

9. Physical and Chemical Properties

Appearance: Colorless liquid
Odor: Fruity
Boiling point: 199 °C
Melting point: -50 °C
Flash point: 96 °C (Closed cup)
Solubility: Slightly soluble in water
Density: 1.06 g/cm³

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, flames and sparks.

Incompatible materials: Strong oxidizing agents, strong bases.
Hazardous decomposition products: Carbon oxides.

11. Toxicological Information

Acute toxicity: LD50 Oral - Rat - 1,600 mg/kg
Skin corrosion/irritation: May cause skin irritation.
Serious eye damage/eye irritation: Causes serious eye irritation.
Carcinogenicity: Not listed as a carcinogen by ACGIH, IARC, NTP, or OSHA.
Additional Information: RTECS: Not available.

12. Ecological Information

Ecotoxicity: Harmful to aquatic life.
Persistence and degradability: No data available.
Bioaccumulative potential: No data available.
Mobility in soil: No data available.

13. Disposal Considerations

Waste treatment methods: Dispose of contents/container in accordance with local/regional/national/international regulations.

14. Transport Information

UN number: 2524
UN proper shipping name: DIETHYL MALONATE
Transport hazard class(es): 3
Packing group: III
Environmental hazards: Not a marine pollutant.

15. Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance:
- TSCA: Listed
- DSL: Listed
Other regulations: No additional information available.

16. Other Information

Prepared by: Juvenus Drugs
Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: 2-Propylpentanoic Acid
Other Name: Valproic Acid
CAS Number: 99-66-1
Recommended Use: Pharmaceutical intermediate
Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

GHS Classification:
- Reproductive toxicity (Category 1B)
- Specific target organ toxicity – repeated exposure (Category 2)
- Acute toxicity, oral (Category 4)

Label Elements:
Signal Word: Danger
Hazard Statements:
- H302: Harmful if swallowed
- H361: Suspected of damaging fertility or the unborn child
- H373: May cause damage to organs through prolonged or repeated exposure

Precautionary Statements:
- P201: Obtain special instructions before use
- P260: Do not breathe dust/fume/gas/mist/vapors/spray
- P280: Wear protective gloves and eye protection
- P308+P313: If exposed or concerned: Get medical advice/attention

3. Composition/Information on Ingredients

Substance: 2-Propylpentanoic Acid
CAS No: 99-66-1
EC No: 202-786-3
Purity: ≥ 98%

4. First-Aid Measures

If inhaled: Move to fresh air. If breathing is difficult, give oxygen. Seek medical attention.
In case of skin contact: Wash off with soap and plenty of water. Remove contaminated clothing.
In case of eye contact: Rinse thoroughly with water for at least 15 minutes. Seek medical advice.
If swallowed: Rinse mouth with water. Seek medical advice. Do not induce vomiting.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, dry chemical, foam, or carbon dioxide.
Specific hazards: Emits toxic fumes under fire conditions.
Protective equipment: Wear self-contained breathing apparatus and protective clothing.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Avoid breathing vapors or mist. Ensure adequate ventilation.
Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.
Methods for cleaning up: Soak up with inert absorbent material and dispose of as hazardous waste.

7. Handling and Storage

Precautions for safe handling: Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.
Conditions for safe storage: Keep container tightly closed in a dry and well-ventilated place. Store at room temperature.

8. Exposure Controls/Personal Protection

Engineering controls: Ensure adequate ventilation, especially in confined areas.
Personal protective equipment:
- Eye protection: Safety goggles
- Skin protection: Protective gloves and lab coat
- Respiratory protection: Use NIOSH-approved respirator when exposure limits are exceeded

9. Physical and Chemical Properties

Appearance: Clear, colorless to pale yellow liquid
Odor: Slight characteristic odor
Boiling Point: ~228 °C
Melting Point: ~14 °C
Flash Point: ~120 °C (closed cup)
Solubility: Slightly soluble in water; soluble in alcohol, chloroform
Density: ~0.93 g/cm³

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, flames, and sparks.
Incompatible materials: Strong oxidizing agents.
Hazardous decomposition products: Carbon oxides

11. Toxicological Information

Acute toxicity: LD50 Oral - Rat - 670 mg/kg
Inhalation: May cause respiratory tract irritation
Skin: May cause mild irritation

Eyes: May cause irritation
Chronic toxicity: Risk of reproductive toxicity and organ damage with prolonged exposure

12. Ecological Information

Ecotoxicity: May be harmful to aquatic organisms.
Persistence and degradability: Expected to be biodegradable.
Bioaccumulative potential: Low potential for bioaccumulation.
Mobility in soil: Likely to leach into groundwater due to water solubility.

13. Disposal Considerations

Waste treatment methods: Dispose of contents/container in accordance with local/regional/national regulations.
Do not discharge into drains or the environment.

14. Transport Information

UN number: Not regulated
Proper shipping name: Not regulated for transport
Transport hazard class(es): Not classified
Packing group: Not applicable
Environmental hazards: None

15. Regulatory Information

Regulatory status:
- TSCA: Listed
- DSL/NDSL: Listed
- SARA Title III: Not listed
- WHMIS: D2A - Very toxic material causing other toxic effects

16. Other Information

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JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

SECTION 1: Identification

Product Name: Cyclohexane-1,1-diacetic acid monoamide
CAS Number: NA
Recommended Use: Research chemical, intermediate
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

SECTION 2: Hazard(s) Identification

GHS Classification:
- Eye irritation (Category 2A) [Assumed based on typical amide properties]

Label Elements:
Signal Word: Warning
Hazard Statements:
- H319: Causes serious eye irritation

Precautionary Statements:
- P264: Wash hands thoroughly after handling
- P280: Wear protective gloves/eye protection
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes

SECTION 3: Composition/Information on Ingredients

Component: Cyclohexane-1,1-diacetic acid monoamide
CAS Number: NA
Concentration: ≥ 98%

SECTION 4: First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms develop.
Skin Contact: Wash thoroughly with soap and water.
Eye Contact: Rinse cautiously with water for several minutes.
Ingestion: Rinse mouth. Seek medical advice if symptoms occur.

SECTION 5: Fire-Fighting Measures

Suitable Extinguishing Media: Water spray, CO_2, dry chemical
Hazards from Combustion: Carbon oxides, nitrogen oxides
Protective Equipment for Firefighters: Wear self-contained breathing apparatus and protective gear

SECTION 6: Accidental Release Measures

Personal Precautions: Avoid dust formation. Use personal protective equipment.
Environmental Precautions: Avoid release into the environment.
Cleanup Methods: Sweep up and dispose of in accordance with regulations.

SECTION 7: Handling and Storage

Handling: Avoid contact with skin, eyes, and clothing. Avoid dust generation.
Storage: Keep container tightly closed in a dry and well-ventilated area.

SECTION 8: Exposure Controls/Personal Protection

Occupational Exposure Limits: Not established
Engineering Controls: Ensure adequate ventilation
Personal Protective Equipment:
- Eyes: Safety glasses
- Skin: Protective gloves
- Respiratory: Dust mask or respirator if dust is generated

SECTION 9: Physical and Chemical Properties

Appearance: White to off-white powder
Odor: Odorless or faint amine-like
Melting Point: [Insert if known]
Boiling Point: [Insert if known]
Solubility: Slightly soluble in water
Molecular Formula: [Insert if known]
Molecular Weight: [Insert if known]

SECTION 10: Stability and Reactivity

Reactivity: Stable under normal conditions
Chemical Stability: Stable
Incompatible Materials: Strong oxidizing agents
Hazardous Decomposition Products: Carbon oxides, nitrogen oxides

SECTION 11: Toxicological Information

Likely Routes of Exposure: Inhalation, skin, eyes, ingestion
Symptoms: Eye irritation, possible respiratory irritation
Carcinogenicity: No data available
Other Effects: No data available

SECTION 12: Ecological Information

Ecotoxicity: No data available
Persistence and Degradability: Expected to be biodegradable
Bioaccumulative Potential: No data available
Mobility in Soil: No data available

SECTION 13: Disposal Considerations

Waste Disposal: Dispose in accordance with local, regional, national, and international regulations.

SECTION 14: Transport Information

UN Number: Not regulated
Transport Hazard Class(es): Not regulated
Packing Group: Not applicable
Environmental Hazards: None known

SECTION 15: Regulatory Information

TSCA: Not listed
Other Regulations: Complies with applicable regulations where required

16. Other Information

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1. IDENTIFICATION

1.1 GHS PRODUCT IDENTIFIER

Product Name	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid

1.2 OTHER MEANS OF IDENTIFICATION

Other names	(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid

1.3 RECOMMENDED USE OF THE CHEMICAL AND RESTRICTIONS ON USE

Identified uses	Industrial and scientific research uses
Uses advised against	No data available

1.4 SUPPLIER'S DETAILS

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

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2. HAZARD IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

NO DATA AVAILABLE

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictogram(s)	No data available
Signal word	No data available
Hazard statement(s)	No data available
Precautionary statement(s)	
Prevention	No data available
Response	No data available
Storage	No data available
Disposal	No data available
Hazard(s) not otherwise classified (HNOC)	None known
Supplemental information	Pharmaceutical related compound of unknown potency.

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3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

NO DATA AVAILABLE

MOLECULAR FORMULA: C9H17NO3 **MOLECULAR WEIGHT:** 187.2

Chemical name	Common names and synonyms	CAS number
(R)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid	NA	181289-33-8

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4. FIRST-AID MEASURES

4.1 DESCRIPTION OF NECESSARY FIRST-AID MEASURES

General advice

Medical attention is required. Consult a doctor. Show this safety data sheet (SDS) to the doctor in attendance

Inhalation

If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing.
Call a physician if symptoms develop or persist.

Following skin contact

Take off contaminated clothing immediately. Wash off with soap and plenty of water. Consult a doctor.

Following eye contact

Rinse with pure water for at least 15 minutes. Consult a doctor.

Following ingestion

Rinse mouth with water. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Call a doctor or Poison Control Center immediately.

4.2 MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND DELAYED

may cause physiological effects

4.3 INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Treat symptomatically

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5. FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Suitable extinguishing media

Water, use dry chemical, carbon dioxide or alcohol-resistant foam.

5.2 SPECIFIC HAZARDS ARISING FROM THE CHEMICAL

Carbon oxides, Nitrogen oxides, Hydrogen fluoride, Sulphur oxides

5.3 SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS

Wear self-contained breathing apparatus for fire fighting if necessary.

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6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Keep unnecessary personnel away. Wear appropriate personal protective equipment. Avoid

Inhalation of dust from the spilled material. Do not touch damaged containers or spilled material

Unless wearing appropriate protective clothing. Ensure adequate ventilation.

6.2 ENVIRONMENTAL PRECAUTIONS

Avoid discharge into drains, water courses or onto the ground.

6.3 METHODS AND MATERIALS FOR CONTAINMENT AND CLEANING UP

Avoid the generation of dusts during clean-up. Sweep up or vacuum up spillage and collect in

Suitable container for disposal. Clean surface thoroughly to remove residual contamination. For

Waste disposal

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7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust

ventilation at places where dust is formed

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Keep container tightly closed in a dry and well-ventilated place

Keep in a dry place.

Storage conditions: Refrigernator

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parametersg

Occupational Exposure limit values

No exposure limits noted for ingredient

8.2 Appropriate engineering controls

A laboratory fume hood or other appropriate form of local exhaust ventilations

8.3 Individual protection measures, such as personal protective equipment (PPE)

Eye/face protection

Wear tightly fitting safety goggles with side-shields conforming to EN 166(EU) or NIOSH (US).

Skin protection

Wear fire/flame resistant and impervious clothing. Handle with gloves. Gloves must be inspected prior to use. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Respiratory protection

Recommended respirators are NIOSH-approved N100 or CEN-approved FFP3 particulate respirators. These are to be only used as

a backup to local exhaust ventilation or other engineering controls. If the respirator is the only means of protection, a full-face

supplied air respirator must be used

Thermal hazards

Wear appropriate thermal protective clothing, when necessary

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9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state

Colour	
Odour	
Melting point/ freezing point	
Boiling point or initial boiling point and boiling range	
Flammability	
Lower and upper explosion limit / flammability limit	
Flash point	NA
Auto-ignition temperature	NA
Decomposition temperature	NA
pH	
Kinematic viscosity	
Solubility	
Partition coefficient n-octanol/water	
Vapour pressure	NA
Density and/or relative density	NA
Relative vapour density	NA
Particle characteristics	NA

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10. STABILITY AND REACTIVITY

10.1 Reactivity

The product is stable and non-reactive under normal conditions of use, storage and transport

10.2 Chemical stability

Material is stable under normal conditions

10.3 Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use

10.4 Conditions to avoid

Contact with incompatible materials

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Irritating and/or toxic fumes or gases. Emits toxic fumes under fire conditions.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

- ORAL LD50: NO DATA AVAILABLE
- INHALATION: NO DATA AVAILABLE
- DERMAL: NO DATA AVAILABLE

Skin corrosion/irritation

No data available

Serious eye damage/irritation

No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT-single exposure

No data available

STOT-repeated exposure

No data available

Aspiration hazard

Based on available data, the classification criteria are not met

12. ECOLOGICAL INFORMATION

12.1 Ecotoxicity

There are no data on the ecotoxicity of this product.

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Other adverse effects

No data available

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13. DISPOSAL CONSIDERATIONS

13.1 Disposal methods
Product

Product may be burned in an incinerator equipped with afterburner and scrubber. Excess and expired materials are to be offered to a licensed hazardous material disposal company. Ensure that all Federal and Local regulations regarding the disposal and destruction of this material are followed.

Contaminated packaging Dispose of as above.

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14. TRANSPORT INFORMATION

14.1 DOT: Not regulated as dangerous goods

IATA: Not regulated as dangerous goods

14.2 UN Proper Shipping Name

ADR/RID: No data available IMDG: No data available IATA: No data available

14.2 UN Proper Shipping Name

ADR/RID: No data available IMDG: No data available IATA: No data available

14.3 Transport hazard class(es)

14.4 Packing group, if applicable

ADR/RID: No data available IMDG: No data available IATA: No data available

14.5 Environmental hazards

ADR/RID: No IMDG: No IATA: No

14.6 Special precautions for user

No data available

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

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It is the shipper's responsibility to determine the correct transport classification at the time of shipment

15. Regulatory information

US federal regulations	This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

European Union

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

16. OTHER INFORMATION

Abbreviations and acronyms

- CAS: CHEMICAL ABSTRACTS SERVICE
- IATA: INTERNATIONAL AIR TRANSPORTATION ASSOCIATION
- LD50: LETHAL DOSE 50%

Disclaimer: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. We as supplier shall not be held liable for any damage resulting from handling or from contact with the above product

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Identification

Product Name: 5-Methylisoxazole-4-carboxylic acid
CAS Number: 42831-50-5
Synonyms: None
Recommended Use: Laboratory chemical, research use only

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazard(s) Identification

Classification: Not classified as hazardous according to GHS
Signal Word: None
Hazard Statements: No known significant effects or critical hazards
Precautionary Statements: Avoid contact with eyes, skin, and clothing

3. Composition/Information on Ingredients

Substance: 5-Methylisoxazole-4-carboxylic acid
CAS Number: 42831-50-5
Molecular Formula: C5H5NO3
Molecular Weight: 127.10 g/mol
Purity: ≥ 98%

4. First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms persist.
Skin Contact: Wash with soap and water. Remove contaminated clothing.
Eye Contact: Rinse with plenty of water for at least 15 minutes.
Ingestion: Rinse mouth. Seek medical advice if feeling unwell.

5. Fire-Fighting Measures

Extinguishing Media: Water spray, foam, dry chemical, or carbon dioxide
Hazards: Carbon oxides, nitrogen oxides
Protective Equipment: Wear self-contained breathing apparatus

6. Accidental Release Measures

Personal Precautions: Use personal protective equipment

Cleanup Methods: Sweep up and place in suitable containers for disposal
Environmental Precautions: Avoid discharge to environment

7. Handling and Storage

Handling: Avoid breathing dust. Use with adequate ventilation.
Storage: Store in tightly closed container in a dry, cool, well-ventilated place.

8. Exposure Controls/Personal Protection

Exposure Limits: Not established
Engineering Controls: Use fume hood
Personal Protection: Protective gloves, safety goggles, lab coat

9. Physical and Chemical Properties

Appearance: White to off-white crystalline powder
Odor: Odorless
Melting Point: ~190 °C (decomposes)
Solubility: Slightly soluble in water

10. Stability and Reactivity

Stability: Stable under recommended storage conditions
Conditions to Avoid: Excessive heat, moisture
Incompatible Materials: Strong oxidizing agents
Hazardous Decomposition: Carbon oxides, nitrogen oxides

11. Toxicological Information

Acute Toxicity: Data not available
Skin/Eye Irritation: May cause slight irritation
Sensitization: No known effects
Carcinogenicity: Not listed as carcinogen

12. Ecological Information

Ecotoxicity: Not expected to be harmful
Persistence: No data available
Bioaccumulation: No data available
Mobility: Likely to be mobile in the environment

13. Disposal Considerations

Waste Disposal: Dispose of in accordance with local, regional, and national regulations

14. Transport Information

UN Number: Not regulated
Transport Hazard Class: Not applicable
Packing Group: Not applicable

Proper Shipping Name: Not hazardous for transport

15. Regulatory Information

Inventory Listings: Listed in TSCA, REACH (if applicable)

Regulations: No special regulations known

16. Other Information

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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

SECTION 1: Identification

Product Name: **4-(Trifluoromethyl)aniline hydrochloride**
CAS Number: 90774-69-9
Recommended Use: industrial and laboratory use
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

SECTION 2: Hazard(s) Identification

2.1 Classification of the substance or mixture :

Classification according to Regulation (EC) No 1272/2008 (CLP) This substance does not meet the criteria for classification in accordance with Regulation No 1272/2008/EC.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP) not required

Choline chloride ≥95 % article number: 2H20 Germany (en) Page 2 / 14

2.3 Other hazards Endocrine disrupting properties Does not contain an endocrine disruptor (ED) at a concentration of ≥ 0,1%.

SECTION 3: Composition/Information on Ingredients

Name of substance : 4-(Trifluoromethyl)anilinium chloride

CAS No 90774-69-9

SECTION 4: First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms occur.
Skin Contact: Wash with soap and water.
Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses if present.
Ingestion: Do not induce vomiting. Seek medical advice immediately.

SECTION 5: Fire-Fighting Measures

Suitable Extinguishing Media: Alcohol-resistant foam, CO_2, dry chemical
Unsuitable Extinguishing Media: Water jet

Hazards from Combustion: Carbon oxides
Protective Equipment for Firefighters: Wear self-contained breathing apparatus and full protective gear

SECTION 6: Accidental Release Measures

Personal Precautions: Eliminate ignition sources. Ventilate area. Wear PPE.
Environmental Precautions: Prevent entry into sewers or waterways.
Cleanup Methods: Absorb with inert material and place in suitable containers for disposal.

SECTION 7: Handling and Storage

Handling: Use in a well-ventilated area. Avoid inhalation and contact with eyes/skin.
Storage: Store in a cool, dry, well-ventilated area away from ignition sources.

SECTION 8: Exposure Controls/Personal Protection

Occupational Exposure Limits (OELs):
- ACGIH TLV: 250 ppm (TWA)
- OSHA PEL: 1000 ppm (TWA)

Engineering Controls: Use local exhaust ventilation
Personal Protective Equipment:
- Eyes: Safety goggles
- Skin: Protective gloves
- Respiratory: Approved respirator if exposure limits are exceeded

SECTION 9: Physical and Chemical Properties

Physical State Powder Solid

Appearance Yellow

Odor Odorless

Odor Threshold No information available

pH No information available

Melting Point/Range 200 °C / 392 °F

Boiling Point/Range No information available

Flash Point No information available

Evaporation Rate Not applicable

Flammability (solid,gas) No information available

Flammability or explosive limits

Upper No data available

Lower No data available

Vapor Pressure No information available

Vapor Density Not applicable

Specific Gravity No information available

Solubility No information available

Partition coefficient; n-octanol/water No data available

Autoignition Temperature No information available

Decomposition Temperature No information available

Viscosity Not applicable

Molecular Formula $C_7 H_6 F_3 N . H Cl$

Molecular Weight 197.59

SECTION 10: Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: None under normal conditions
Conditions to Avoid: Heat, flames, sparks
Incompatible Materials: Oxidizers, acids
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide

SECTION 11: Toxicological Information

Routes of Exposure: Inhalation, eye, skin, ingestion
Acute Toxicity: LD50 (oral, rat): 5800 mg/kg
Skin Irritation: May cause drying or cracking
Eye Irritation: Causes serious eye irritation
Respiratory: May cause drowsiness or dizziness
Carcinogenicity: Not classified as carcinogenic
Other Effects: Repeated exposure may cause skin dryness or cracking

SECTION 12: Ecological Information

Ecotoxicity: Harmful to aquatic life in high concentrations
Persistence and Degradability: Readily biodegradable
Bioaccumulative Potential: Low potential for bioaccumulation
Mobility in Soil: High mobility
Other Adverse Effects: None known

SECTION 13: Disposal Considerations

Waste Disposal: Dispose in accordance with local, regional, and national regulations.
Contaminated Packaging: Rinse thoroughly and dispose according to regulations.

SECTION 14: Transport Information

UN Number: UN1090
Transport Hazard Class(es): 3
Packing Group: II
Environmental Hazards: None
Special Precautions: Flammable - keep away from heat and sources of ignition

SECTION 15: Regulatory Information

OSHA Hazards: Flammable, Irritant
SARA Title III: Section 311/312: Fire Hazard, Acute Health Hazard
TSCA: Listed
Other Regulations: Complies with applicable chemical safety regulations

16. Other Information

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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: N-(2-(2-Hydroxy-4-(methylsulfonamido)-5-phenoxyphenyl)-2-oxoethyl)formamide

CAS Number: 149457-03-4

Recommended Use: Pharmaceutical intermediate

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

Classification:

Acute Toxicity (Oral) – Category 4

Skin Corrosion/Irritation – Category 2

Serious Eye Damage/Irritation – Category 2A

STOT SE – Category 3 (respiratory tract irritation)

Signal Word: Warning

Hazard Statements:

H302: Harmful if swallowed

H315: Causes skin irritation

H319: Causes serious eye irritation

H335: May cause respiratory irritation

Precautionary Statements:

P280: Wear protective gloves/eye protection/face protection

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes

P405: Store locked up

P501: Dispose of contents/container in accordance with local regulations

3. Composition/Information on Ingredients

Chemical Identity: Same as product name

CAS Number: 149457-03-4

Concentration: ≥98%

Synonyms: Iguratimod Intermediate; Methanesulfonamide derivative

4. First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms persist.

Skin Contact: Wash thoroughly with soap and water. Remove contaminated clothing.

Eye Contact: Rinse cautiously with water. Seek medical advice if irritation persists.

Ingestion: Do not induce vomiting. Rinse mouth. Get medical help.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, dry chemical, foam, or carbon dioxide.
Specific hazards: Emits toxic fumes under fire conditions.
Protective equipment: Wear self-contained breathing apparatus and protective clothing.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Avoid dust formation. Ensure adequate ventilation.
Environmental precautions: Prevent further leakage or spillage. Do not let product enter drains.
Methods for cleaning up: Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. Handling and Storage

Precautions for Safe Handling: Use in well-ventilated areas. Avoid breathing dust/vapors.

Conditions for Safe Storage: Keep tightly closed in a dry, cool, and well-ventilated place (2–8 °C).

8. Exposure Controls/Personal Protection

Engineering controls: Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels low.
Personal protective equipment:
- Eye/face protection: Safety glasses with side shields
- Skin protection: Gloves and lab coat
- Respiratory protection: Use appropriate respirator if exposure limits are exceeded

9. Physical and Chemical Properties

Appearance: White to off-white powder

Odor: Odorless or faint chemical odor

Melting Point: Not available

Boiling Point: Not available

Solubility: Not available

Density: Not available

10. Stability and Reactivity

Stability: Stable under recommended storage conditions.
Incompatible materials: Strong oxidizing agents, acids.
Hazardous decomposition products: Carbon oxides, sodium oxides.
Conditions to avoid: Heat, moisture, light.

11. Toxicological Information

Routes of Exposure: Inhalation, ingestion, skin and eye contact

Effects: Causes irritation; harmful if swallowed

Symptoms: Coughing, shortness of breath, skin and eye redness

Acute Toxicity: Not specifically known; treat as harmful

Chronic Effects: Not established

12. Ecological Information

Ecotoxicity: May be harmful to aquatic organisms with long lasting effects.
Persistence and degradability: Expected to be biodegradable.
Bioaccumulation: Low potential.
Mobility: Likely to be mobile in the environment due to solubility in water.

13. Disposal Considerations

Dispose of waste in accordance with local, regional, national, and international regulations. Avoid release into the environment.

14. Transport Information

UN number: Not regulated
Proper shipping name: Not classified as hazardous
Hazard class: Not applicable
Packing group: Not applicable
Environmental hazards: None

15. Regulatory Information

TSCA Inventory: Listed
REACH Status: Registered
WHMIS Classification: D2A – Very toxic material causing other toxic effects
SARA 313: Not listed

16. Other Information

Prepared by: Juvenus Drugs
Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

SECTION 1: Identification

Product Name: 4-(4-Aminophenyl)morpholin-3-one
CAS Number: 438056-69-0
Recommended Use: industrial and laboratory use
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

SECTION 2: Hazard(s) Identification

Hazard statement(s)

H315 Causes skin irritation.

H319 Causes serious eye irritation Precautionary statement(s)

P264 Wash hands and face thoroughly after handling.

P280 Wear protective gloves, eye protection.

P302+P352+P332+P313+ P362+P364 IF ON SKIN: Wash with plenty of water. If skin irritation occurs: Get medical advice or attention. Take off contaminated clothing and wash it before reuse.

P305+P351+P338+P337+ P313 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

SECTION 3: Composition/Information on Ingredients

Product name 4-(4-Aminophenyl)morpholin-3-one

Molecular formula C10H12N2O2

Molecular weight 192.2 g/mol

CAS-No. 438056-69-0

EC-No. 610-147-8

SECTION 4: First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms occur.
Skin Contact: Wash with soap and water.
Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses if present.
Ingestion: Do not induce vomiting. Seek medical advice immediately.

SECTION 5: Fire-Fighting Measures

Suitable Extinguishing Media: Alcohol-resistant foam, CO_2, dry chemical
Unsuitable Extinguishing Media: Water jet
Hazards from Combustion: Carbon oxides
Protective Equipment for Firefighters: Wear self-contained breathing apparatus and full protective gear

SECTION 6: Accidental Release Measures

Personal Precautions: Eliminate ignition sources. Ventilate area. Wear PPE.
Environmental Precautions: Prevent entry into sewers or waterways.
Cleanup Methods: Absorb with inert material and place in suitable containers for disposal.

SECTION 7: Handling and Storage

Handling: Use in a well-ventilated area. Avoid inhalation and contact with eyes/skin.
Storage: Store in a cool, dry, well-ventilated area away from ignition sources.

SECTION 8: Exposure Controls/Personal Protection

Occupational Exposure Limits (OELs):No data available
Engineering Controls: Use local exhaust ventilation
Personal Protective Equipment:
- Eyes: Safety goggles
- Skin: Protective gloves
- Respiratory: Approved respirator if exposure limits are exceeded

SECTION 9: Physical and Chemical Properties

Appearance Solid, crystal Powder

Colour White - Very pale yellow

Odour No data available Odour

threshold No data available

pH value No data available

Melting point/freezing point 173 °C

Initial boiling point and boiling range No data available

Flash point No data available

Evaporation rate No data available

Flammability (solid, gas) No data available

Upper/lower flammability or explosive limits No data available

Vapour pressure No data available

Relative density No data available

Water solubility No data available

Partition coefficient: noctanol/water No data available

Auto-ignition temperature No data available

SECTION 10: Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: None under normal conditions
Conditions to Avoid: Heat, flames, sparks
Incompatible Materials: Oxidizers, acids
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide

SECTION 11: Toxicological Information

Routes of Exposure: Inhalation, eye, skin, ingestion
Acute Toxicity: LD50 (oral, rat): 5800 mg/kg
Skin Irritation: May cause drying or cracking
Eye Irritation: Causes serious eye irritation
Respiratory: May cause drowsiness or dizziness
Carcinogenicity: Not classified as carcinogenic
Other Effects: Repeated exposure may cause skin dryness or cracking

SECTION 12: Ecological Information

Ecotoxicity: Harmful to aquatic life in high concentrations
Persistence and Degradability: Readily biodegradable
Bioaccumulative Potential: Low potential for bioaccumulation

Mobility in Soil: High mobility
Other Adverse Effects: None known

SECTION 13: Disposal Considerations

Waste Disposal: Dispose in accordance with local, regional, and national regulations.
Contaminated Packaging: Rinse thoroughly and dispose according to regulations.

SECTION 14: Transport Information

UN Number: No data available
Transport Hazard Class(es): No data available
Packing Group: No data available
Environmental Hazards: None
Special Precautions: Flammable - keep away from heat and sources of ignition

SECTION 15: Regulatory Information

OSHA Hazards: Flammable, Irritant
SARA Title III: Section 311/312: Fire Hazard, Acute Health Hazard
TSCA: No data available
Other Regulations: Complies with applicable chemical safety regulations

16. Other Information

Prepared by: Juvenus Drugs
Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

Material Safety Data Sheet (MSDS)

para-Hydroxybenzaldehyde (4-Hydroxybenzaldehyde)

1. Identification
Product Name: para-Hydroxybenzaldehyde (4-Hydroxybenzaldehyde) Synonyms: 4-Hydroxybenzaldehyde, p-Hydroxybenzaldehyde Recommended Use: Pharmaceutical intermediate Supplier: Juvenus Drugs Emergency Contact: 9655606404

2. Hazard(s) Identification
Classification (GHS): Irritant (Category 3) Signal Word: Warning Hazard Statements: Causes mild skin and eye irritation. Precautionary Statements: Avoid inhalation of dust. Wear protective gloves and goggles.

3. Composition / Information on Ingredients
Chemical Name: para-Hydroxybenzaldehyde CAS No: 123-08-0 Purity: ≥ 99% Molecular Formula: C7H6O2 Molecular Weight: 122.12 g/mol

4. First-Aid Measures
Inhalation: Move person to fresh air. Skin Contact: Wash with soap and water. Eye Contact: Rinse thoroughly with water. Ingestion: Rinse mouth; seek medical advice.

5. Fire-Fighting Measures
Suitable Extinguishing Media: Dry chemical, CO_2, foam, water spray. Hazardous Combustion Products: Carbon oxides. Protective Equipment: Firefighters should wear self-contained breathing apparatus.

6. Accidental Release Measures
Personal Precautions: Avoid dust formation. Use protective equipment. Environmental Precautions: Prevent entry into drains. Cleanup Methods: Sweep up and place in suitable container for disposal.

7. Handling and Storage

Handling: Avoid contact with eyes and skin.
Storage: Keep container tightly closed in a cool, dry, and well-ventilated area.
Incompatible Materials: Strong oxidizers.

8. Exposure Controls / Personal Protection

Engineering Controls: Provide adequate ventilation.
Personal Protection: Safety goggles, gloves, lab coat.
Respiratory Protection: Use respirator if needed.

9. Physical and Chemical Properties

Appearance: White to light yellow crystalline solid
Odor: Aromatic odor
Melting Point: 114–116°C
Boiling Point: 246°C
Solubility: Slightly soluble in water; soluble in ethanol and ether
Flash Point: 149°C

10. Stability and Reactivity

Stability: Stable under normal conditions.
Incompatible Materials: Strong oxidizers.
Decomposition Products: Carbon oxides.

11. Toxicological Information

Acute Toxicity (Oral, Rat): LD50 = 870 mg/kg
Skin/Eye Irritation: May cause mild irritation.
Carcinogenicity: Not listed by IARC, NTP, or OSHA.

12. Ecological Information

Ecotoxicity: No data available.
Persistence: Expected biodegradable.
Bioaccumulation: Low potential.
Mobility: Low mobility expected.

13. Disposal Considerations

Dispose in accordance with local regulations. Prefer incineration for disposal.

14. Transport Information

UN Number: Not regulated
Transport Hazard Class: Non-hazardous
Packing Group: Not applicable
Environmental Hazards: None known

15. Regulatory Information
Not classified as hazardous under most chemical inventories. Ensure compliance with applicable regulations.

16. Other Information
Prepared by: Juvenus Drugs Date of Issue: October 2025 Disclaimer: Information is believed accurate but not guaranteed. User is responsible for safe handling.

p-**Benzoquinone** **CAS No 106-51-4**	**MATERIAL SAFETY DATA SHEET** **SDS/MSDS**

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : p-**Benzoquinone**

CAS-No. : 106-51-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Industrial & for professional use only.

1.3 Details of the supplier of the safety data sheet

Company : Central Drug House (P) Ltd
7/28 Vardaan House
Ansari Road Daryaganj
New Delhi-110002
INDIA

Telephone : +91 11 49404040

Email : care@cdhfinechemical.com

1.4 Emergency telephone number

Emergency Phone # : +91 11 49404040 (9:00am - 6:00 pm) [Office hours]

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008

Acute toxicity, Oral (Category 3), H301
Acute toxicity, Inhalation (Category 3), H331
Skin irritation (Category 2), H315
Eye irritation (Category 2), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008

Pictogram



Signal word Danger

Hazard statement(s)	
H301 + H331	Toxic if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273	Avoid release to the environment.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
P304 + P340 + P311	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P501	Dispose of contents/ container to an approved waste disposal plant.
Supplemental Hazard Statements	none

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	Quinone
Formula	:	C6H4O2
Molecular weight	:	108.09 g/mol
CAS-No.	:	106-51-4
EC-No.	:	203-405-2
Index-No.	:	606-013-00-3

Hazardous ingredients according to Regulation (EC) No 1272/2008

Component		Classification	Concentration
Quinone			
CAS-No.	106-51-4	Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H301, H331, H315, H319, H335, H400, H410 M-Factor - Aquatic Acute: 10	<= 100 %
EC-No.	203-405-2		
Index-No.	606-013-00-3		

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

Light sensitive. Moisture sensitive.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use (EN 143) respirator cartridges as a backup to engineering controls. If th full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: beige to green, yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 112 - 115 °C - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	0.1 mmHg at 25 °C
l)	Vapour density	4.33
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 0.2
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	243 °C -

r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension	32.58 mN/m at 112 °C
Relative vapour density	4.33

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Reacts violently with:, Strong oxidizing agents

10.6 Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 130 mg/kg(Quinone)
LD50 Oral - Mouse - 25 mg/kg(Quinone)
Remarks: Behavioral:Somnolence (general depressed activity). Behavioral:Tremor. Skin and Appendages: Other: Hair.
LD50 Oral - Rat - 100 mg/kg(Quinone)
Inhalation: No data available(Quinone)

Skin corrosion/irritation

No data available(Quinone)

Serious eye damage/eye irritation

No data available(Quinone)

Respiratory or skin sensitisation

No data available(Quinone)

Germ cell mutagenicity

No data available(Quinone)
Ames test(Quinone)
S. typhimurium
Histidine reversion (Ames)
Mouse(Quinone)
lymphocyte
DNA damage
Mouse(Quinone)
lymphocyte
DNA inhibition

Mouse(Quinone)
lymphocyte
Mutation in mammalian somatic cells.
Human(Quinone)
lymphocyte
Sister chromatid exchange
Mouse(Quinone)
Embryo
Morphological transformation.
Mouse(Quinone)
lymphocyte
Other mutation test systems
Hamster(Quinone)
Lungs
Micronucleus test
Human(Quinone)
lymphocyte
Other mutation test systems
(Quinone)
Mouse
Micronucleus test

Carcinogenicity

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Quinone)

Reproductive toxicity
No data available(Quinone)

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.(Quinone)

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available(Quinone)

Additional Information
RTECS: DK2625000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Damage to the eyes.(Quinone)

No data available(Quinone)

Stomach - Irregularities - Based on Human Evidence(Quinone)

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.04 - 0.125 mg/l - 96.0 h(Quinone)
Toxicity to daphnia and other aquatic Invertebrates	EC50 - Daphnia magna (Water flea) - 1 - 3.5 mg/l - 24 h(Quinone)
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 0.08 mg/l - 4 h(Quinone)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available(Quinone)

12.5 Results of PBT and vPvB assessment
This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects
Very toxic to aquatic life.

Very toxic to aquatic life with long lasting effects.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Dissolve or mix the material with a combustible solvent and burn in a chem scrubber.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 2587	IMDG: 2587	IATA: 2587

14.2 UN proper shipping name

ADR/RID:	BENZOQUINONE
IMDG:	BENZOQUINONE
IATA:	Benzoquinone

14.3 Transport hazard class(es)

ADR/RID: 6.1	IMDG: 6.1	IATA: 6.1

14.4 Packaging group

ADR/RID: II	IMDG: II	IATA: II

14.5 Environmental hazards

ADR/RID: no	IMDG Marine pollutant: no	IATA: no

14.6 Special precautions for user
No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.2 Chemical safety assessment
For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

H301	Toxic if swallowed.
H301 + H331	Toxic if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.

H331	Toxic if inhaled.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Central Drug House (P) Ltd and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.cdhfinechemical.com for additional terms and conditions of sale.

SAFETY DATA SHEET

Revision Date 24-Dec-2021 **Revision Number** 4

1. Identification

Product Name **Dibenzosuberone**

Cat No. : **AC114740000; AC114741000**

CAS No 1210-35-1
Synonyms 10,11-Dihydro-5H-dibenzo[a,d]cyclohepten-5-one; Dibenzocycloheptadienone

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious Eye Damage/Eye Irritation	Category 2

Label Elements

Signal Word
Warning

Hazard Statements
Causes serious eye irritation



Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS No	Weight %
5H-Dibenzo[a,d]cyclohepten-5-one, 10,11-dihydro-	1210-35-1	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation Remove to fresh air. Get medical attention. If not breathing, give artificial respiration.

Ingestion Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.

Most important symptoms and effects None reasonably foreseeable.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Thermal decomposition can lead to release of irritating gases and vapors. Carbon monoxide (CO). Carbon dioxide (CO_2).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Avoid dust formation.

Environmental Precautions Should not be released into the environment. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Avoid dust formation.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Incompatible Materials. Strong oxidizing agents.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ventilation systems. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Tight sealing safety goggles.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Yellow
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	32 - 34 °C / 89.6 - 93.2 °F

Boiling Point/Range	148 °C / 298.4 °F @ 0.3 mmHg
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	1.150
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C15 H12 O
Molecular Weight	208.26

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability No information available.

Conditions to Avoid Incompatible products. Excess heat. Avoid dust formation.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Thermal decomposition can lead to release of irritating gases and vapors, Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization No information available.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
5H-Dibenzo[a,d]cycloh epten-5-one, 10,11-dihydro-	1210-35-1	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
5H-Dibenzo[a,d]cyclohepten-5-one, 10,11-dihydro-	1210-35-1	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
5H-Dibenzo[a,d]cyclohepten-5-one	1210-35-1	X	-	214-912-3	X	X	X	X	X	-

, 10,11-dihydro-										

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
5H-Dibenzo[a,d]cyclohepten-5-one, 10,11-dihydro-	1210-35-1	Not applicable	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
5H-Dibenzo[a,d]cyclohepten-5-one, 10,11-dihydro-	1210-35-1	Not applicable	Not applicable	Not applicable	Not applicable

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific

Email: EMSDS.RA@thermofisher.com

Revision Date	24-Dec-2021
Print Date	24-Dec-2021
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product Identification

Chemical Name: (S)-3-(Methylamino)-1-(thiophen-2-yl)propan-1-ol
CAS Number: NA
Synonyms: (S)-2-Amino-1-(2-thienyl)-1-propanol methylated
Recommended Use: Laboratory chemical / intermediate
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU – INDIA

2. Hazard Identification

Classification:
Acute Toxicity, Oral – Category 4
Skin Irritation – Category 2
Eye Irritation – Category 2A
Signal Word: *Warning*
Hazard Statements:
H302: Harmful if swallowed
H315: Causes skin irritation
H319: Causes serious eye irritation
Precautionary Statements:
P264: Wash thoroughly after handling
P280: Wear protective gloves/eye protection
P301+P312: If swallowed, call a poison center/doctor
P305+P351+P338: If in eyes, rinse cautiously with water

3. Composition/Information on Ingredients

Chemical Name: (S)-3-(Methylamino)-1-(thiophen-2-yl)propane-1-ol

CAS Number: [No CAS officially assigned]

Purity: >95%

4. First Aid Measures

Inhalation**:** Move to fresh air. If symptoms persist, seek medical attention.
Skin Contact**:** Immediately flush with water for at least 15 minutes. Remove contaminated clothing.

Eye Contact**:** Flush eyes with plenty of water for at least 15 minutes. Seek medical attention immediately.

Ingestion**:** Rinse mouth. Do not induce vomiting. Seek immediate medical attention.

5. Firefighting Measures

Suitable Extinguishing Media: Water spray, alcohol-resistant foam, dry chemical, or CO_2.

Hazards: Emits toxic fumes under fire (e.g., nitrogen oxides, sulfur oxides)

Protective Equipment: Self-contained breathing apparatus and full protective gear.

6. Accidental Release Measures

Personal Precautions: Wear appropriate protective equipment. Avoid dust formation. Ventilate area.

Environmental Precautions: Prevent further leakage or spillage. Do not allow to enter drains.

Cleanup: Sweep up and place in a suitable container. Avoid raising dust.

7. Handling and Storage

Handling: Avoid contact with skin and eyes. Do not breathe dust or vapors. Handle in a chemical fume hood.

Storage: Keep container tightly closed in a dry and well-ventilated place. Store at 2–8°C.

8. Exposure Controls / Personal Protection

Exposure Limits (ACGIH TLV)**: 10 mg/m³ (TWA), 20 mg/m³ (STEL)**

Engineering Controls**: Use local exhaust ventilation.**

PPE**:**

Eyes**: Safety goggles**

Skin**: Protective gloves**

Respiratory**: Dust mask if ventilation is inadequate**

9. Physical and Chemical Properties

Appearance: Pale yellow to light brown solid or oil

Odor: Mild

pH: Not available

Melting Point: Not available

Boiling Point: Not available

Flash Point: >100°C (estimate)

Solubility: Soluble in water and alcohol

Density: Not determined

10. Stability and Reactivity

Chemical Stability: Stable under recommended conditions

Reactivity: No specific reactivity hazards known

Hazardous Reactions: None under normal use

Decomposition Products: Carbon oxides, sulfur oxides, nitrogen oxides

Conditions to Avoid: Heat, moisture, oxidizers

11. Toxicological Information

Likely Routes of Exposure: Inhalation, skin and eye contact, ingestion

Acute Toxicity:

Estimated Oral LD50 (rat): ~300–1000 mg/kg

Skin/Eye Irritation: Causes irritation

Sensitization: Not known

Carcinogenicity: Not listed by IARC, NTP, or OSHA

12. Ecological Information

Ecotoxicity: Harmful to aquatic organisms due to pH change

Persistence: Biodegradable

Bioaccumulation: Not expected

Mobility: Mobile in water.

13. Disposal Considerations

Disposal Methods**: Dispose of according to local, regional, and national regulations**

Contaminated Packaging**: Dispose of as hazardous waste**

14. Transport Information

UN Number: Not classified

Proper Shipping Name: Not regulated for transport

Hazard Class: Not applicable

Packing Group: Not applicable

Labeling: Not required

15. Regulatory Information

TSCA: Not listed

DSL/NDSL (Canada): Not listed

SARA 313: Not listed

EU Classification: Xi – Irritant

REACH: Not registered

16. Other Information

Prepared by: Juvenus Drugs

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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product Identification

Product Name: 3-(2-Hydroxyethyl)-N-methyl-1H-indole-5-methanesulphonamide
Synonyms: Not available
CAS Number: Not available
Recommended Use: Laboratory chemical, research and development
Details of the supplier of the safety data sheet
Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU – INDIA

2. Hazard Identification

Classification: Not classified under GHS.
Label Elements:

Pictogram: None

Signal Word: None

Hazard Statements: Not classified as hazardous

Precautionary Statements: Handle in accordance with good industrial hygiene and safety practices.

3. Composition/Information on Ingredients

Substance: 3-(2-Hydroxyethyl)-N-methyl-1H-indole-5-methanesulphonamide

CAS Number: NA

Molecular weight: $C_{12}H_{16}N_2O_3S$

Concentration: 98–100% (pure grade)

4. First Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms persist.

Skin Contact: Wash thoroughly with soap and water. Seek medical advice for irritation.

Eye Contact: Rinse with plenty of water for several minutes. Seek medical attention.

Ingestion: Rinse mouth. Do NOT induce vomiting. Get medical help if symptoms occur.

5. Firefighting Measures

Extinguishing Media: Water spray, foam, dry chemical, or CO_2

Hazards: Can emit toxic fumes (sulfur oxides) when heated to decomposition

Protective Equipment: Firefighters should wear full protective clothing and self-contained breathing apparatus.

6. Accidental Release Measures

Personal Precautions: Wear appropriate protective equipment. Avoid dust formation. Ventilate area.

Environmental Precautions: Prevent further leakage or spillage. Do not allow to enter drains.

Cleanup: Sweep up and place in a suitable container. Avoid raising dust.

7. Handling and Storage

Handling: Avoid contact with skin and eyes. Do not breathe dust or vapors. Handle in a chemical fume hood.

Storage: Keep container tightly closed in a dry and well-ventilated place. Store at 2–8°C.

8. Exposure Controls / Personal Protection

Exposure Limits: Not established for DMSO

Engineering Controls: Local exhaust ventilation

PPE:

Eyes: Chemical safety goggles

Skin: Protective gloves (e.g., nitrile)

Clothing: Lab coat or protective clothing

Respiratory: Not usually required under normal use

9. Physical and Chemical Properties

Appearance: White to off-white solid
Odor: Not available
Odor Threshold: Not available
pH: Not available
Melting Point/Freezing Point: Not available
Boiling Point: Not available
Flash Point: Not available
Solubility: Soluble in water
Density: Not available

10. Stability and Reactivity

Chemical Stability: Stable under recommended conditions

Reactivity: No specific reactivity hazards known

Hazardous Reactions: None under normal use

Decomposition Products: Carbon oxides, sulfur oxides, nitrogen oxides

Conditions to Avoid: Heat, moisture, oxidizers

11. Toxicological Information

Routes of Exposure: Inhalation, skin, eye, ingestion
Acute Toxicity: No data available
Chronic Effects: No known significant effects
Irritation: May cause mild skin/eye irritation
Carcinogenicity: Not listed as a carcinogen by IARC, NTP, or OSHA

12. Ecological Information

Ecotoxicity: Harmful to aquatic organisms due to pH change

Persistence: Biodegradable

Bioaccumulation: Not expected

Mobility: Mobile in water.

13. Disposal Considerations

Disposal Methods**: Dispose of according to local, regional, and national regulations**

Contaminated Packaging**: Dispose of as hazardous waste**

14. Transport Information

UN Number: Not classified

Proper Shipping Name: Not applicable

Hazard Class: Not applicable

Packing Group: Not applicable

Labeling: Not required

15. Regulatory Information

TSCA: Not listed

DSL/NDSL (Canada): Not listed

SARA 313: Not listed

EU Classification: Xi – Irritant

REACH: Not registered

16. Other Information

Prepared by: Juvenus Drugs

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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: Methyl 2-(2-hydroxyphenyl)acetate
CAS Number: 22446-37-3
Synonyms: NA
Recommended Use: Industrial chemical

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

GHS Classification:
- Skin corrosion (Category 1B)
- Serious eye damage (Category 1)
- Specific target organ toxicity – single exposure (Category 3)

Label Elements:
Signal Word: Danger
Hazard Statements:
- H314: Causes severe skin burns and eye damage
- H335: May cause respiratory irritation

Precautionary Statements:
- P260: Do not breathe mist/vapors/spray
- P280: Wear protective gloves/protective clothing/eye protection
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes
- P310: Immediately call a POISON CENTER/doctor

3. Composition/Information on Ingredients

Substance: Methyl 2-(2-hydroxyphenyl)acetate
CAS No: 22446-37-3
Concentration: 97%

4. First-Aid Measures

If inhaled: Remove to fresh air. Seek medical attention immediately.
In case of skin contact: Remove contaminated clothing. Wash off immediately with plenty of water.
In case of eye contact: Rinse immediately with plenty of water for at least 15 minutes. Seek medical

attention.
If swallowed: Rinse mouth. Do NOT induce vomiting. Seek immediate medical assistance.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical, or carbon dioxide.
Specific hazards: Emits toxic fumes of hydrogen chloride gas when heated.
Protective equipment: Use self-contained breathing apparatus and full protective gear.

6. Accidental Release Measures

Personal precautions: Evacuate personnel to safe areas. Use personal protective equipment. Avoid breathing vapors.
Environmental precautions: Prevent further leakage or spillage if safe to do so. Avoid discharge into drains.
Methods for cleaning up: Neutralize with sodium bicarbonate or lime. Absorb with inert material. Collect and dispose in appropriate containers.

7. Handling and Storage

Precautions for safe handling: Avoid contact with skin, eyes, and clothing. Do not breathe vapors or mist. Use only with adequate ventilation.
Conditions for safe storage: Store in a cool, dry, and well-ventilated area. Keep container tightly closed and away from incompatible substances.

8. Exposure Controls/Personal Protection

Engineering controls: Use in a chemical fume hood. Provide adequate ventilation.
Personal protective equipment:
- Eye protection: Tightly fitting safety goggles and face shield
- Skin protection: Chemical-resistant gloves and protective clothing
- Respiratory protection: NIOSH-approved respirator if exposure limits are exceeded

9. Physical and Chemical Properties

a) Appearance Powder

b) Odour no data available

c) Odour Threshold no data available

d) pH no data available

e) Melting point/freezing point no data available

f) Initial boiling point and boiling range no data available

g) Flash point no data available

h) Evaporation rate no data available

i) Flammability (solid, gas) no data available

j) Flammability or explosive limits no data available

l) Vapour density no data available

m) Relative density no data available

n) Water solubility no data available

o) Partition coefficient: no data available

p) Autoignition temperature no data available

) Decomposition temperature no data available

r) Viscosity no data available

s) Explosive properties no data available

t) Oxidizing properties no data available

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, sparks, open flames
Incompatible materials: Metals, bases, oxidizing agents
Hazardous decomposition products: Hydrogen chloride gas

11. Toxicological Information

Acute toxicity: No data available
Skin irritation: No data available
Eye irritation: Causes serious eye damage
Inhalation: Causes serious eye damage
Chronic effects: Causes serious eye damage ion

12. Ecological Information

Ecotoxicity: Harmful to aquatic life in high concentrations
Persistence and degradability: Dissociates in water, not persistent
Bioaccumulative potential: Low
Mobility in soil: High due to solubility in water

13. Disposal Considerations

Waste treatment methods: Neutralize before disposal. Dispose of contents/container in accordance with local/regional/national/international regulations.

14. Transport Information

UN number: Causes serious eye damage
Proper shipping name: Causes serious eye damage
Transport hazard class(es): Causes serious eye damage)
Packing group: Causes serious eye damage
Environmental hazards: Not classified as a marine pollutant

15. Regulatory Information

Regulations:
- TSCA: No data available
- OSHA: No data available
- SARA 302: No data available
- SARA 313: No data available
- WHMIS Classification: No data available

16. Other Information

Prepared by: Juvenus Drugs
Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

Material Safety Data Sheet (MSDS)

(S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl)phenyl)propan-1-ol

1. Identification
Product Name: (S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl)phenyl)propan-1-ol Recommended Use: Pharmaceutical intermediate Supplier:Juvenus Drugs Emergency Contact: 9655606404

2. Hazard(s) Identification
Classification: Not classified as hazardous. Signal Word: None Hazard Statements: May cause mild irritation. Precautionary Statements: Avoid contact with eyes and skin.

3. Composition / Information on Ingredients
Chemical Name: (S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl)phenyl)propan-1-ol CAS No: --- Purity: ≥ 95% Molecular Formula: C27H26ClNO2 Molecular Weight: 431.95 g/mol

4. First-Aid Measures
Inhalation: Move to fresh air. Skin Contact: Wash with soap and water. Eye Contact: Rinse cautiously with water. Ingestion: Rinse mouth; seek medical advice.

5. Fire-Fighting Measures
Suitable Extinguishing Media: Dry chemical, CO_2, foam. Hazardous Combustion Products: Carbon oxides, nitrogen oxides, HCl. Protective Equipment: Wear self-contained breathing apparatus.

6. Accidental Release Measures
Personal Precautions: Avoid dust formation. Environmental Precautions: Prevent entry into waterways. Cleanup Methods: Sweep and collect for disposal.

7. Handling and Storage
Handling: Avoid inhalation and contact. Storage: Store tightly closed in a cool, dry, well-ventilated place.

8. Exposure Controls / Personal Protection
Engineering Controls: Use adequate ventilation. Personal Protection: Gloves, goggles, lab coat. Respiratory Protection: Use respirator if exposure limits are exceeded.

9. Physical and Chemical Properties
Appearance: Off-white solid Odor: Odorless Solubility: Soluble in DMSO, ethanol; insoluble in water Molecular Weight: 431.95 g/mol

10. Stability and Reactivity
Stability: Stable under normal conditions. Incompatible Materials: Strong oxidizers. Decomposition Products: CO, CO_2, HCl, NOx.

11. Toxicological Information
Acute Toxicity: No data available. Skin/Eye Irritation: May cause mild irritation. Carcinogenicity: Not listed by IARC, NTP, or OSHA.

12. Ecological Information
Ecotoxicity: No data available. Persistence: Not readily biodegradable. Bioaccumulation: Possible due to low solubility.

13. Disposal Considerations
Dispose of in accordance with local regulations. Incinerate if possible.

14. Transport Information
UN Number: Not regulated Transport Hazard Class: Non-hazardous Packing Group: Not applicable

15. Regulatory Information
No specific regulations identified for this compound.

16. Other Information
Prepared by: --- Date of Issue: October 2025 Disclaimer: Information believed accurate but not guaranteed.

JUVENUS DRUGS
Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: 1-Fluoro-4-nitrobenzene
Synonyms: p-Fluoronitrobenzene, 4-Fluoronitrobenzene
Recommended Use: Laboratory chemical, intermediate in organic synthesis

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

Classification (GHS):

- Acute toxicity (oral, dermal): Category 4
- Skin irritation: Category 2
- Eye irritation: Category 2A
- Specific target organ toxicity - single exposure: Category 3

Label Elements:

- **Pictograms:** ![Exclamation Mark]
- **Signal Word:** Warning
- **Hazard Statements:**
  - H302: Harmful if swallowed
  - H315: Causes skin irritation
  - H319: Causes serious eye irritation
  - H335: May cause respiratory irritation
- **Precautionary Statements:**
  - P261, P264, P270, P280, P301+P312, P305+P351+P338

3. Composition/Information on Ingredients

Substance: 1-Fluoro-4-nitrobenzene
CAS No: 350-46-9
Purity: ≥ 99%

4. First-Aid Measures

If inhaled: Move to fresh air. If breathing is difficult, give oxygen. Seek medical attention.
In case of skin contact: Wash off with soap and plenty of water. Remove contaminated clothing.
In case of eye contact: Rinse thoroughly with water for at least 15 minutes. Seek medical advice.
If swallowed: Rinse mouth with water. Seek medical advice. Do not induce vomiting.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, dry chemical, foam, or carbon dioxide.
Specific hazards: Emits toxic fumes under fire conditions.
Protective equipment: Wear self-contained breathing apparatus and protective clothing.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Avoid breathing vapors or mist. Ensure adequate ventilation.
Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.
Methods for cleaning up: Soak up with inert absorbent material and dispose of as hazardous waste.

7. Handling and Storage

Handling: Avoid contact. Handle in a well-ventilated area. Use protective equipment.

Storage: Store in a tightly sealed container, in a cool, dry, well-ventilated place. Away from heat and incompatible substances.

8. Exposure Controls/Personal Protection

Engineering controls: Ensure adequate ventilation, especially in confined areas.
Personal protective equipment:
- Eye protection: Safety goggles
- Skin protection: Protective gloves and lab coat
- Respiratory protection: Use NIOSH-approved respirator when exposure limits are exceeded

9. Physical and Chemical Properties

Appearance: Pale yellow liquid

Odor: Slight aromatic odor

Boiling Point: ~213 °C

Melting Point: ~5 °C

Flash Point: >93 °C

Solubility: Slightly soluble in water

Density: **~1.4 g/cm³**

Vapor Pressure: **Low**

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, flames, and sparks.
Incompatible materials: Strong oxidizing agents.
Hazardous decomposition products: Carbon oxides

11. Toxicological Information

Acute Toxicity: Oral LD50 (rat): ~200-500 mg/kg (estimated)

Skin/Eye Irritation: Causes irritation

Inhalation: May cause respiratory irritation

Carcinogenicity: Not listed by IARC, NTP, or OSHA

12. Ecological Information

Ecotoxicity: May be harmful to aquatic organisms.
Persistence and degradability: Expected to be biodegradable.
Bioaccumulative potential: Low potential for bioaccumulation.
Mobility in soil: Likely to leach into groundwater due to water solubility.

13. Disposal Considerations

Waste treatment methods: Dispose of contents/container in accordance with local/regional/national regulations.
Do not discharge into drains or the environment.

14. Transport Information

UN Number: UN2810

Proper Shipping Name: Toxic liquid, organic, n.o.s. (1-Fluoro-4-nitrobenzene)

Class: 6.1

Packing Group: III

Environmental Hazards: Marine pollutant (potential)

15. Regulatory Information

Regulatory status:
- TSCA: Listed
- DSL/NDSL: Listed
- SARA Title III: Not listed
- WHMIS: D2A - Very toxic material causing other toxic effects

16. Other Information

Prepared by: Juvenus Drugs

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Head Office: No: 55, Raj Flat, Near Ring Road, Ponniammanmedu, Chennai – 600110
Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Identification

Product Name: 2-Bromobutane

Synonyms: sec-Butyl bromide

Recommended Use: Laboratory chemical

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU – INDIASECTION

2. Hazard Identification

Classification:

Flammable liquid – Category 2

Acute toxicity (inhalation) – Category 4

Specific target organ toxicity (single exposure) – Category 3

Aspiration hazard – Category 1

Label Elements:

Pictograms: ![Flame], ![Exclamation Mark], ![Health Hazard]

Signal Word: *Danger*

Hazard Statements:

H225: Highly flammable liquid and vapor

H332: Harmful if inhaled

H336: May cause drowsiness or dizziness

H304: May be fatal if swallowed and enters airways

Precautionary Statements:

P210, P261, P271, P301+P310, P331, P370+P378

3. Composition/Information on Ingredients

Chemical Name: 2-Bromobutane

CAS Number: 78-76-2

Concentration: ≥ 95%

4. First Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms persist.
Skin Contact: Wash with soap and water. Remove contaminated clothing.
Eye Contact: Rinse cautiously with water for several minutes.
Ingestion: Rinse mouth. Seek medical attention.

5. Fire-Fighting Measures

Suitable Extinguishing Media: Water spray, carbon dioxide, dry chemical, alcohol-resistant foam

Hazards from Combustion: Nitrogen oxides, carbon oxides, and other toxic fumes

Protective Equipment: Firefighters should wear full protective gear and self-contained breathing apparatus (SCBA)

6. Accidental Release Measures

Personal Precautions: Use PPE, avoid dust formation
Methods for Cleanup: Sweep up and dispose in suitable containers
Environmental Precautions: Prevent entry into drains and water bodies

7. Handling and Storage

Handling: Avoid contact with eyes, skin, and clothing. Handle under fume hood

Storage: Store tightly closed in a cool, dry, well-ventilated place away from ignition sources

8. Exposure Controls/Personal Protection

Engineering Measures

Use explosion-proof electrical/ventilating/lighting equipment. Ensure that eyewashstationsand safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as describedbyOSHA's eye and face protection regulations in 29 CFR 1910.133 or EuropeanStandardEN166.

Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection

No protective equipment is needed under normal use conditions.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice

9. Physical and Chemical Properties

Physical State Liquid

Appearance Yellow

Odor aromatic Odor

Threshold No information available

pH Not applicable

Melting Point/Range -112 °C / -169.6 °F

Boiling Point/Range 91 °C / 195.8 °F @ 760 mmHg

Flash Point 21 °C / 69.8 °F

Evaporation Rate No information available

Flammability (solid,gas) Not applicable

Flammability or explosive limits

Upper 6.6% Lower 2.6%

Vapor Pressure 70 mbar @ 20 °C

Vapor Density 4.7

Specific Gravity 1.250

Solubility No information available

Partition coefficient; n-octanol/water No data available

Autoignition Temperature 265 °C / 509 °F

Decomposition Temperature No information available

Viscosity No information available

10. Stability and Reactivity

Stability: May form explosive peroxides on long exposure to air

Incompatible Materials: Oxidizers, acids, air (peroxide formation)

Hazardous Decomposition Products: Carbon oxides

Conditions to Avoid: Heat, sparks, open flame, air exposure (peroxides)

11. Toxicological Information

Acute Toxicity:

Inhalation LC50 (rat): 25,000 mg/m³ (4 hr)

Oral LD50 (rat): 1,820 mg/kg

Irritation: May cause eye and respiratory tract irritation

Chronic Effects: CNS effects such as dizziness, headache

Carcinogenicity: Not listed by IARC, NTP, or OSHA

12. Ecological Information

Ecotoxicity: Harmful to aquatic life
Persistence/Degradability: Biodegradable
Bioaccumulation: Low potential
Mobility in Soil: Moderate

13. Disposal Considerations

Disposal Methods: Dispose of contents/container in accordance with local regulations
Contaminated Packaging: Dispose of as unused product

14. Transport Information

UN Number: UN2339

UN Proper Shipping Name: 2-BROMOBUTANE

Transport Hazard Class: 3 (Flammable liquid)

Packing Group: II

Marine Pollutant: No

15. Regulatory Information

TSCA: Listed

SARA Title III: Not reportable

CERCLA: Not listed

Other Regulations: Subject to fire and workplace safety laws

16. Other Information

Prepared by: Juvenus Drugs

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JUVENUS DRUGS
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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

SECTION 1: Identification

Product Name: Choline chloride
CAS Number: 67-48-1
Recommended Use: industrial and laboratory use
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

SECTION 2: Hazard(s) Identification

2.1 Classification of the substance or mixture :

Classification according to Regulation (EC) No 1272/2008 (CLP) This substance does not meet the criteria for classification in accordance with Regulation No 1272/2008/EC.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP) not required

Choline chloride ≥95 % article number: 2H20 Germany (en) Page 2 / 14

2.3 Other hazards Endocrine disrupting properties Does not contain an endocrine disruptor (ED) at a concentration of ≥ 0,1%.

SECTION 3: Composition/Information on Ingredients

Name of substance Choline chloride

Molecular formula $C_5H_{14}ClNO$

Molar mass 139,6 g /mol

CAS No 67-48-1

EC No 200-655-4

SECTION 4: First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms occur.
Skin Contact: Wash with soap and water.
Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses if present.
Ingestion: Do not induce vomiting. Seek medical advice immediately.

SECTION 5: Fire-Fighting Measures

Suitable Extinguishing Media: Alcohol-resistant foam, CO_2, dry chemical
Unsuitable Extinguishing Media: Water jet
Hazards from Combustion: Carbon oxides
Protective Equipment for Firefighters: Wear self-contained breathing apparatus and full protective gear

SECTION 6: Accidental Release Measures

Personal Precautions: Eliminate ignition sources. Ventilate area. Wear PPE.
Environmental Precautions: Prevent entry into sewers or waterways.
Cleanup Methods: Absorb with inert material and place in suitable containers for disposal.

SECTION 7: Handling and Storage

Handling: Use in a well-ventilated area. Avoid inhalation and contact with eyes/skin.
Storage: Store in a cool, dry, well-ventilated area away from ignition sources.

SECTION 8: Exposure Controls/Personal Protection

Occupational Exposure Limits (OELs):
- ACGIH TLV: 250 ppm (TWA)
- OSHA PEL: 1000 ppm (TWA)

Engineering Controls: Use local exhaust ventilation
Personal Protective Equipment:
- Eyes: Safety goggles
- Skin: Protective gloves
- Respiratory: Approved respirator if exposure limits are exceeded

SECTION 9: Physical and Chemical Properties

Physical state solid

Form powder

Colour white

Odour characteristic

Melting point/freezing point 303 °C at 1.013 hPa (ECHA Chem)

Boiling point or initial boiling point and boiling range not determined

Flammability this material is combustible, but will not ignite readily

Lower and upper explosion limit not relevant (solid)

Flash point not applicable

Auto-ignition temperature not determined

Decomposition temperature not relevant

pH (value) not applicable

Kinematic viscosity not relevant

SECTION 10: Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: None under normal conditions
Conditions to Avoid: Heat, flames, sparks
Incompatible Materials: Oxidizers, acids
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide

SECTION 11: Toxicological Information

Routes of Exposure: Inhalation, eye, skin, ingestion
Acute Toxicity: LD50 (oral, rat): 5800 mg/kg
Skin Irritation: May cause drying or cracking
Eye Irritation: Causes serious eye irritation
Respiratory: May cause drowsiness or dizziness
Carcinogenicity: Not classified as carcinogenic
Other Effects: Repeated exposure may cause skin dryness or cracking

SECTION 12: Ecological Information

Ecotoxicity: Harmful to aquatic life in high concentrations
Persistence and Degradability: Readily biodegradable
Bioaccumulative Potential: Low potential for bioaccumulation
Mobility in Soil: High mobility
Other Adverse Effects: None known

SECTION 13: Disposal Considerations

Waste Disposal: Dispose in accordance with local, regional, and national regulations.
Contaminated Packaging: Rinse thoroughly and dispose according to regulations.

SECTION 14: Transport Information

UN Number: UN1090
Transport Hazard Class(es): 3
Packing Group: II
Environmental Hazards: None
Special Precautions: Flammable - keep away from heat and sources of ignition

SECTION 15: Regulatory Information

OSHA Hazards: Flammable, Irritant
SARA Title III: Section 311/312: Fire Hazard, Acute Health Hazard
TSCA: Listed
Other Regulations: Complies with applicable chemical safety regulations

16. Other Information

Prepared by: Juvenus Drugs

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JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Name: Isopropyl Alcohol
CAS Number: 67-63-0
Synonyms: 2-Propanol, Isopropanol
Recommended Use: Solvent, disinfectant, cleaning agent

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

GHS Classification:
- Flammable liquids (Category 2)
- Eye irritation (Category 2A)
- Specific target organ toxicity – single exposure (Category 3)

Label Elements:
Signal Word: Danger
Hazard Statements:
- H225: Highly flammable liquid and vapor
- H319: Causes serious eye irritation
- H336: May cause drowsiness or dizziness

Precautionary Statements:
- P210: Keep away from heat/sparks/open flames/hot surfaces
- P261: Avoid breathing vapors
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes
- P403+P233: Store in a well-ventilated place. Keep container tightly closed

3. Composition/Information on Ingredients

Substance: Isopropyl Alcohol
CAS No: 67-63-0
EC No: 200-661-7
Purity: ≥ 99%

4. First-Aid Measures

If inhaled: Remove to fresh air. If not breathing, give artificial respiration.
In case of skin contact: Wash off with soap and water.
In case of eye contact: Rinse thoroughly with water for at least 15 minutes. Seek medical advice.
If swallowed: Rinse mouth. Do NOT induce vomiting. Get medical attention if symptoms occur.

5. Fire-Fighting Measures

Suitable extinguishing media: Alcohol-resistant foam, dry chemical, CO_2, or water spray.
Specific hazards: Vapors may form explosive mixtures with air. Containers may explode when heated.
Protective equipment: Wear self-contained breathing apparatus.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Remove all sources of ignition. Ensure adequate ventilation.
Environmental precautions: Prevent entry into sewers or waterways.
Methods for cleaning up: Contain and collect spillage with non-combustible absorbent materials. Dispose of in accordance with regulations.

7. Handling and Storage

Precautions for safe handling: Avoid contact with eyes and skin. Avoid inhalation of vapors. Use in well-ventilated areas.
Conditions for safe storage: Store in a tightly closed container in a cool, dry, and well-ventilated area away from heat or ignition sources.

8. Exposure Controls/Personal Protection

Engineering controls: Provide sufficient mechanical ventilation.
Personal protective equipment:
- Eye/face protection: Safety glasses with side-shields
- Skin protection: Protective gloves and clothing
- Respiratory protection: Use appropriate respirators if ventilation is inadequate

9. Physical and Chemical Properties

Appearance: Clear, colorless liquid
Odor: Alcohol-like
Boiling point: 82.6 °C
Melting point: -89 °C
Flash point: 12 °C (Closed cup)
Solubility: Miscible with water
Density: 0.785 g/cm³

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, flames, sparks

Incompatible materials: Oxidizing agents, acids
Hazardous decomposition products: Carbon oxides

11. Toxicological Information

Acute toxicity: LD50 Oral - Rat - 5,045 mg/kg
Skin irritation: May cause mild irritation
Eye irritation: Causes serious eye irritation
Inhalation: May cause drowsiness or dizziness
Carcinogenicity: Not listed as a carcinogen
Additional Information: Prolonged exposure may cause central nervous system effects

12. Ecological Information

Ecotoxicity: Low toxicity to aquatic life
Persistence and degradability: Readily biodegradable
Bioaccumulative potential: Low
Mobility in soil: High due to water solubility

13. Disposal Considerations

Waste treatment methods: Dispose of in accordance with local, regional, and national regulations. Do not discharge into drains.

14. Transport Information

UN number: 1219
Proper shipping name: Isopropanol (Isopropyl Alcohol)
Transport hazard class(es): 3 (Flammable liquids)
Packing group: II
Environmental hazards: Not classified as a marine pollutant

15. Regulatory Information

Regulations:
- TSCA: Listed
- OSHA: Flammable liquid, eye irritant
- SARA 313: Listed
- WHMIS Classification: B2, D2B

16. Other Information

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JUVENUS DRUGS – SAFETY DATA SHEET

SECTION 1: Identification

Product Name: Acetone
Synonyms: Dimethyl ketone, 2-Propanone
CAS Number: 67-64-1
Recommended Use: Solvent, industrial and laboratory use
Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

SECTION 2: Hazard(s) Identification

GHS Classification:
- Flammable liquids (Category 2)
- Eye irritation (Category 2A)
- Specific target organ toxicity - single exposure (Category 3)

Label Elements:
Signal Word: Danger
Hazard Statements:
- H225: Highly flammable liquid and vapor
- H319: Causes serious eye irritation
- H336: May cause drowsiness or dizziness

Precautionary Statements:
- P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking
- P261: Avoid breathing vapors
- P280: Wear protective gloves/eye protection
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes

SECTION 3: Composition/Information on Ingredients

Component: Acetone
CAS Number: 67-64-1
Concentration: ≥ 99%

SECTION 4: First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms occur.
Skin Contact: Wash with soap and water.

Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses if present.
Ingestion: Do not induce vomiting. Seek medical advice immediately.

SECTION 5: Fire-Fighting Measures

Suitable Extinguishing Media: Alcohol-resistant foam, CO_2, dry chemical
Unsuitable Extinguishing Media: Water jet
Hazards from Combustion: Carbon oxides
Protective Equipment for Firefighters: Wear self-contained breathing apparatus and full protective gear

SECTION 6: Accidental Release Measures

Personal Precautions: Eliminate ignition sources. Ventilate area. Wear PPE.
Environmental Precautions: Prevent entry into sewers or waterways.
Cleanup Methods: Absorb with inert material and place in suitable containers for disposal.

SECTION 7: Handling and Storage

Handling: Use in a well-ventilated area. Avoid inhalation and contact with eyes/skin.
Storage: Store in a cool, dry, well-ventilated area away from ignition sources.

SECTION 8: Exposure Controls/Personal Protection

Occupational Exposure Limits (OELs):
- ACGIH TLV: 250 ppm (TWA)
- OSHA PEL: 1000 ppm (TWA)

Engineering Controls: Use local exhaust ventilation
Personal Protective Equipment:
- Eyes: Safety goggles
- Skin: Protective gloves
- Respiratory: Approved respirator if exposure limits are exceeded

SECTION 9: Physical and Chemical Properties

Appearance: Colorless liquid
Odor: Sweet, pungent odor
Odor Threshold: ~62 ppm
pH: Not applicable
Melting Point: -95 °C
Boiling Point: 56 °C
Flash Point: -20 °C (closed cup)
Flammability: Highly flammable
Solubility in Water: Miscible
Density: 0.79 g/cm³
Molecular Formula: C3H6O
Molecular Weight: 58.08 g/mol

SECTION 10: Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: None under normal conditions
Conditions to Avoid: Heat, flames, sparks
Incompatible Materials: Oxidizers, acids
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide

SECTION 11: Toxicological Information

Routes of Exposure: Inhalation, eye, skin, ingestion
Acute Toxicity: LD50 (oral, rat): 5800 mg/kg
Skin Irritation: May cause drying or cracking
Eye Irritation: Causes serious eye irritation
Respiratory: May cause drowsiness or dizziness
Carcinogenicity: Not classified as carcinogenic
Other Effects: Repeated exposure may cause skin dryness or cracking

SECTION 12: Ecological Information

Ecotoxicity: Harmful to aquatic life in high concentrations
Persistence and Degradability: Readily biodegradable
Bioaccumulative Potential: Low potential for bioaccumulation
Mobility in Soil: High mobility
Other Adverse Effects: None known

SECTION 13: Disposal Considerations

Waste Disposal: Dispose in accordance with local, regional, and national regulations.
Contaminated Packaging: Rinse thoroughly and dispose according to regulations.

SECTION 14: Transport Information

UN Number: UN1090
Transport Hazard Class(es): 3
Packing Group: II
Environmental Hazards: None
Special Precautions: Flammable - keep away from heat and sources of ignition

SECTION 15: Regulatory Information

OSHA Hazards: Flammable, Irritant
SARA Title III: Section 311/312: Fire Hazard, Acute Health Hazard
TSCA: Listed
Other Regulations: Complies with applicable chemical safety regulations

16. Other Information

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JUVENUS DRUGS – SAFETY DATA SHEET

1. Product and Company Identification

Product Identifier: n-Hexane

Other Means of Identification: Hexyl hydride

CAS No.: 110-54-3

Recommended Use: Industrial solvent, extraction agent

Restrictions on Use: Not for food, drug, or household use

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU - INDIA

2. Hazards Identification

Classification:

Flammable Liquid – Category 2
Reproductive Toxicity – Category 2
Specific Target Organ Toxicity (Single Exposure) – Category 3
Specific Target Organ Toxicity (Repeated Exposure) – Category 2
Aspiration Hazard – Category 1
Acute Aquatic Toxicity – Category 1
Chronic Aquatic Toxicity – Category 2
Signal Word: Danger

Hazard Statements:

Highly flammable liquid and vapor
May cause drowsiness or dizziness
Suspected of damaging fertility
Causes damage to organs through prolonged or repeated exposure
May be fatal if swallowed and enters airways
Very toxic to aquatic life with long-lasting effects

Precautionary Statements:

Keep away from heat/sparks/open flames/hot surfaces
Use explosion-proof equipment
Avoid inhalation of vapors
Wear protective gloves and eye/face protection
Dispose of contents/container in accordance with local regulations

3. Composition/Information on Ingredients

Chemical Name: n-Hexane
CAS Number: 110-54-3
Concentration: ≥ 95%

4. First-Aid Measures

Inhalation: Move to fresh air. Seek medical attention if symptoms occur.
Skin Contact: Wash with soap and water. Remove contaminated clothing.
Eye Contact: Rinse thoroughly with water for several minutes.
Ingestion: Do NOT induce vomiting. Seek immediate medical attention.
Most Important Symptoms: Headache, dizziness, nausea, peripheral neuropathy
Notes to Physician: Aspiration hazard. Gastric lavage only after intubation.

5. Fire-Fighting Measures

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Special protective equipment: Wear self-contained breathing apparatus for firefighting if necessary.

6. Accidental Release Measures

Personal precautions: Use personal protective equipment. Avoid breathing vapors, mist or gas.
Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.
Methods for cleaning up: Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal.

7. Handling and Storage

Precautions for Safe Handling:
Use only in well-ventilated areas
Ground/bond containers and equipment
Avoid contact with skin and eyes
Storage Conditions:
Store in a cool, dry, and well-ventilated area
Keep container tightly closed and away from ignition sources

8. Exposure Controls/Personal Protection

Engineering controls: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels.
Personal protective equipment:
- Eye/face protection: Safety goggles
- Skin protection: Protective gloves and clothing
- Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate, use a full-face respirator.

9. Physical and Chemical Properties

Appearance: Clear, colorless liquid
Odor: Gasoline-like
Odor Threshold: 130 ppm
pH: Not applicable
Melting Point: -95 °C
Boiling Point: ~68–70 °C
Flash Point: -22 °C (closed cup)
Evaporation Rate: Fast
Flammability: Highly flammable
Vapor Pressure: ~160 mmHg @ 25°C
Vapor Density: >2 (air = 1)
Relative Density: 0.66 g/cm³
Solubility in Water: Insoluble
Partition Coefficient (log Kow): ~3.5
Auto-ignition Temperature: ~234 °C
Decomposition Temperature: Not available
Viscosity: ~0.3 cP

10. Stability and Reactivity

Chemical stability: Stable under recommended storage conditions.
Conditions to avoid: Heat, flames and sparks.
Incompatible materials: Strong oxidizing agents, strong bases.
Hazardous decomposition products: Carbon oxides.

11. Toxicological Information

Routes of Exposure: Inhalation, skin contact, eye contact, ingestion
Acute Toxicity:
Oral LD50 (rat): ~25,000 mg/kg
Inhalation LC50 (rat): ~48,000 ppm (4h)
Skin Irritation: May cause dryness or cracking
Eye Irritation: Slightly irritating
Sensitization: Not a known sensitizer
Chronic Effects:
Prolonged exposure can cause peripheral neuropathy
Suspected of damaging fertility
Carcinogenicity: Not classified as carcinogenic by IARC, NTP, or OSHA

12. Ecological Information

Ecotoxicity: Harmful to aquatic life.
Persistence and degradability: No data available.
Bioaccumulative potential: No data available.
Mobility in soil: No data available.

13. Disposal Considerations

Waste treatment methods: Dispose of contents/container in accordance with local/regional/national/international regulations.

14. Transport Information

UN Number: UN 1208
UN Proper Shipping Name: Hexanes
Transport Hazard Class: 3 (Flammable liquid)
Packing Group: II
Environmental Hazards: Marine pollutant
Special Precautions: Keep away from heat and ignition sources during transport.

15. Regulatory Information

US TSCA: Listed
SARA 302/304: Not listed
SARA 311/312: Fire hazard, Immediate health hazard, Chronic health hazard
SARA 313: n-Hexane is subject to reporting
California Prop 65: WARNING: This product contains a chemical known to the State of California to cause reproductive toxicity.

16. Other Information

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Email: info@juvenusdrugs.com **Ph.No:** 7010834338

JUVENUS DRUGS – SAFETY DATA SHEET

1. Identification

Product Name: Toluene

Synonyms: Methylbenzene, Phenylmethane

Recommended Use: Solvent, chemical feedstock, fuel additive

Details of the supplier of the safety data sheet

Company: Juvenus Drugs
No: 55, Raj Flat, Near Ring Road,
Ponniammanmedu,
Chennai – 600110
TAMIL NADU – INDIA

2. Hazard Identification

Classification: Flammable liquid (Category 2), Skin irritation (Category 2), Specific target organ toxicity - single exposure (Category 3), Reproductive toxicity (Category 2)

Label Elements:

Signal Word: Danger

Hazard Statements:

- Highly flammable liquid and vapor

- Causes skin irritation

- May cause drowsiness or dizziness

- Suspected of damaging fertility or the unborn child

Precautionary Statements:

- Keep away from heat/sparks/open flames

- Use explosion-proof equipment

- Avoid breathing vapors

- Wear protective gloves/eye protection

3. Composition / Information on Ingredients

Component: Toluene

CAS Number: 108-88-3

Concentration: > 99%

4. First-Aid Measures

Inhalation: Move to fresh air. Administer oxygen if needed. Seek medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing.

Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses if easy to do.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

5. Fire-Fighting Measures

Suitable Extinguishing Media: Dry chemical, foam, CO_2

Hazards: Vapors may form explosive mixtures with air

Protective Equipment: Wear SCBA and full protective gear

6. Accidental Release Measures

Personal Precautions: Remove ignition sources. Ventilate area. Use PPE.

Environmental Precautions: Prevent release into drains or waterways

Cleanup Methods: Absorb with inert material and place in chemical waste container

7. Handling and Storage

Handling: Avoid inhalation. Use in well-ventilated areas. Ground all containers.

Storage: Store in a tightly closed container in a cool, dry, well-ventilated area away from heat or ignition sources

8. Exposure Controls / Personal Protection

Exposure Limits:

- OSHA PEL: 200 ppm

- ACGIH TLV: 20 ppm (TWA)

Engineering Controls: Ensure good ventilation or use exhaust

PPE:

- Gloves: Nitrile or neoprene

- Eye: Safety goggles

- Respiratory: Use NIOSH-approved respirator if exposure limits are exceeded

9. Physical and Chemical Properties

Appearance: Clear, colorless liquid

Odor: Sweet, aromatic

Boiling Point: 110.6°C

Melting Point: -95°C

Flash Point: 4°C (closed cup)

Vapor Pressure: 22 mmHg at 20°C

Solubility: Slightly soluble in water

10. Stability and Reactivity

Stability: Stable under recommended conditions

Hazardous Reactions: May form peroxides over time

Incompatible Materials: Strong oxidizing agents, acids

Hazardous Decomposition: Carbon monoxide, carbon dioxide, irritating fumes

11. Toxicological Information

Acute Toxicity:

- Oral (rat): LD50 ~5000 mg/kg

- Inhalation (rat): LC50 ~8000 ppm (4h)

Skin Irritation: Causes irritation

Chronic Effects: Prolonged exposure may affect the central nervous system, liver, kidneys

12. Ecological Information

Aquatic Toxicity: Toxic to aquatic life

Persistence: Readily biodegradable

Bioaccumulation: Potential to bioaccumulate

Mobility in Soil: Moderate

13. Disposal Considerations

Waste Treatment Methods: Dispose in accordance with local, regional, and national regulations

Disposal: Do not discharge into drains or the environment

14. Transport Information

UN Number: UN1294

Proper Shipping Name: Toluene

Hazard Class: 3 (Flammable liquid)

Packing Group: II

Marine Pollutant: No

15. Regulatory Information

OSHA: Hazardous

TSCA: Listed

SARA 313: Listed

CERCLA: 1000 lb reportable quantity

California Prop 65: Listed (developmental toxicity)

16. Other Information

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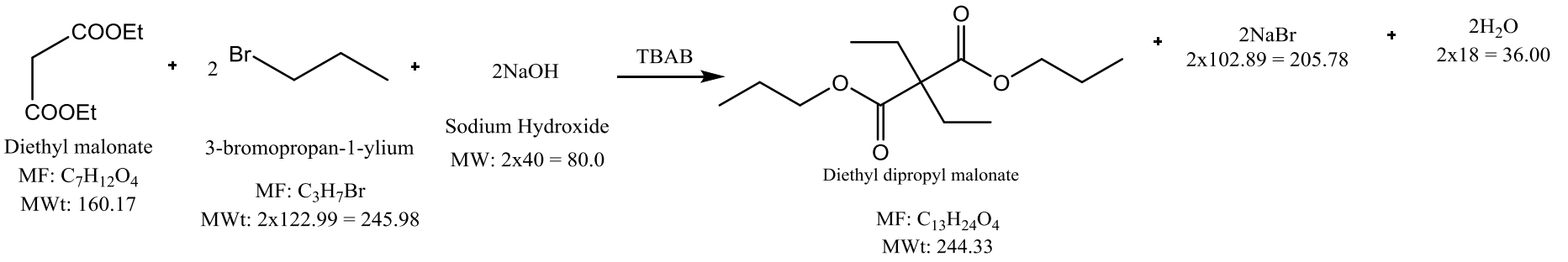
ANNEXURE – XI

MANUFACTURING PROCESS ALONG WITH FLOW CHART FOR EACH PRODUCT

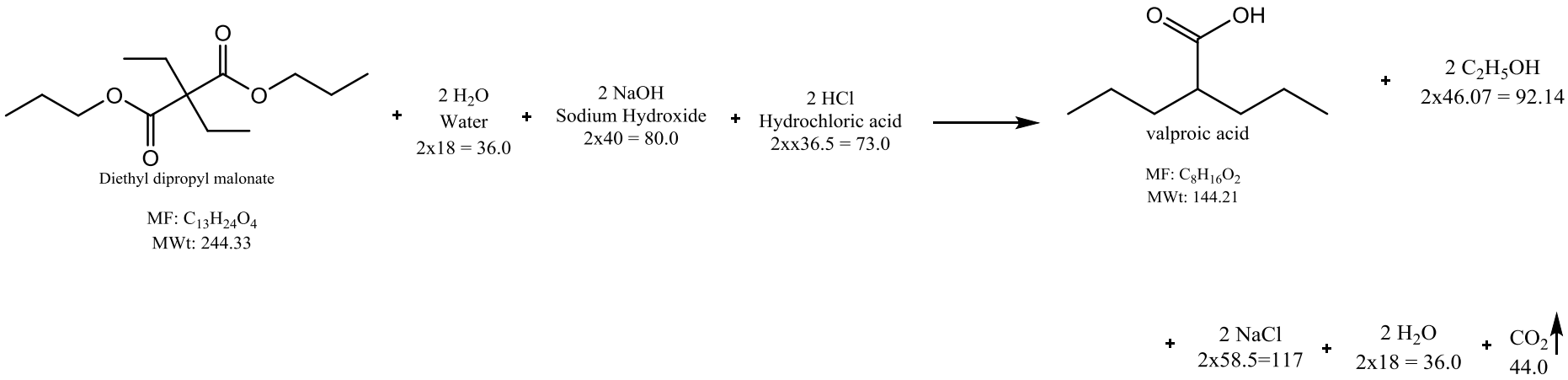
VALPROIC ACID

Route of synthesis

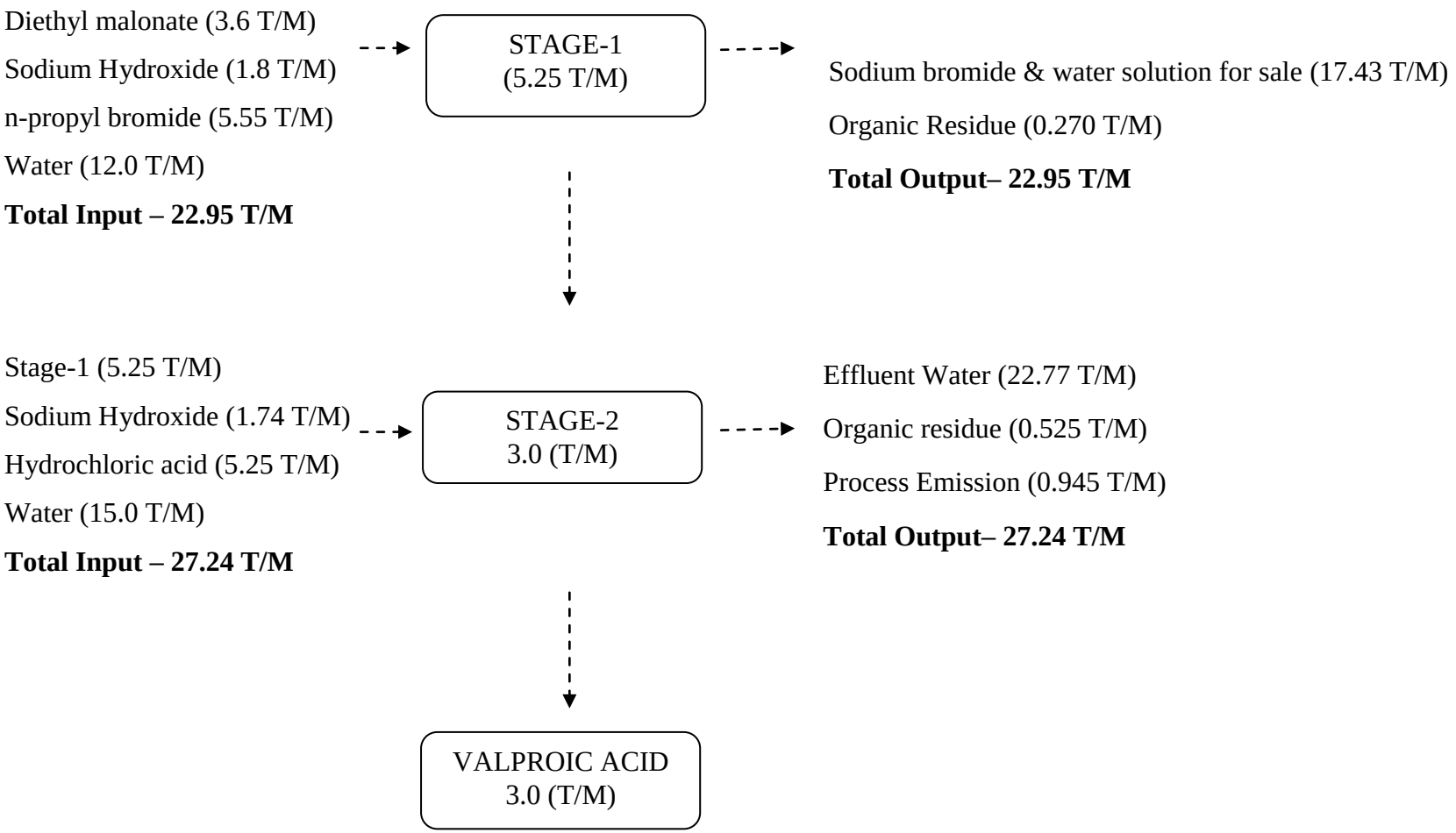
Stage-1:



Stage-2:

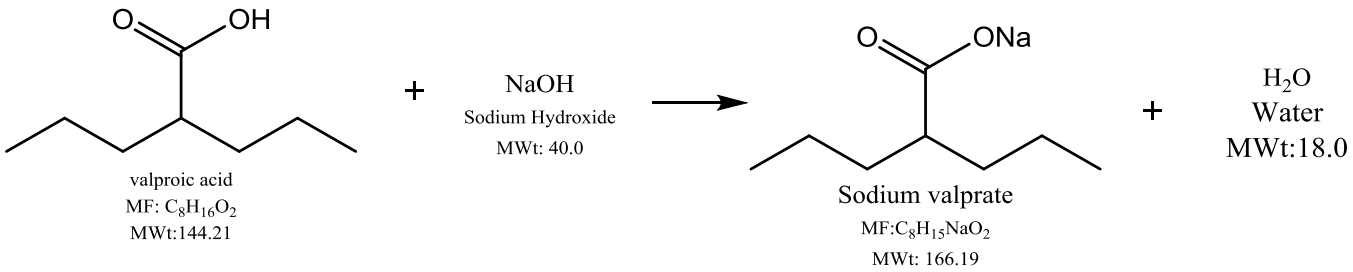


Flow Chart

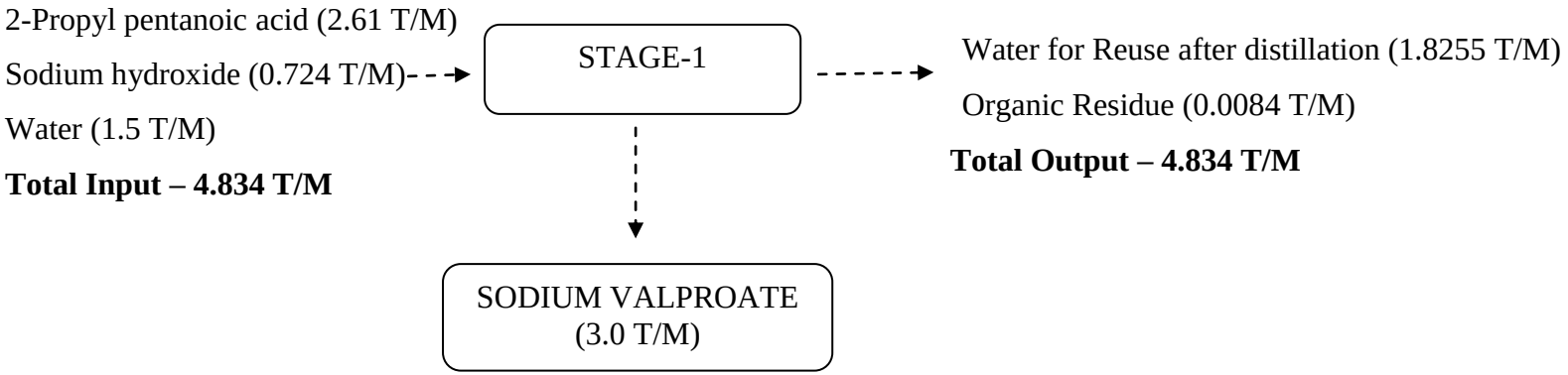

Diethyl malonate (3.6 T/M)
Sodium Hydroxide (1.8 T/M)
n-propyl bromide (5.55 T/M)
Water (12.0 T/M)
Total Input – 22.95 T/M
STAGE-1
(5.25 T/M)
Sodium bromide & water solution for sale (17.43 T/M)
Organic Residue (0.270 T/M)
Total Output– 22.95 T/M
Stage-1 (5.25 T/M)
Sodium Hydroxide (1.74 T/M)
Hydrochloric acid (5.25 T/M)
Water (15.0 T/M)
Total Input – 27.24 T/M
STAGE-2
3.0 (T/M)
Effluent Water (22.77 T/M)
Organic residue (0.525 T/M)
Process Emission (0.945 T/M)
Total Output– 27.24 T/M
VALPROIC ACID
3.0 (T/M)

SODIUM VALPROATE

Route of synthesis

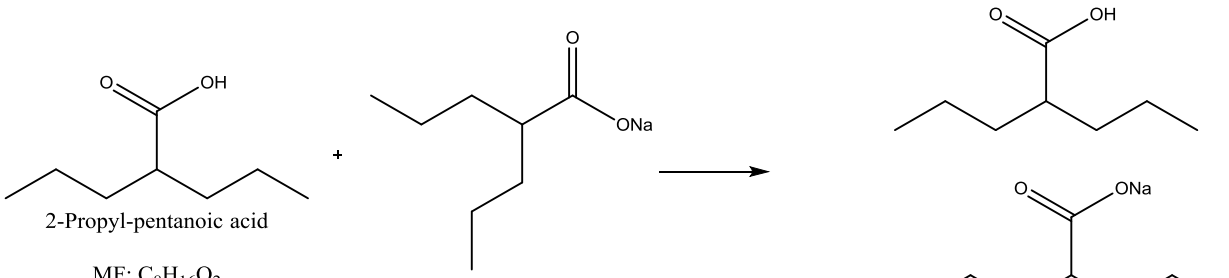


Flow Chart



DIVALPROEX SODIUM

Route of synthesis



Flow Chart

2-propyl pentanoic acid (1.455 T/M)

Sodium-2-propyl pentanoate (1.605 T/M)

Water (1.50 T/M)

Total Input – 4.56 T/M

STAGE-1

Effluent water to ETP (1.560 T/M)

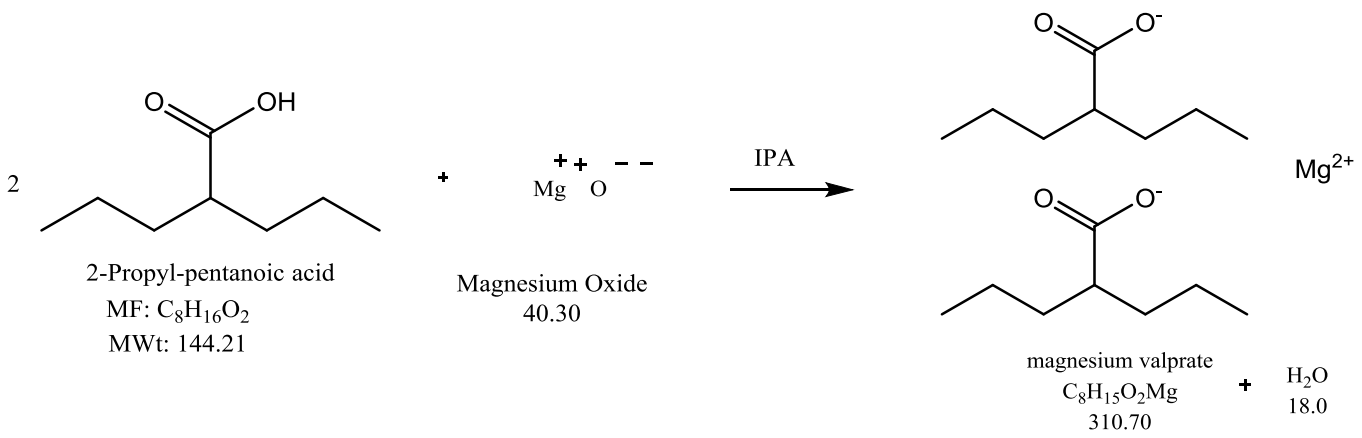
Total Output – 4.56 T/M

DIVALPROEX SODIUM

(3.0 T/M)

MAGNESIUM VALPRAOATE

Route of synthesis



Flow Chart

2-propyl pentanoic acid (0.935 T/M)

Magnesium oxide (0.130 T/M)

IPA (2.78 T/M)

Acetone (2.0 T/M)

Total Input – 5.845 T/M

STAGE-1

IPA Rec & Loss (2.77 T/M)

Acetone Rec & Loss (1.99 T/M)

Generated water (0.058 T/M)

Organic Residue (0.026 T/M)

Total Output – 5.845 T/M

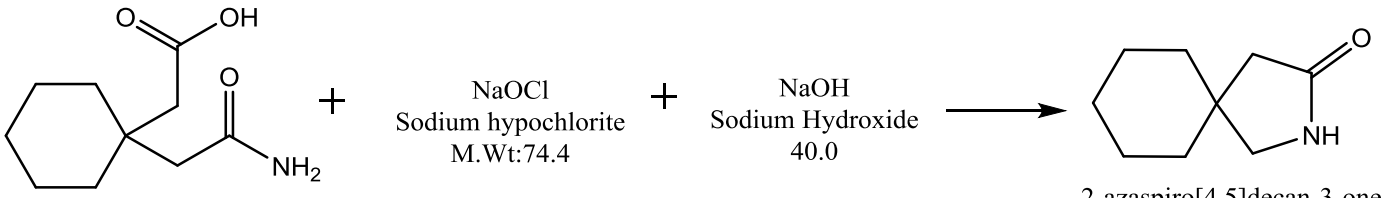
MAGNESIUM VALPRAOATE

(1.0 T/M)

GABAPENTIN

Route of synthesis

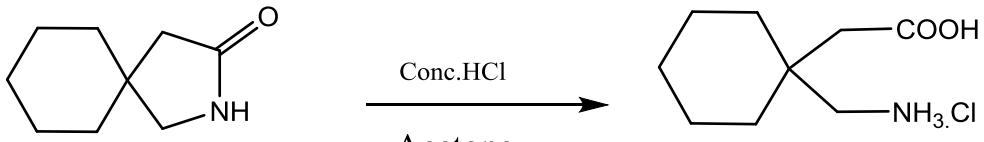
Stage-1



Cyclohexane-1,1-diacetic acid monoamide
MF: $C_{10}H_{17}NO_3$
MWt: 199.25

2-azaspiro[4.5]decan-3-one
MF: $C_9H_{15}NO$
MWt: 153.23

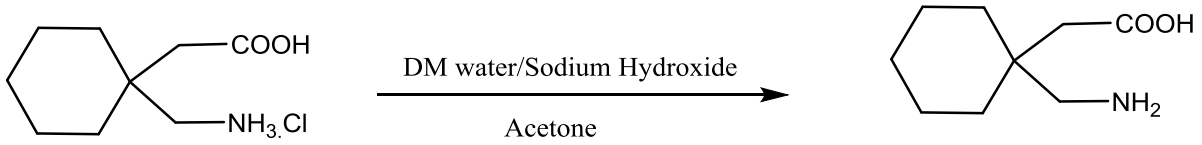
Stage-2



2-azaspiro[4.5]decan-3-one
MF: $C_9H_{15}NO$
MWt: 153.23

Gabapentin Hydrochloride
$C_9H_{18}ClNO_2$
207.70

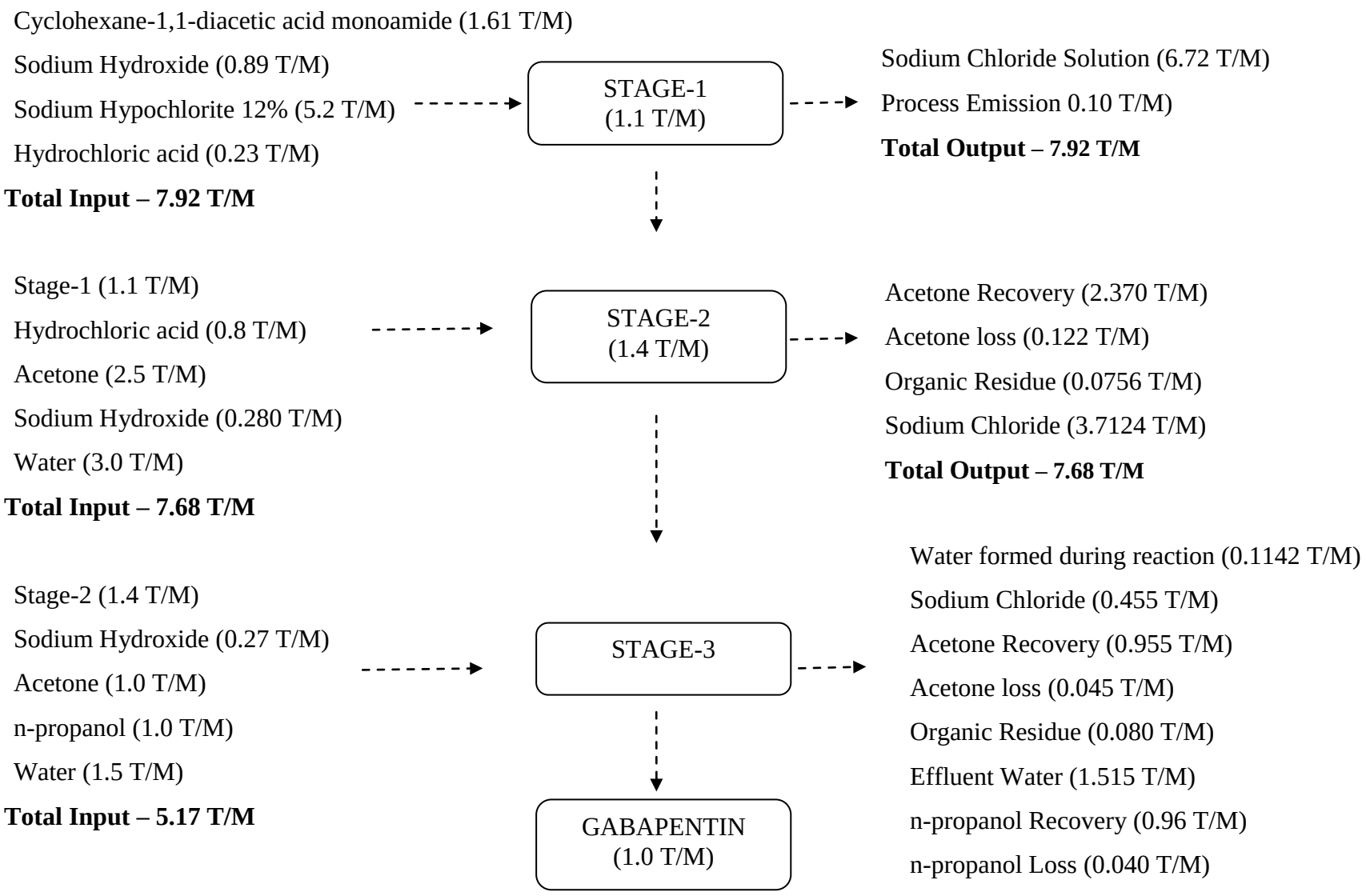
Stage-3



Gabapentin Hydrochloride
$C_9H_{18}ClNO_2$
207.70

Gabapentin
$C_9H_{17}NO_2$
171.24

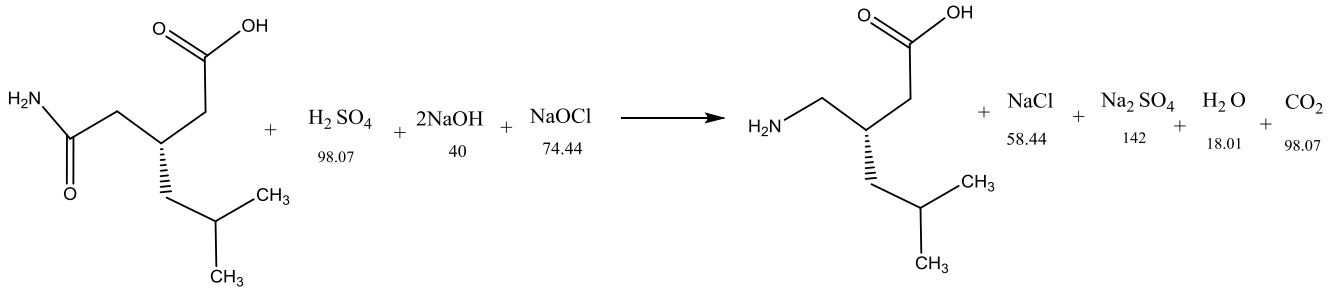
Flow Chart


Cyclohexane-1,1-diacetic acid monoamide (1.61 T/M)
Sodium Hydroxide (0.89 T/M)
Sodium Hypochlorite 12% (5.2 T/M)
Hydrochloric acid (0.23 T/M)
Total Input – 7.92 T/M
STAGE-1
(1.1 T/M)
Sodium Chloride Solution (6.72 T/M)
Process Emission 0.10 T/M)
Total Output – 7.92 T/M
Stage-1 (1.1 T/M)
Hydrochloric acid (0.8 T/M)
Acetone (2.5 T/M)
Sodium Hydroxide (0.280 T/M)
Water (3.0 T/M)
Total Input – 7.68 T/M
STAGE-2
(1.4 T/M)
Acetone Recovery (2.370 T/M)
Acetone loss (0.122 T/M)
Organic Residue (0.0756 T/M)
Sodium Chloride (3.7124 T/M)
Total Output – 7.68 T/M
Stage-2 (1.4 T/M)
Sodium Hydroxide (0.27 T/M)
Acetone (1.0 T/M)
n-propanol (1.0 T/M)
Water (1.5 T/M)
Total Input – 5.17 T/M
STAGE-3
Water formed during reaction (0.1142 T/M)
Sodium Chloride (0.455 T/M)
Acetone Recovery (0.955 T/M)
Acetone loss (0.045 T/M)
Organic Residue (0.080 T/M)
Effluent Water (1.515 T/M)
n-propanol Recovery (0.96 T/M)
n-propanol Loss (0.040 T/M)
Total Output – 5.17 T/M
GABAPENTIN
(1.0 T/M)

PREGABALIN

Route of synthesis

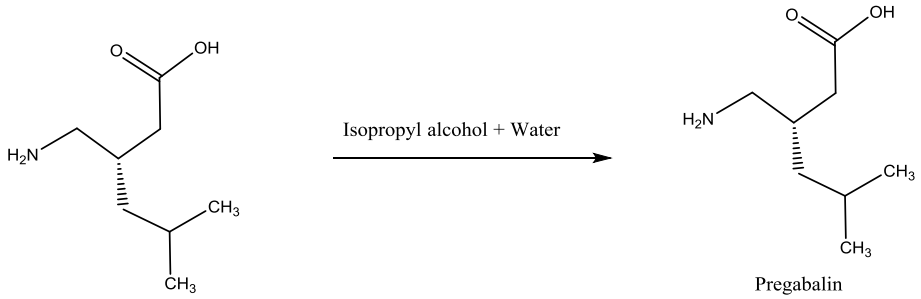
Stage-1



(*R*)-3-(2-amino-2-oxoethyl)-5-methylhexanoic acid
MF: $C_9H_{17}NO_3$
MWt: 187.24

(*S*)-3-(aminomethyl)-5-methylhexanoic acid
MF: $C_8H_{17}NO_2$
MWt: 159.23

Purification:

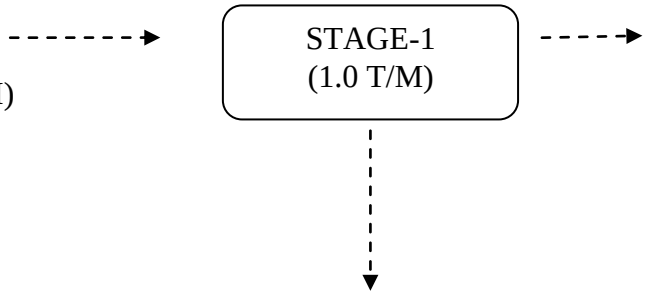


Crude Pregabalin
MF: $C_8H_{17}NO_2$
MWt: 159.23

Pregabalin
MF: $C_8H_{17}NO_2$
MWt: 159.23

Flow Chart

(R)-3-(2-amino-2-oxoethyl)
-5-methylhexanoic acid (4.942 T/M)
Sulphuric acid (2.0 T/M)
Sodium Hydroxide (0.430 T/M)
Sodium Hypochlorite (5.010 T/M)
Activated carbon (0.082 T/M)
Celite (0.014 T/M)
Iso propyl alcohol (5.0 T/M)
Total Input – 17.478 T/M



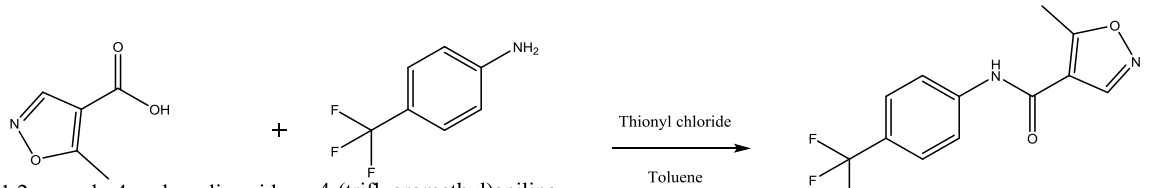
Sodium Chloride solution (5.376 T/M)
Sodium Sulphate (1.755 T/M)
Carbon di oxide (0.117 T/M)
Spent carbon + Celite (0.180 T/M)
Effluent to ETP (4.050 T/M)
Isopropyl alcohol Recovery & Loss (5.0 T/M)
Total Output – 17.478 T/M

PREGABALIN

LEFLUNOMIDE

Route of synthesis

Stage-1



5-methyl-1,2-oxazole-4-carboxylic acid

MF: $C_5H_5NO_3$
MWt: 127.10

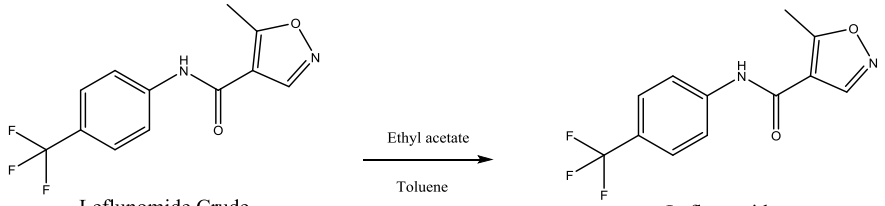
4-(trifluoromethyl)aniline

MF $C_7H_6F_3N$
MWt: 161.13

Leflunomide Crude

MF: $C_{12}H_9F_3N_2O_2$
MWt: 270.21

Stage-2



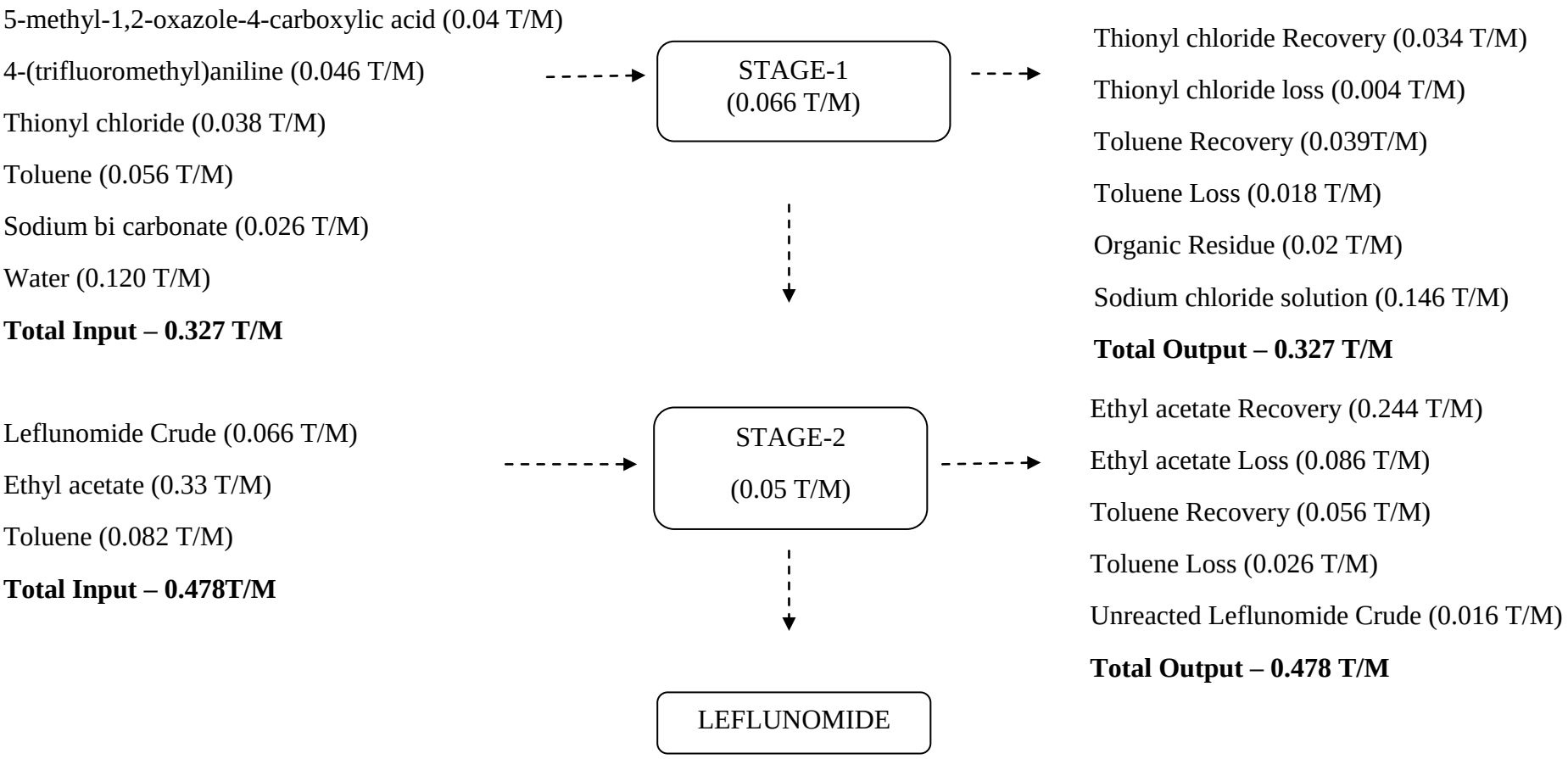
Leflunomide Crude

MF: $C_{12}H_9F_3N_2O_2$
MWt: 270.21

Leflunomide

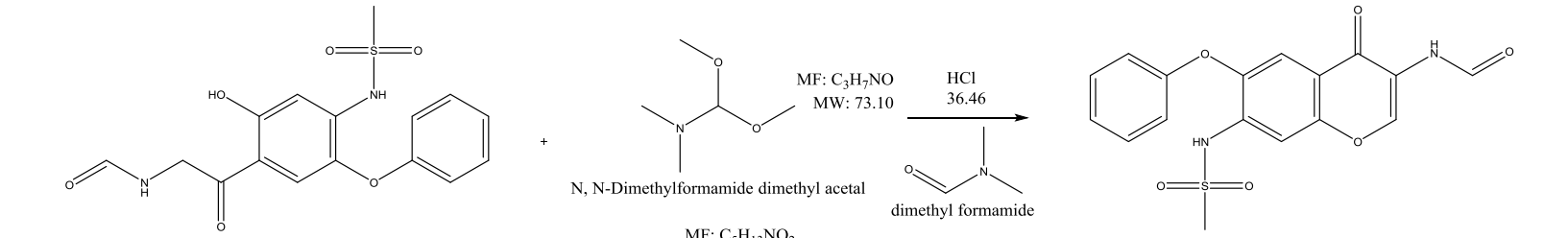
MF: $C_{12}H_9F_3N_2O_2$
MWt: 270.21

Flow Chart


5-methyl-1,2-oxazole-4-carboxylic acid (0.04 T/M)
4-(trifluoromethyl)aniline (0.046 T/M)
Thionyl chloride (0.038 T/M)
Toluene (0.056 T/M)
Sodium bi carbonate (0.026 T/M)
Water (0.120 T/M)
Total Input – 0.327 T/M
STAGE-1
(0.066 T/M)
Thionyl chloride Recovery (0.034 T/M)
Thionyl chloride loss (0.004 T/M)
Toluene Recovery (0.039T/M)
Toluene Loss (0.018 T/M)
Organic Residue (0.02 T/M)
Sodium chloride solution (0.146 T/M)
Total Output – 0.327 T/M
Leflunomide Crude (0.066 T/M)
Ethyl acetate (0.33 T/M)
Toluene (0.082 T/M)
Total Input – 0.478T/M
STAGE-2
(0.05 T/M)
Ethyl acetate Recovery (0.244 T/M)
Ethyl acetate Loss (0.086 T/M)
Toluene Recovery (0.056 T/M)
Toluene Loss (0.026 T/M)
Unreacted Leflunomide Crude (0.016 T/M)
Total Output – 0.478 T/M
LEFLUNOMIDE

IGURATIMOD

Route of synthesis



N-(2-(2-hydroxy-4-(methylsulfonamido)-5-phenoxyphenyl)-2-oxoethyl)formamide
MF: $C_{16}H_{16}N_2O_6S$
MW: 364.37

N, N-Dimethylformamide dimethyl acetal
MF: $C_5H_{13}NO_2$
MW: 119.16

N-(7-(Methylsulfonamido)-4-oxo-6-phenoxy-4H-chromen-3-yl)formamide
MF: $C_{17}H_{14}N_2O_6S$
MW: 374.37

\+ Methanol 32.04 + HCl 36.46 + Dimethyl amine 45.08

Flow Chart

N, N-Dimethylformamide (0.089 T/M)

N-[4-Formylaminoacetyl]-5-hydroxy-2-phenoxyphenyl] methane sulphonamide (0.094 T/M)

N, N-Dimethylformamide dimethyl acetal (0.089 T/M)

Water (0.167 T/M)

Hydrochloric acid (0.051 T/M)

Total Input – 0.49 T/M

STAGE-1

Dimethyl formamide (Recovered & Loss) (0.089 T/M)

Effluent water (0.267 T/M)

Evaporation loss (0.036 T/M)

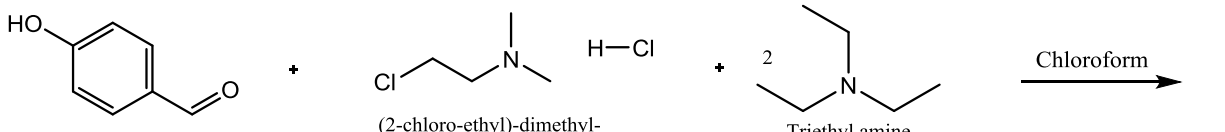
Total Output – 0.49 T/M

IGURATIMOD
(0.1 T/M)

ITOPRIDE HYDROCHLORIDE

Route of synthesis

Stage-1:



4-Hydroxy-benzaldehyde

MF: $C_7H_6O_2$

MWt: 122.12

(2-chloro-ethyl)-dimethyl-amine hydrochloride

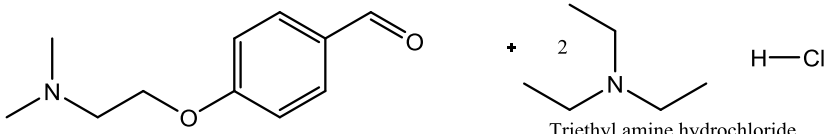
MF $C_4H_{11}Cl_2N$

MWt: 144.04

Triethyl amine

MF: $C_6H_{15}N$

MWt:202.00



4-(2-Dimethylamino-ethoxy)-benzaldehyde

MF: $C_{11}H_{15}NO_2$

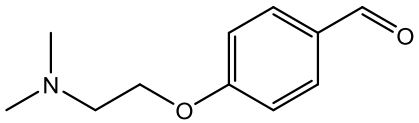
MWt: 193.25

Triethyl amine hydrochloride

MF: $C_6H_{16}ClN$

MWt: 275.30

Stage-2:



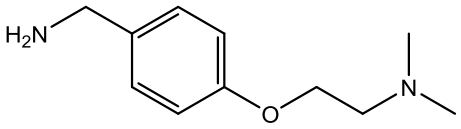
4-(2-Dimethylamino-ethoxy)-benzaldehyde

MF: $C_{11}H_{15}NO_2$
MWt: 193.25

+ $(NH_2OH)\ H_2SO_4$
Hydroxylamine sulpahte
131.11

+ $2H_2$
4.00

Raney Ni
→
Methanol



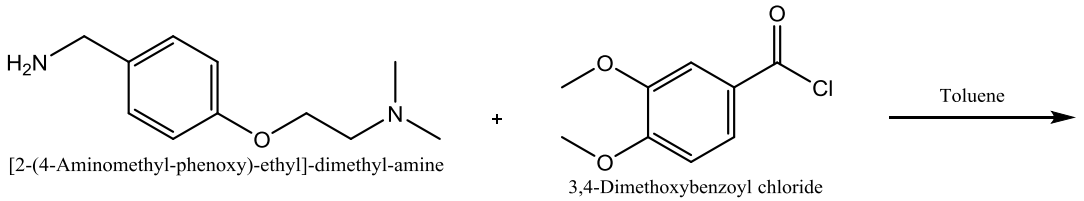
[2-(4-Aminomethyl-phenoxy)-ethyl]-dimethyl-amine

MF: $C_{11}H_{18}N_2O$
MW: 194.28

+ H_2SO_4
Sulfuric acid
98.00

+ $2H_2O$
36.00

Stage-3:

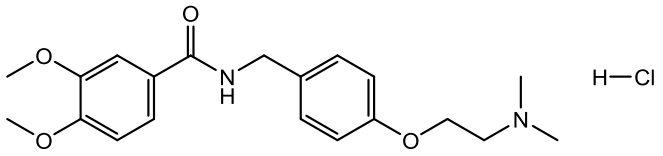


[2-(4-Aminomethyl-phenoxy)-ethyl]-dimethyl-amine

MF: $C_{11}H_{18}N_2O$
MW: 194.28

3,4-Dimethoxybenzoyl chloride

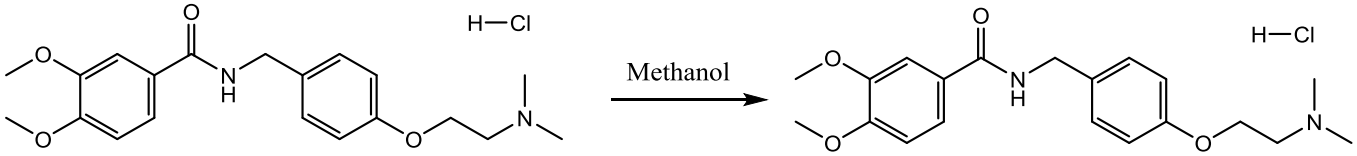
MF: $C_9H_9ClO_3$
MW: 200.62



N-[[4-[2-(dimethylamino)ethoxy]phenyl]methyl]-
3,4-dimethoxybenzamide;hydrochloride

MF: $C_{20}H_{27}ClN_2O_4$
MW: 394.90

Stage-4:



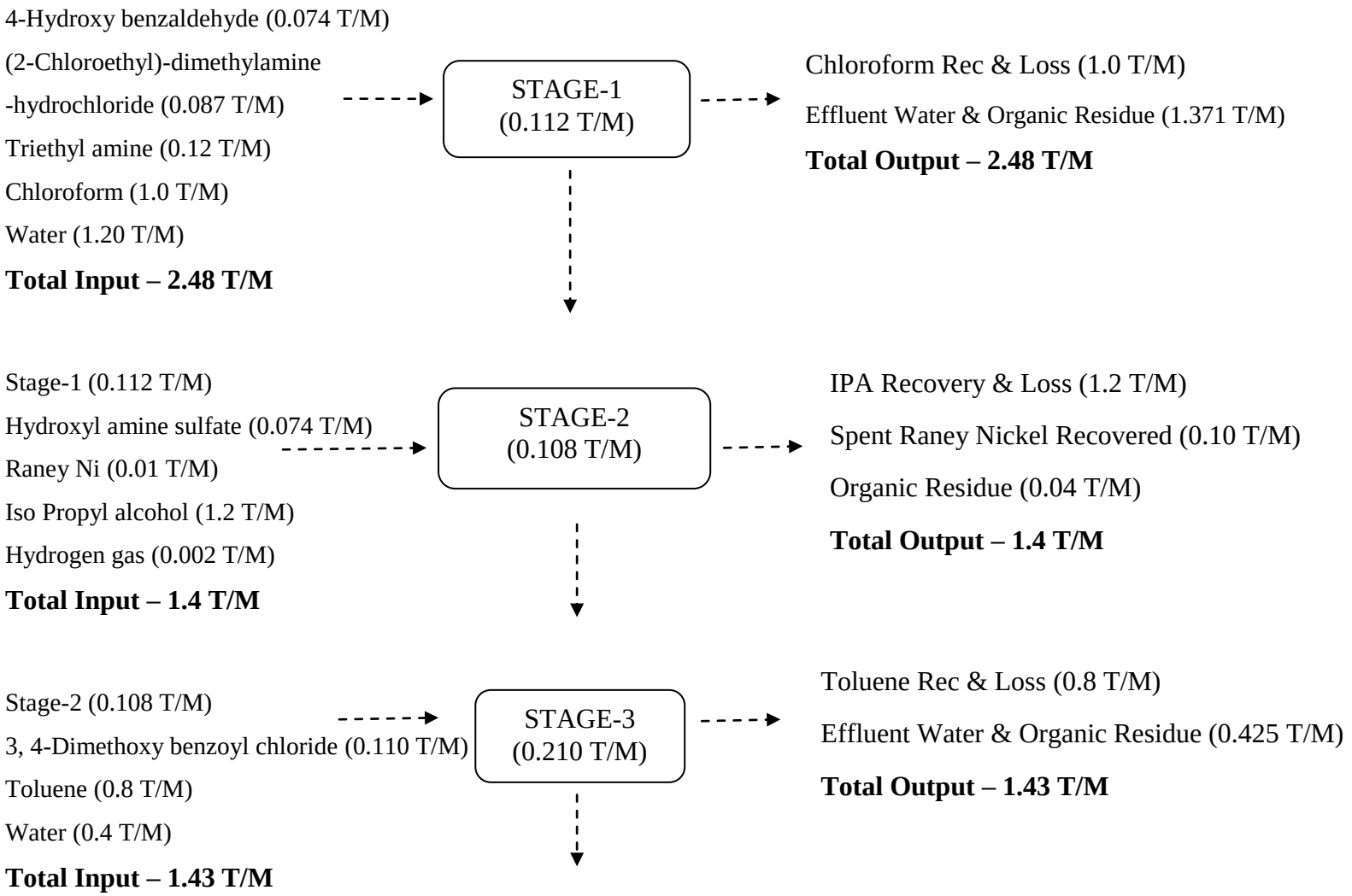
N-[[4-[2-(dimethylamino)ethoxy]phenyl]methyl]-
3,4-dimethoxybenzamide;hydrochloride

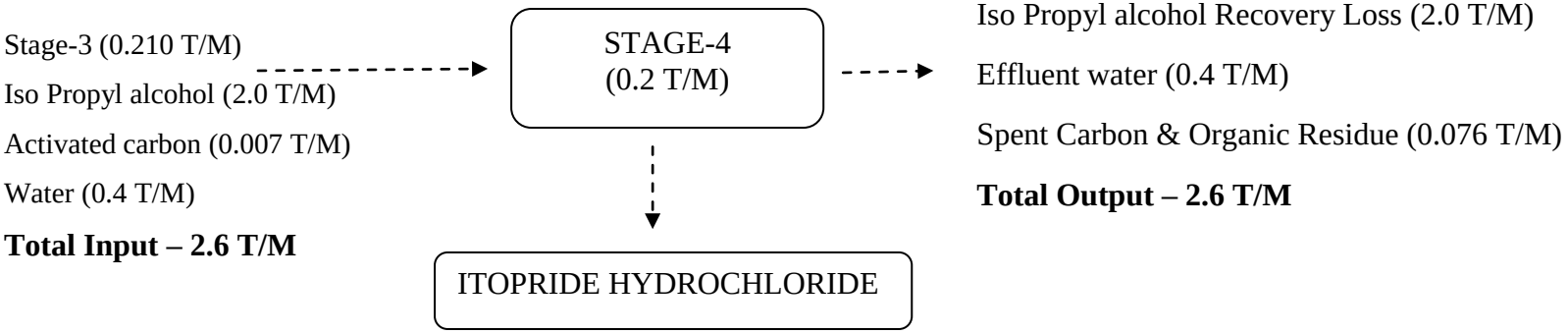
MF: $C_{20}H_{27}ClN_2O_4$
MW: 394.90

N-[[4-[2-(dimethylamino)ethoxy]phenyl]methyl]-
3,4-dimethoxybenzamide;hydrochloride

MF: $C_{20}H_{27}ClN_2O_4$
MW: 394.90

Flow Chart

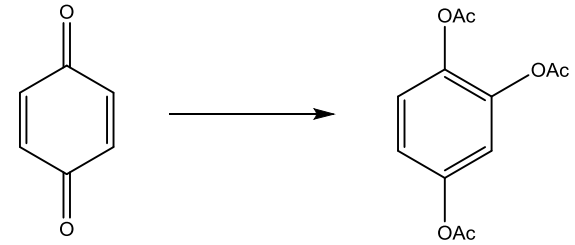

4-Hydroxy benzaldehyde (0.074 T/M)
(2-Chloroethyl)-dimethylamine
-hydrochloride (0.087 T/M)
Triethyl amine (0.12 T/M)
Chloroform (1.0 T/M)
Water (1.20 T/M)
Total Input – 2.48 T/M
STAGE-1
(0.112 T/M)
Chloroform Rec & Loss (1.0 T/M)
Effluent Water & Organic Residue (1.371 T/M)
Total Output – 2.48 T/M
Stage-1 (0.112 T/M)
Hydroxyl amine sulfate (0.074 T/M)
Raney Ni (0.01 T/M)
Iso Propyl alcohol (1.2 T/M)
Hydrogen gas (0.002 T/M)
Total Input – 1.4 T/M
STAGE-2
(0.108 T/M)
IPA Recovery & Loss (1.2 T/M)
Spent Raney Nickel Recovered (0.10 T/M)
Organic Residue (0.04 T/M)
Total Output – 1.4 T/M
Stage-2 (0.108 T/M)
3, 4-Dimethoxy benzoyl chloride (0.110 T/M)
Toluene (0.8 T/M)
Water (0.4 T/M)
Total Input – 1.43 T/M
STAGE-3
(0.210 T/M)
Toluene Rec & Loss (0.8 T/M)
Effluent Water & Organic Residue (0.425 T/M)
Total Output – 1.43 T/M


Stage-3 (0.210 T/M)
Iso Propyl alcohol (2.0 T/M)
Activated carbon (0.007 T/M)
Water (0.4 T/M)
Total Input – 2.6 T/M
STAGE-4
(0.2 T/M)
ITOPRIDE HYDROCHLORIDE
Iso Propyl alcohol Recovery Loss (2.0 T/M)
Effluent water (0.4 T/M)
Spent Carbon & Organic Residue (0.076 T/M)
Total Output – 2.6 T/M

PERMETHOL SODIUM

Route of synthesis

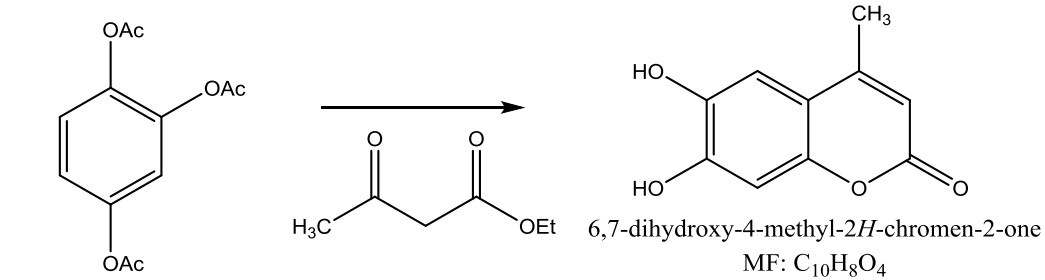
Stage-1:



benzoquinone
MF: $C_6H_4O_2$
MWt: 108.10

benzene-1,2,4-triyl triacetate
MF: $C_{12}H_{12}O_6$
MWt: 252.22

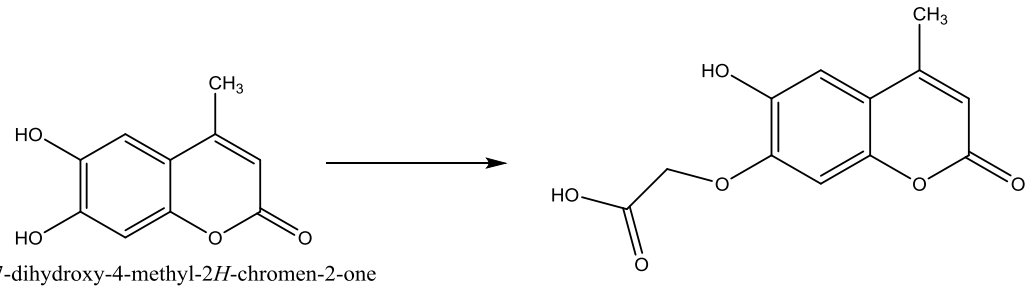
Stage-2:



benzene-1,2,4-triyl triacetate
MF: $C_{12}H_{12}O_6$
MWt: 252.22

6,7-dihydroxy-4-methyl-2*H*-chromen-2-one
MF: $C_{10}H_8O_4$
MWt: 192.17

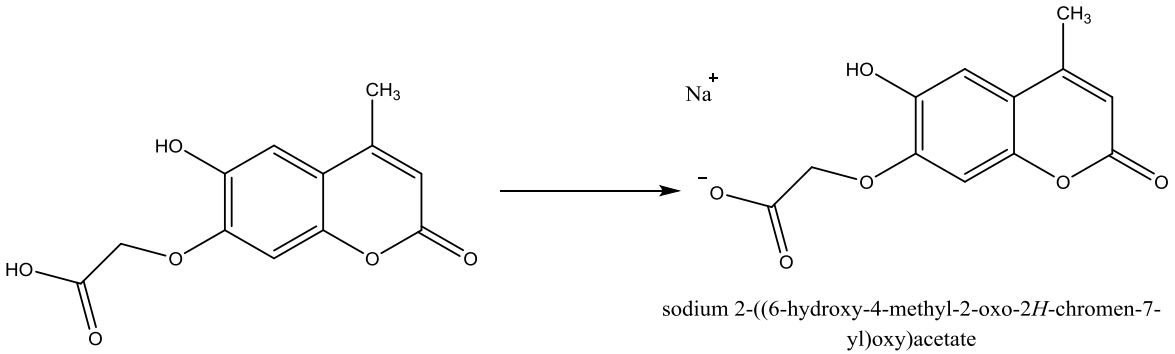
Stage-3:



6,7-dihydroxy-4-methyl-2*H*-chromen-2-one
MF: $C_{10}H_8O_4$
MWt: 192.17

2-((6-hydroxy-4-methyl-2-oxo-2*H*-chromen-7-yl)oxy)acetic acid
MF: $C_{12}H_{10}O_6$
MWt: 250.21

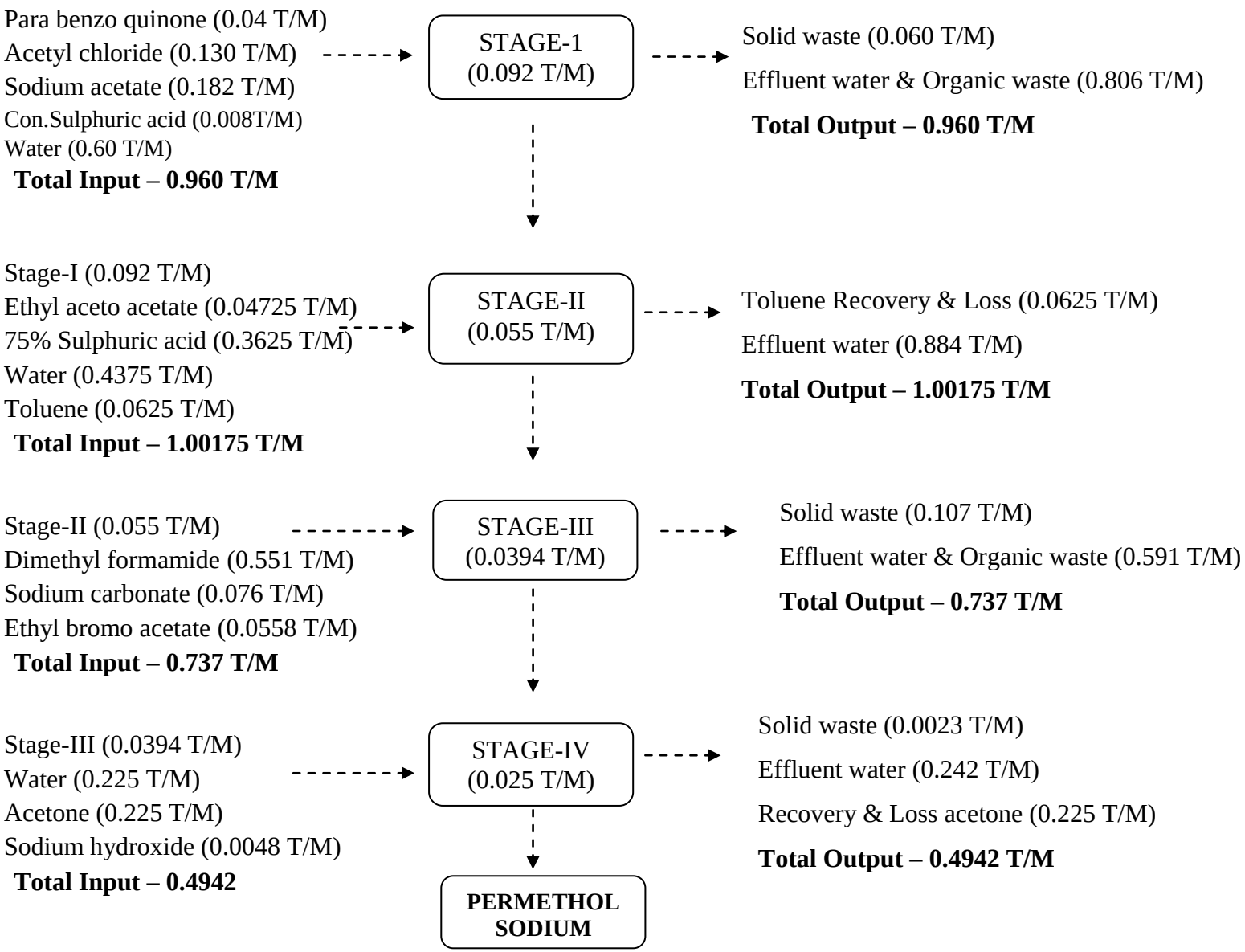
Stage-4:



2-((6-hydroxy-4-methyl-2-oxo-2*H*-chromen-7-yl)oxy)acetic acid
MF: $C_{12}H_{10}O_6$
MWt: 250.21

sodium 2-((6-hydroxy-4-methyl-2-oxo-2*H*-chromen-7-yl)oxy)acetate
MF: $C_{12}H_9NaO_6$
MWt: 272.19

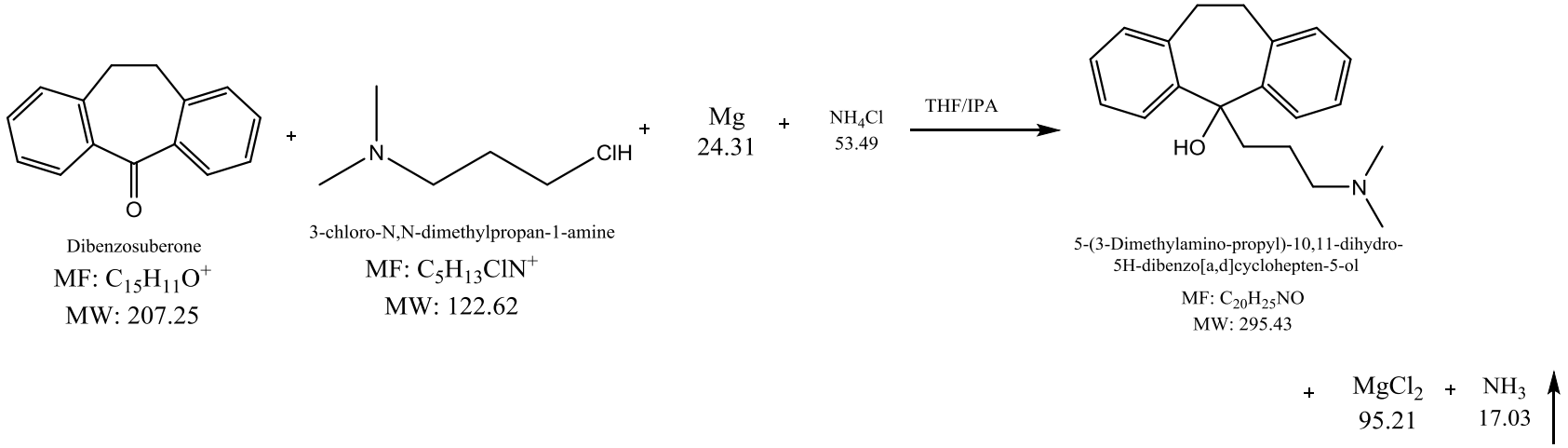
Flow Chart


Para benzo quinone (0.04 T/M)
Acetyl chloride (0.130 T/M)
Sodium acetate (0.182 T/M)
Con.Sulphuric acid (0.008T/M)
Water (0.60 T/M)
Total Input – 0.960 T/M
STAGE-1
(0.092 T/M)
Solid waste (0.060 T/M)
Effluent water & Organic waste (0.806 T/M)
Total Output – 0.960 T/M
Stage-I (0.092 T/M)
Ethyl aceto acetate (0.04725 T/M)
75% Sulphuric acid (0.3625 T/M)
Water (0.4375 T/M)
Toluene (0.0625 T/M)
Total Input – 1.00175 T/M
STAGE-II
(0.055 T/M)
Toluene Recovery & Loss (0.0625 T/M)
Effluent water (0.884 T/M)
Total Output – 1.00175 T/M
Stage-II (0.055 T/M)
Dimethyl formamide (0.551 T/M)
Sodium carbonate (0.076 T/M)
Ethyl bromo acetate (0.0558 T/M)
Total Input – 0.737 T/M
STAGE-III
(0.0394 T/M)
Solid waste (0.107 T/M)
Effluent water & Organic waste (0.591 T/M)
Total Output – 0.737 T/M
Stage-III (0.0394 T/M)
Water (0.225 T/M)
Acetone (0.225 T/M)
Sodium hydroxide (0.0048 T/M)
Total Input – 0.4942
STAGE-IV
(0.025 T/M)
Solid waste (0.0023 T/M)
Effluent water (0.242 T/M)
Recovery & Loss acetone (0.225 T/M)
Total Output – 0.4942 T/M
PERMETHOL SODIUM

AMITRIPTYLINE HYDROCHLORIDE

Route of synthesis

Stage-1:

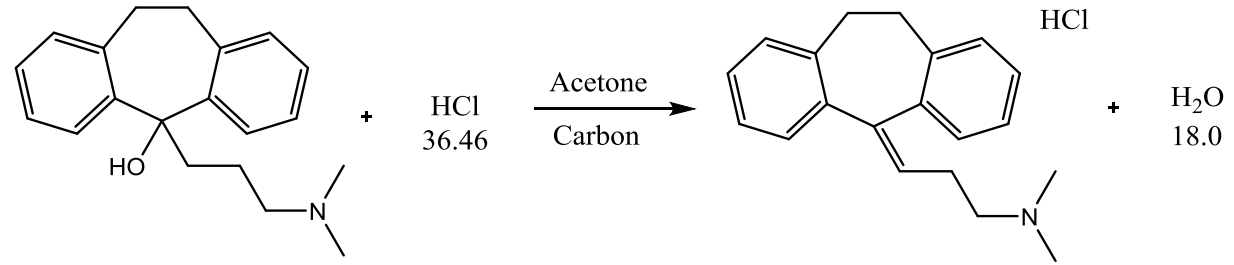


Dibenzosuberone
MF: $C_{15}H_{11}O^{+}$
MW: 207.25

3-chloro-N,N-dimethylpropan-1-amine
MF: $C_5H_{13}ClN^{+}$
MW: 122.62

5-(3-Dimethylamino-propyl)-10,11-dihydro-5H-dibenzo[a,d]cyclohepten-5-ol
MF: $C_{20}H_{25}NO$
MW: 295.43

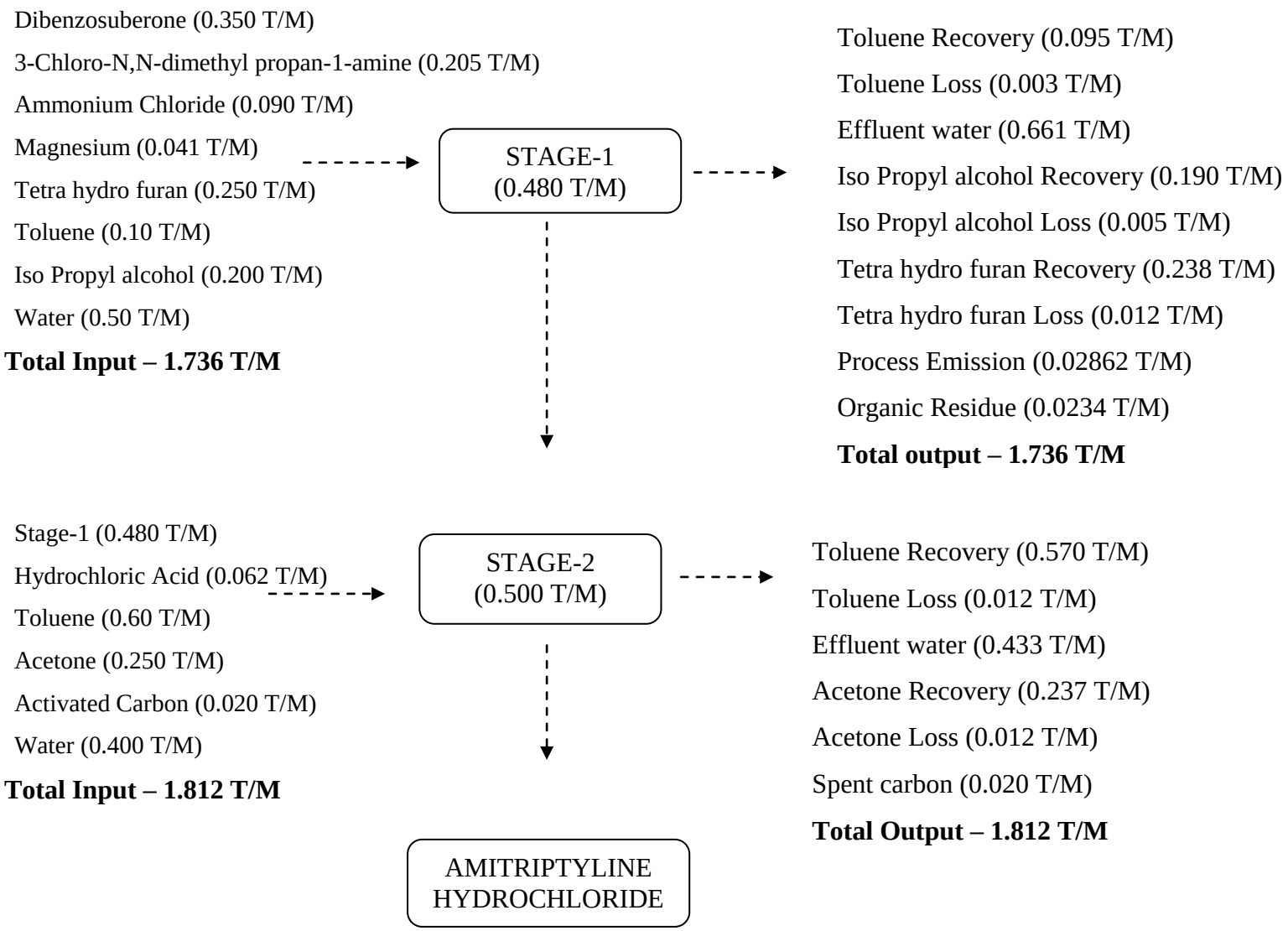
Stage-2:



5-(3-Dimethylamino-propyl)-10,11-dihydro-5H-dibenzo[a,d]cyclohepten-5-ol
MF: $C_{20}H_{25}NO$
MW: 295.43

Amitriptyline Hydrochloride
MF: $C_{20}H_{24}ClN$
MW: 313.87

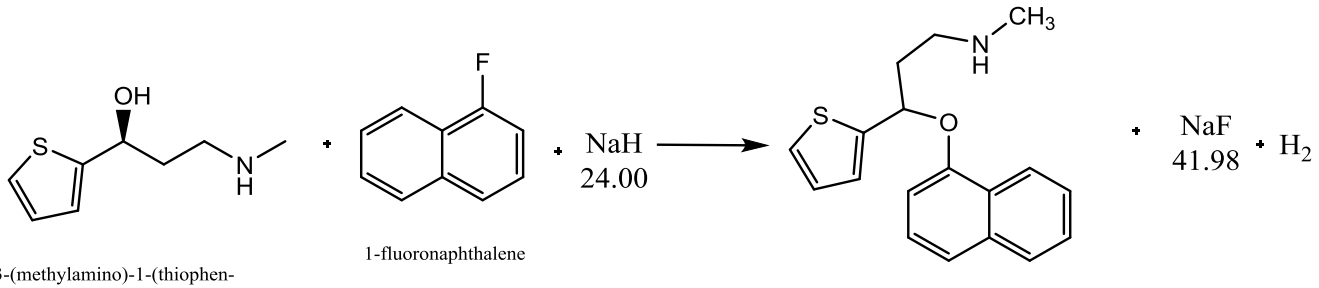
Flow Chart


Dibenzosuberone (0.350 T/M)
3-Chloro-N,N-dimethyl propan-1-amine (0.205 T/M)
Ammonium Chloride (0.090 T/M)
Magnesium (0.041 T/M)
Tetra hydro furan (0.250 T/M)
Toluene (0.10 T/M)
Iso Propyl alcohol (0.200 T/M)
Water (0.50 T/M)
Total Input – 1.736 T/M
STAGE-1
(0.480 T/M)
Toluene Recovery (0.095 T/M)
Toluene Loss (0.003 T/M)
Effluent water (0.661 T/M)
Iso Propyl alcohol Recovery (0.190 T/M)
Iso Propyl alcohol Loss (0.005 T/M)
Tetra hydro furan Recovery (0.238 T/M)
Tetra hydro furan Loss (0.012 T/M)
Process Emission (0.02862 T/M)
Organic Residue (0.0234 T/M)
Total output – 1.736 T/M
Stage-1 (0.480 T/M)
Hydrochloric Acid (0.062 T/M)
Toluene (0.60 T/M)
Acetone (0.250 T/M)
Activated Carbon (0.020 T/M)
Water (0.400 T/M)
Total Input – 1.812 T/M
STAGE-2
(0.500 T/M)
Toluene Recovery (0.570 T/M)
Toluene Loss (0.012 T/M)
Effluent water (0.433 T/M)
Acetone Recovery (0.237 T/M)
Acetone Loss (0.012 T/M)
Spent carbon (0.020 T/M)
Total Output – 1.812 T/M
AMITRIPTYLINE
HYDROCHLORIDE

DULOXETINE HYDROCHLORIDE

Route of synthesis

Stage-1:



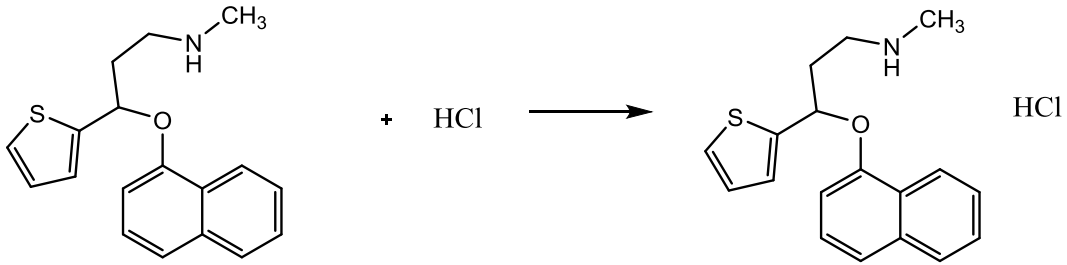
(*S*)-3-(methylamino)-1-(thiophen-2-yl)propan-1-ol
MF: $C_8H_{13}NOS$
MWt: 171.26

1-fluoronaphthalene

MF: $C_{10}H_7F$
MWt: 146.16

N-methyl-3-(naphthalen-1-yloxy)-3-(thiophen-2-yl)propan-1-amine
MF: $C_{18}H_{19}NOS$
MWt: 297.42

Stage-2:



N-methyl-3-(naphthalen-1-yloxy)-3-(thiophen-2-yl)propan-1-amine
MF: $C_{18}H_{19}NOS$
MWt: 297.42

Duloxetine Hydrochloride
MF $C_{18}H_{20}ClNOS$
MWt: 333.87

Flow Chart

(s)-3-(Methylamino)-1-(thiophen -2-yl)propane-1-ol (0.675 T/M)

1-Fluoro naphthalene (1.0 T/M)

Sodium hydride (60%) in Paraffin oil (0.270 T/M)

Toluene (4.10 T/M)

DMSO (2.250 T/M)

Ethyl acetate (12.20 T/M)

Potassium acetate (0.035 T/M)

Ammonium chloride (0.250 T/M)

Sodium chloride (0.88 T/M)

Water (4.25 T/M)

Total Input – 25.91 T/M

STAGE-1
(1.0 T/M)

Toluene recovery (3.885 T/M)

Toluene loss (0.165 T/M)

Dimethyl Sulfoxide recovery (2.115 T/M)

Dimethyl Sulfoxide loss (0.090 T/M)

Ethyl acetate recovery (11.345 T/M)

Ethyl acetate loss (0.610 T/M)

Effluent Water (4.80 T/M)

Organic residue (1.380 T/M)

Inorganic solid waste (0.785 T/M)

Process Emissions (0.270 T/M)

Total Output – 25.91 T/M

Stage-1 (1.0 T/M)

Ethyl acetate (5.80 T/M)

IPA HCl (0.825 T/M)

Activated carbon (0.025 T/M)

Acetone (5.80 T/M)

Iso Propyl alcohol (0.50 T/M)

Total Input – 13.70 T/M

STAGE-2
(0.50 T/M)

Ethyl acetate recovery (5.395 T/M)

Ethyl acetate loss (0.290 T/M)

IPA loss (0.060 T/M)

IPA Recovery (1.115 T/M)

Acetone recovery (5.160 T/M)

Acetone Loss (0.280 T/M)

Organic residue (0.755 T/M)

Spent Carbon (0.025 T/M)

Process Emissions (0.010 T/M)

Drying loss (0.110 T/M)

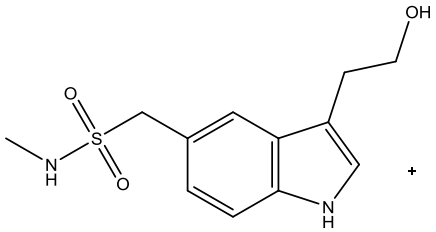
Total Output – 13.70 T/M

DULOXETINE HYDROCHLORIDE

SUMATRIPTAN

Route of synthesis

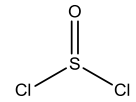
Stage-1:



3-(2-chloroethyl)-N-methyl-1H-indole-5-methanesulphonamide

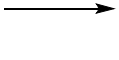
MF: $C_{12}H_{16}N_2O_3S$
MWt: 268.33

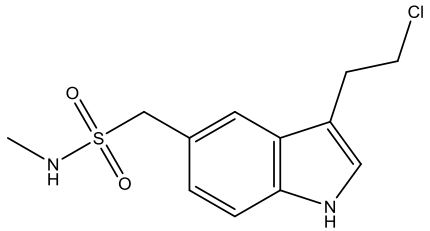
+



thionyl chloride

MF: Cl_2OS
MWt: 118.96

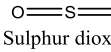




3-(2-chloroethyl)-N-methyl-1H-indole-5-methanesulphonamide

MF: $C_{12}H_{15}ClN_2O_2S$
MWt: 286.77

+

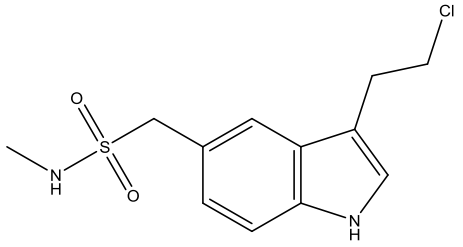


Sulphur dioxide

MF: O_2S
MWt: 64.06

+ HCl
36.5

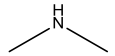
Stage-2:



3-(2-chloroethyl)-N-methyl-1H-indole-5-methanesulphonamide

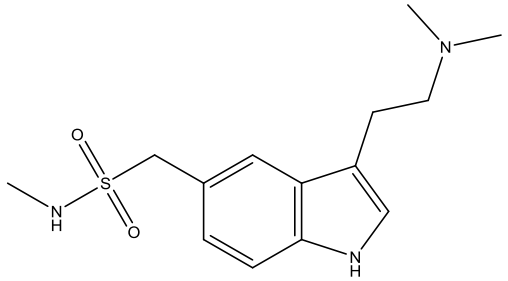
MF: $C_{12}H_{15}ClN_2O_2S$
MWt: 286.77

+



Dimethyl amine

MF: C_2H_7N
MWt 45.09

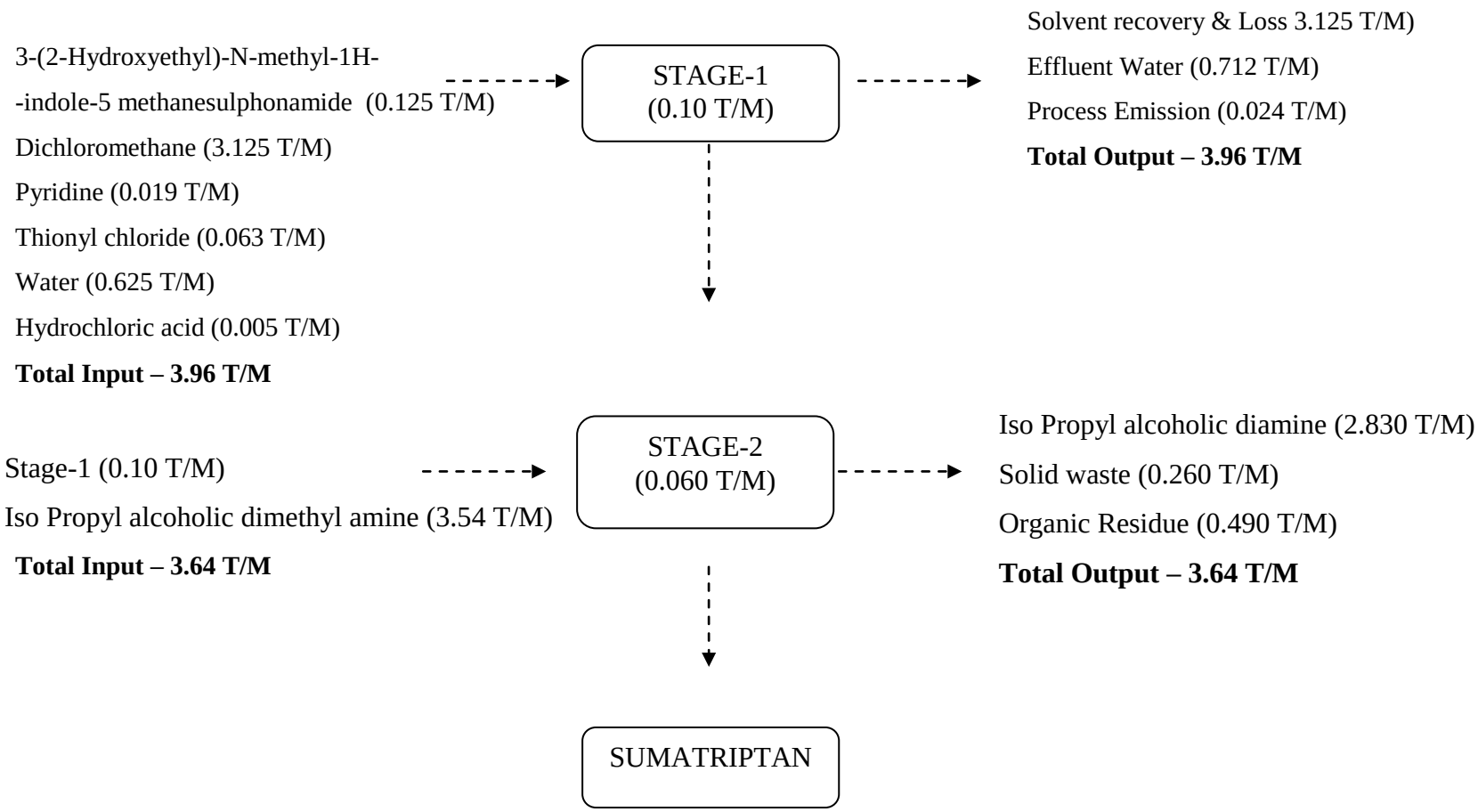


1-[3-[2-(dimethylamino)ethyl]-1H-indol-5-yl]-N-methylmethanesulfonamide

MF: $C_{14}H_{21}N_3O_2S$
MWt: 295.40

+ HCl
36.5

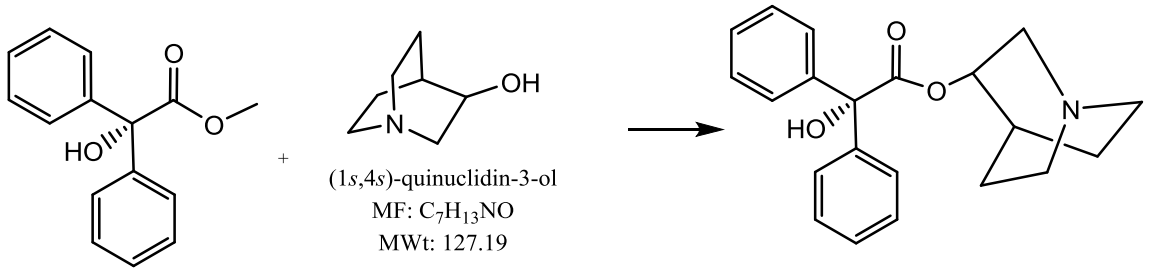
Flow Chart


3-(2-Hydroxyethyl)-N-methyl-1H-
-indole-5 methanesulphonamide (0.125 T/M)
Dichloromethane (3.125 T/M)
Pyridine (0.019 T/M)
Thionyl chloride (0.063 T/M)
Water (0.625 T/M)
Hydrochloric acid (0.005 T/M)
Total Input – 3.96 T/M
STAGE-1
(0.10 T/M)
Solvent recovery & Loss 3.125 T/M)
Effluent Water (0.712 T/M)
Process Emission (0.024 T/M)
Total Output – 3.96 T/M
Stage-1 (0.10 T/M)
Iso Propyl alcoholic dimethyl amine (3.54 T/M)
Total Input – 3.64 T/M
STAGE-2
(0.060 T/M)
Iso Propyl alcoholic diamine (2.830 T/M)
Solid waste (0.260 T/M)
Organic Residue (0.490 T/M)
Total Output – 3.64 T/M
SUMATRIPTAN

CLIDINIUM BROMIDE

Route of synthesis

Stage-1:

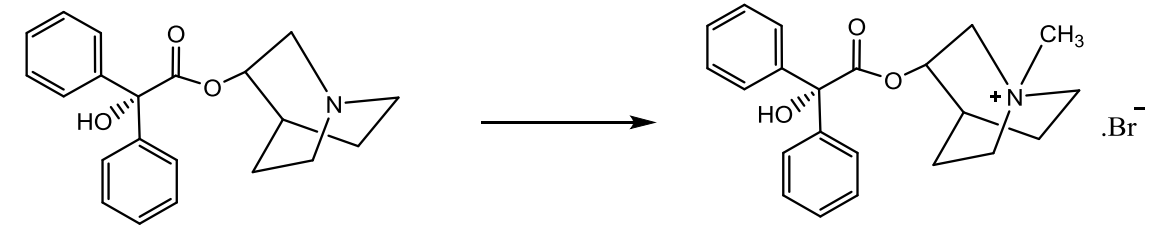


methyl 2-hydroxy-2,2-diphenylacetate
MF: $C_{15}H_{14}O_3$
MWt: 242.27

(1*s*,4*s*)-quinuclidin-3-ol
MF: $C_7H_{13}NO$
MWt: 127.19

quinuclidin-3-yl 2-hydroxy-2,2-diphenylacetate
MF: $C_{21}H_{23}NO_3$
MWt: 337.42

Stage-2:



quinuclidin-3-yl 2-hydroxy-2,2-diphenylacetate
MF: $C_{21}H_{23}NO_3$
MWt: 337.42

Clidinium Bromide
MF: $C_{22}H_{26}NO_3^+$
MWt: 352.45

Flow Chart

Methyl 2-hydroxy-2,2 diphenyl acetate (0.110 T/M)

Cyclohexane (0.320 T/M)

Methyl benzilate (0.046 T/M)

Water (0.472 T/M)

Total Input – 0.95 T/M

STAGE-I
(0.149 T/M)

Cyclohexane (0.32 T/M)

Iso propyl alcohol (0.006 T/M)

Effluent Water (0.472 T/M)

Total Output – 0.95 T/M

Clidinium base (0.149 T/M)

Iso propyl alcohol (1.10 T/M)

Methyl bromide (0.312 T/M)

Activated Carbon (0.020 T/M)

Acetone (1.0 T/M)

Total Input – 2.58 T/M

STAGE-II
(0.080 T/M)

Iso propyl alcohol vapour (1.83 T/M)

Carbon (0.020 T/M)

Acetone vapour (0.60 T/M)

Methylene Bromide (0.056 T/M)

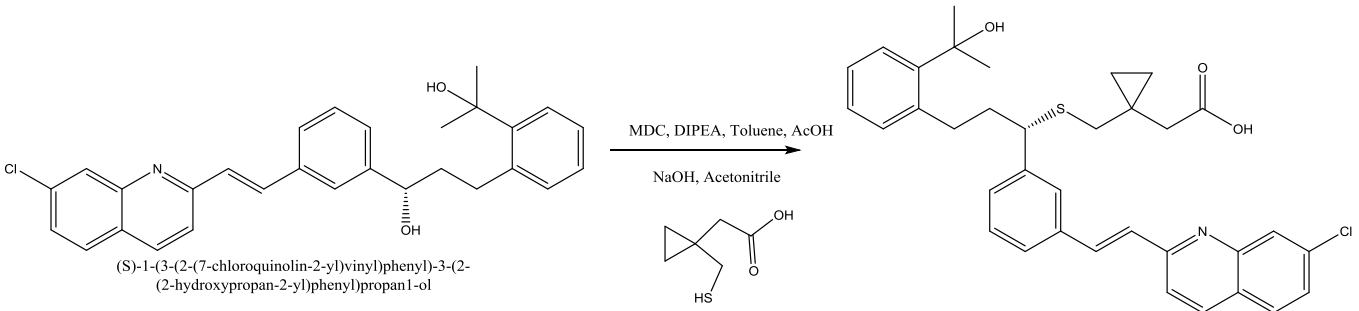
Total Output – 2.58 T/M

CLIDINIUM BROMIDE

MONTELUKAST SODIUM

Route of synthesis

Stage-1:



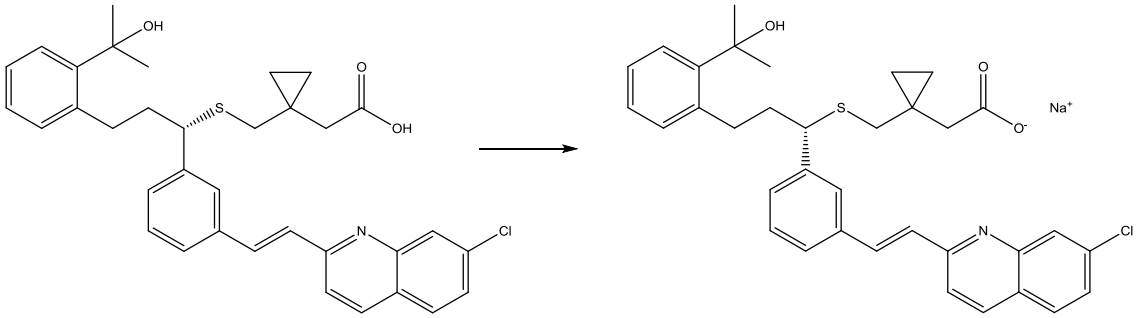
(S)-1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl)phenyl)propan1-ol

MF: $C_{29}H_{28}ClNO_2$
MWt: 458.00

(S)-2-(1-((1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl) phenyl) propylthio) methyl) cyclopropyl) acetic acid

MF: $C_{35}H_{36}ClNO_3S$
MWt: 586.19

Stage-2:



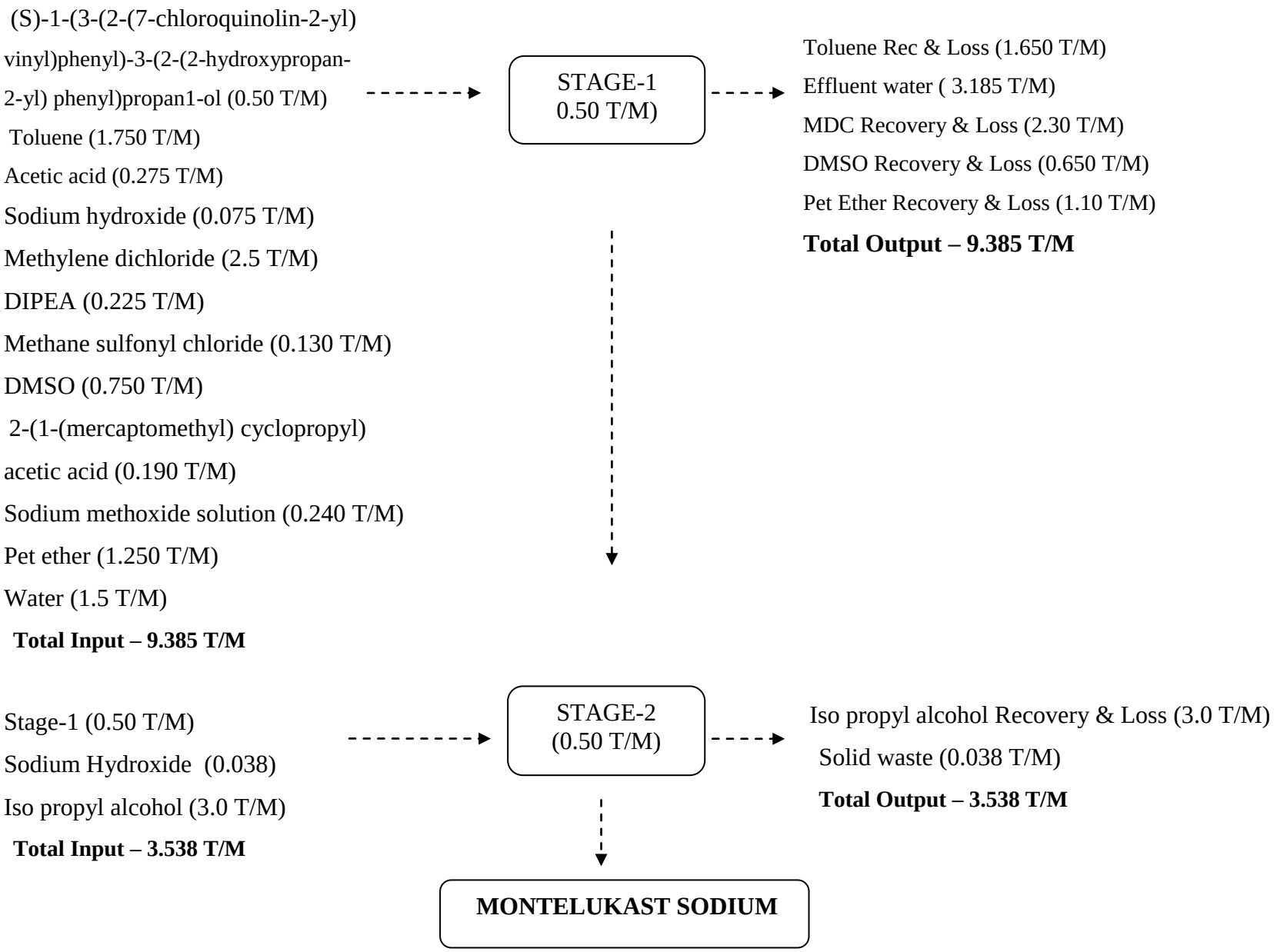
(S)-2-(1-((1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl) phenyl) propylthio) methyl) cyclopropyl) acetic acid

MF: $C_{35}H_{36}ClNO_3S$
MWt: 586.19

(S)-2-(1-((1-(3-(2-(7-chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2-yl) phenyl) propylthio) methyl) cyclopropyl) acetic acid sodium salt

MF: $C_{35}H_{35}ClNNaO_3S$
MWt: 608.17

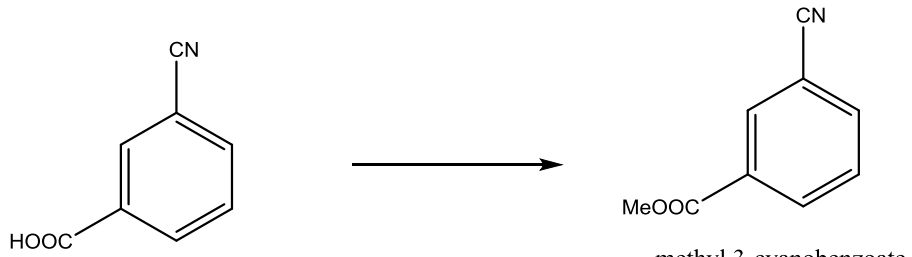
Flow Chart


(S)-1-(3-(2-(7-chloroquinolin-2-yl)
vinyl)phenyl)-3-(2-(2-hydroxypropan-
2-yl) phenyl)propan1-ol (0.50 T/M)
Toluene (1.750 T/M)
Acetic acid (0.275 T/M)
Sodium hydroxide (0.075 T/M)
Methylene dichloride (2.5 T/M)
DIPEA (0.225 T/M)
Methane sulfonyl chloride (0.130 T/M)
DMSO (0.750 T/M)
2-(1-(mercaptomethyl) cyclopropyl)
acetic acid (0.190 T/M)
Sodium methoxide solution (0.240 T/M)
Pet ether (1.250 T/M)
Water (1.5 T/M)
Total Input – 9.385 T/M
STAGE-1
0.50 T/M)
Toluene Rec & Loss (1.650 T/M)
Effluent water (3.185 T/M)
MDC Recovery & Loss (2.30 T/M)
DMSO Recovery & Loss (0.650 T/M)
Pet Ether Recovery & Loss (1.10 T/M)
Total Output – 9.385 T/M
Stage-1 (0.50 T/M)
Sodium Hydroxide (0.038)
Iso propyl alcohol (3.0 T/M)
Total Input – 3.538 T/M
STAGE-2
(0.50 T/M)
Iso propyl alcohol Recovery & Loss (3.0 T/M)
Solid waste (0.038 T/M)
Total Output – 3.538 T/M
MONTELUKAST SODIUM

ATALUREN

Route of synthesis

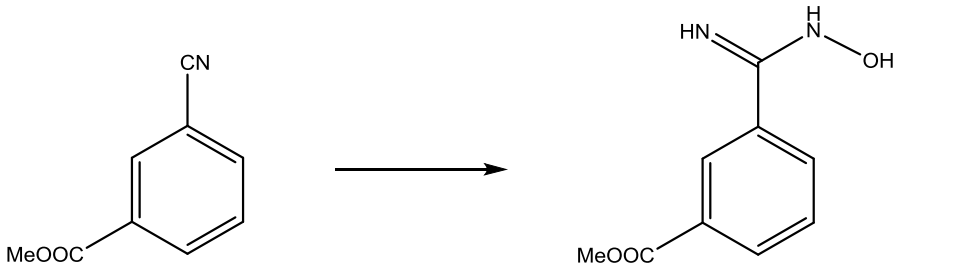
Stage-1



3-cyanobenzoic acid
MF:$C_8H_5NO_2$
MWt: 147.13

methyl 3-cyanobenzoate
MF: $C_9H_7NO_2$
MWt: 161.16

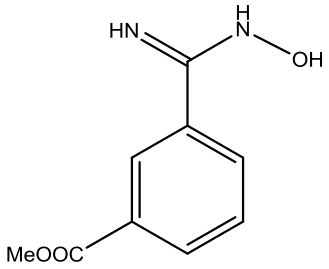
Stage-2:



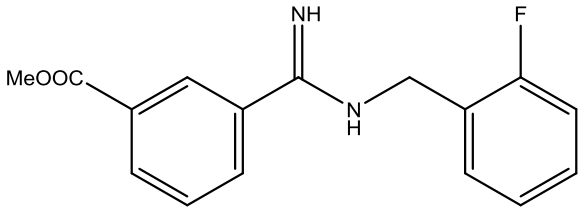
methyl 3-cyanobenzoate
MF: $C_9H_7NO_2$
MWt: 161.16

methyl 3-(*N*-hydroxycarbamimidoyl)benzoate
MF: $C_9H_{10}N_2O_3$
MWt: 194.19

Stage-3:

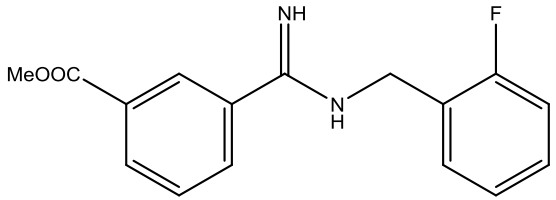


methyl 3-(*N*-hydroxycarbamimidoyl)benzoate
MF: $C_9H_{10}N_2O_3$
MWt: 194.19

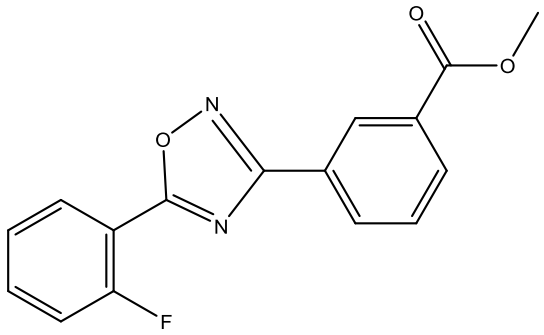


methyl 3-(*N*-(2-fluorobenzyl)carbamimidoyl)benzoate
MF: $C_{16}H_{15}FN_2O_2$
MWt: 286.31

Stage-4:

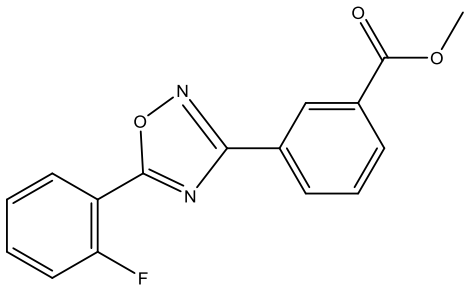


methyl 3-(*N*-(2-fluorobenzyl)carbamimidoyl)benzoate
MF: $C_{16}H_{15}FN_2O_2$
MWt: 286.31



methyl 3-(5-(2-fluorophenyl)-1,2,4-oxadiazol-3-yl)benzoate
MF: $C_{16}H_{11}FN_2O_3$
MWt: 298.27

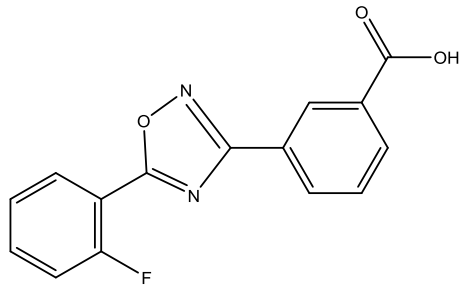
Stage-5:



methyl 3-(5-(2-fluorophenyl)-1,2,4-oxadiazol-3-yl)benzoate

MF: $C_{16}H_{11}FN_2O_3$

MWt: 298.27

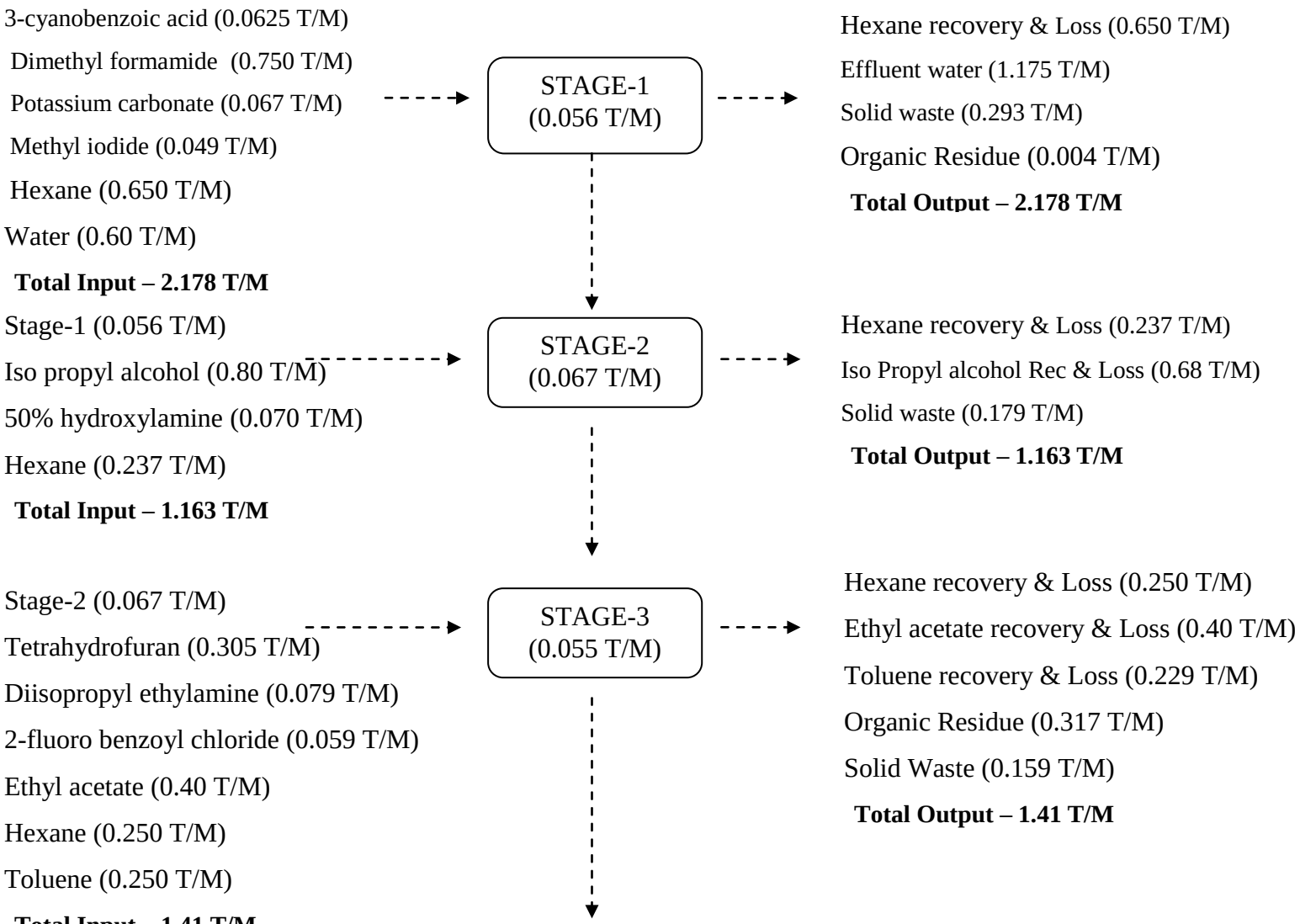


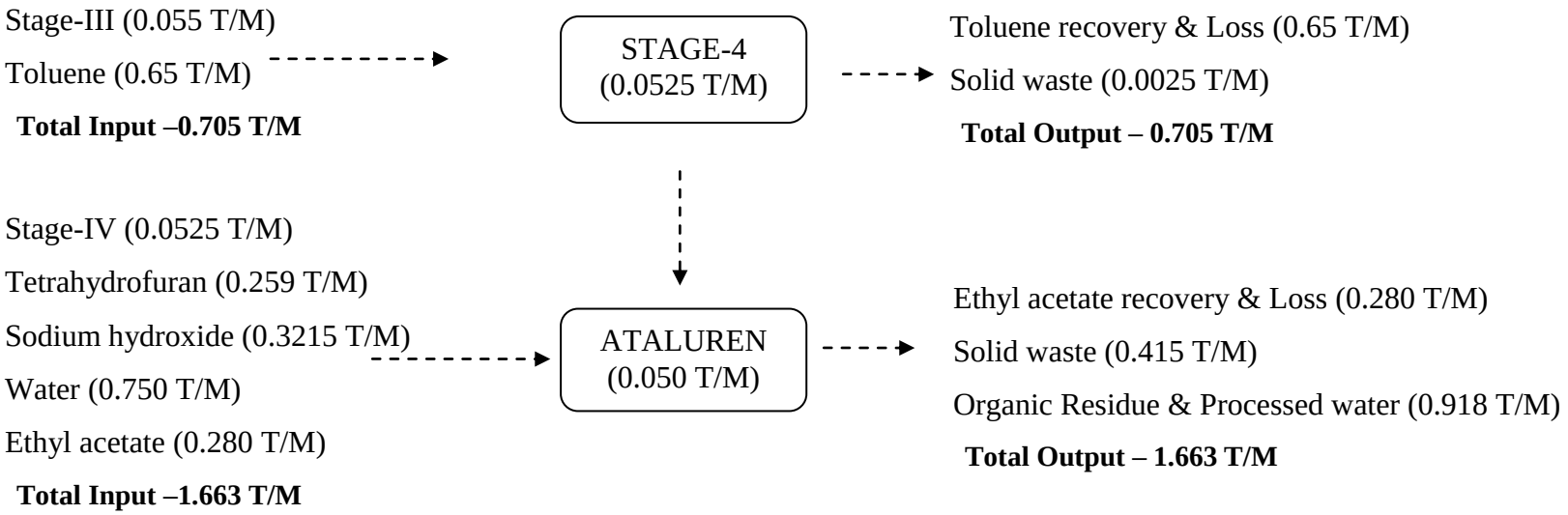
3-(5-(2-fluorophenyl)-1,2,4-oxadiazol-3-yl)benzoic acid

MF: $C_{15}H_9FN_2O_3$

MWt: 284.25

Flow Chart

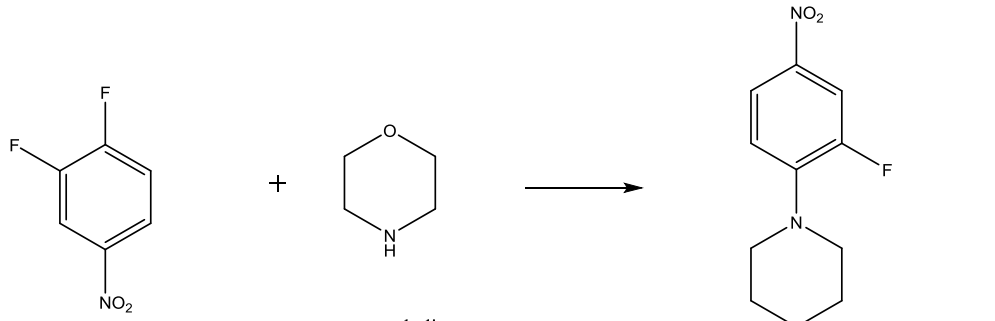

3-cyanobenzoic acid (0.0625 T/M)
Dimethyl formamide (0.750 T/M)
Potassium carbonate (0.067 T/M)
Methyl iodide (0.049 T/M)
Hexane (0.650 T/M)
Water (0.60 T/M)
Total Input – 2.178 T/M
STAGE-1 (0.056 T/M)
Hexane recovery & Loss (0.650 T/M)
Effluent water (1.175 T/M)
Solid waste (0.293 T/M)
Organic Residue (0.004 T/M)
Total Output – 2.178 T/M
Stage-1 (0.056 T/M)
Iso propyl alcohol (0.80 T/M)
50% hydroxylamine (0.070 T/M)
Hexane (0.237 T/M)
Total Input – 1.163 T/M
STAGE-2 (0.067 T/M)
Hexane recovery & Loss (0.237 T/M)
Iso Propyl alcohol Rec & Loss (0.68 T/M)
Solid waste (0.179 T/M)
Total Output – 1.163 T/M
Stage-2 (0.067 T/M)
Tetrahydrofuran (0.305 T/M)
Diisopropyl ethylamine (0.079 T/M)
2-fluoro benzoyl chloride (0.059 T/M)
Ethyl acetate (0.40 T/M)
Hexane (0.250 T/M)
Toluene (0.250 T/M)
Total Input – 1.41 T/M
STAGE-3 (0.055 T/M)
Hexane recovery & Loss (0.250 T/M)
Ethyl acetate recovery & Loss (0.40 T/M)
Toluene recovery & Loss (0.229 T/M)
Organic Residue (0.317 T/M)
Solid Waste (0.159 T/M)
Total Output – 1.41 T/M


Stage-III (0.055 T/M)
Toluene (0.65 T/M)
Total Input –0.705 T/M
STAGE-4
(0.0525 T/M)
Toluene recovery & Loss (0.65 T/M)
Solid waste (0.0025 T/M)
Total Output – 0.705 T/M
Stage-IV (0.0525 T/M)
Tetrahydrofuran (0.259 T/M)
Sodium hydroxide (0.3215 T/M)
Water (0.750 T/M)
Ethyl acetate (0.280 T/M)
Total Input –1.663 T/M
ATALUREN
(0.050 T/M)
Ethyl acetate recovery & Loss (0.280 T/M)
Solid waste (0.415 T/M)
Organic Residue & Processed water (0.918 T/M)
Total Output – 1.663 T/M

LINEZOLID

Route of synthesis

Stage-1:

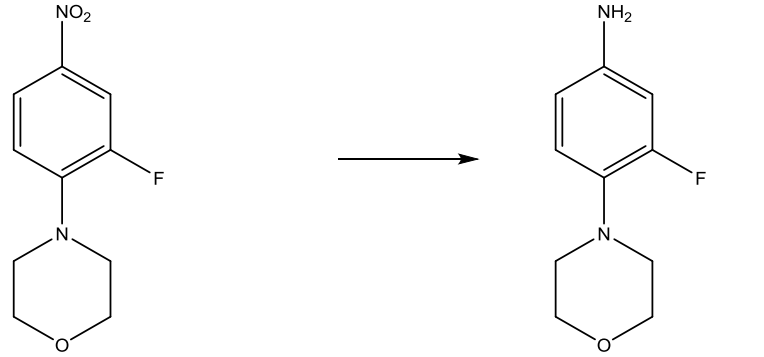


1,2-difluoro-4-nitrobenzene
MF: $C_6H_3F_2NO_2$
MW: 159.09

morpholine
MF: C_4H_9NO
MW: 87.12

4-(2-fluoro-4-nitrophenyl)morpholine
MF: $C_{10}H_{11}FN_2O_3$
MF: 226.21

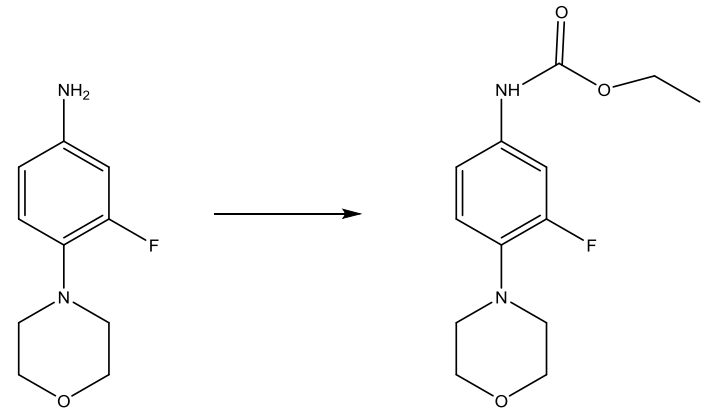
Stage-2:



4-(2-fluoro-4-nitrophenyl)morpholine
MF: $C_{10}H_{11}FN_2O_3$
MW: 226.21

3-fluoro-4-morpholinoaniline
MF: $C_{10}H_{13}FN_2O$
MW: 196.23

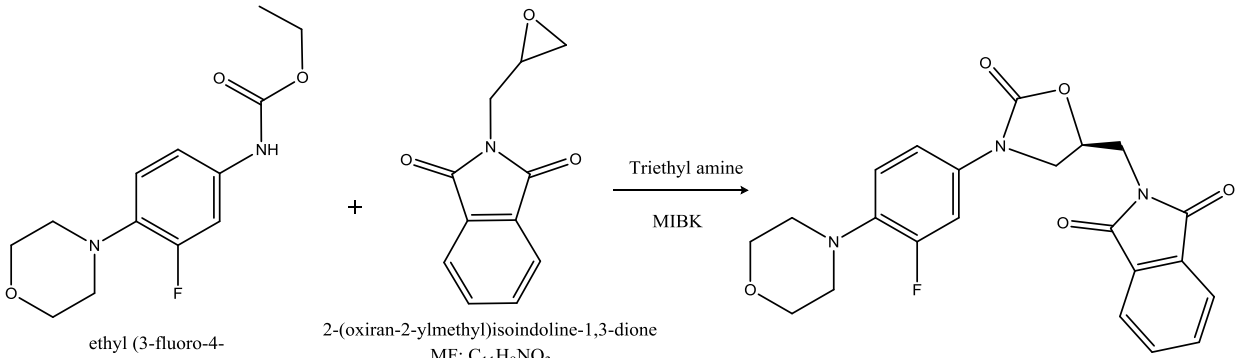
Stage-3:



3-fluoro-4-morpholinoaniline
MF: $C_{10}H_{13}FN_2O$
MW: 196.23

ethyl (3-fluoro-4-morpholinophenyl)carbamate
MF: $C_{13}H_{17}FN_2O_3$
MW: 268.29

Stage-4:

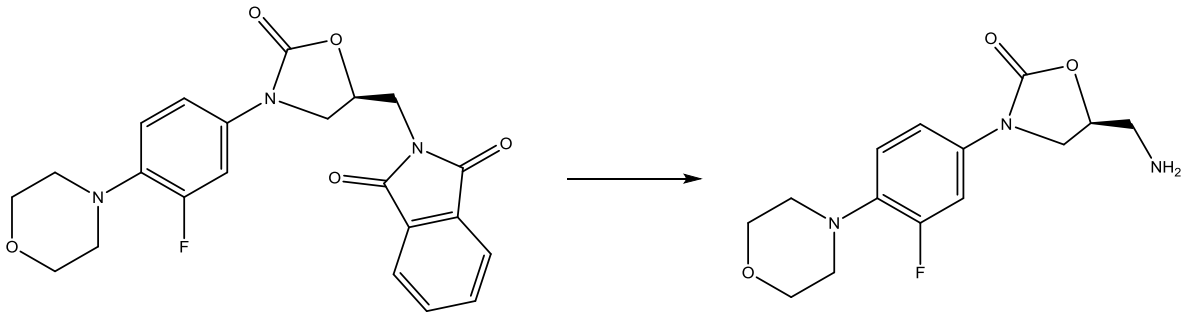


ethyl (3-fluoro-4-morpholinophenyl)carbamate
MF: $C_{13}H_{17}FN_2O_3$
MW: 268.29

2-(oxiran-2-ylmethyl)isoindoline-1,3-dione
MF: $C_{11}H_9NO_3$
MWt: 203.20

(*S*)-2-((3-(3-fluoro-4-morpholinophenyl)-2-oxooxazolidin-5-yl)methyl)isoindoline-1,3-dione
MF: $C_{22}H_{20}FN_3O_5$
MW: 425.42

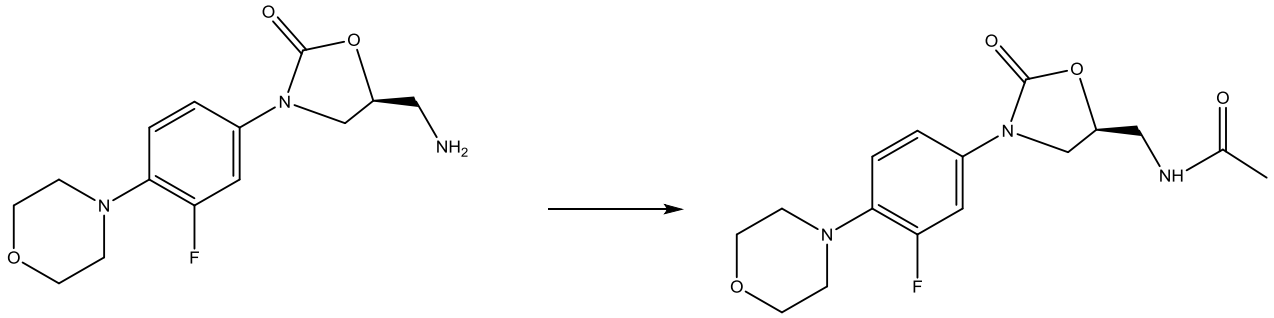
Stage-5:



(*S*)-2-((3-(3-fluoro-4-morpholinophenyl)-2-oxooxazolidin-5-yl)methyl)isoindoline-1,3-dione
MF: $C_{22}H_{20}FN_3O_5$
MW: 425.42

(*S*)-5-(aminomethyl)-3-(3-fluoro-4-morpholinophenyl)oxazolidin-2-one
MF: $C_{14}H_{18}FN_3O_3$
MW: 295.31

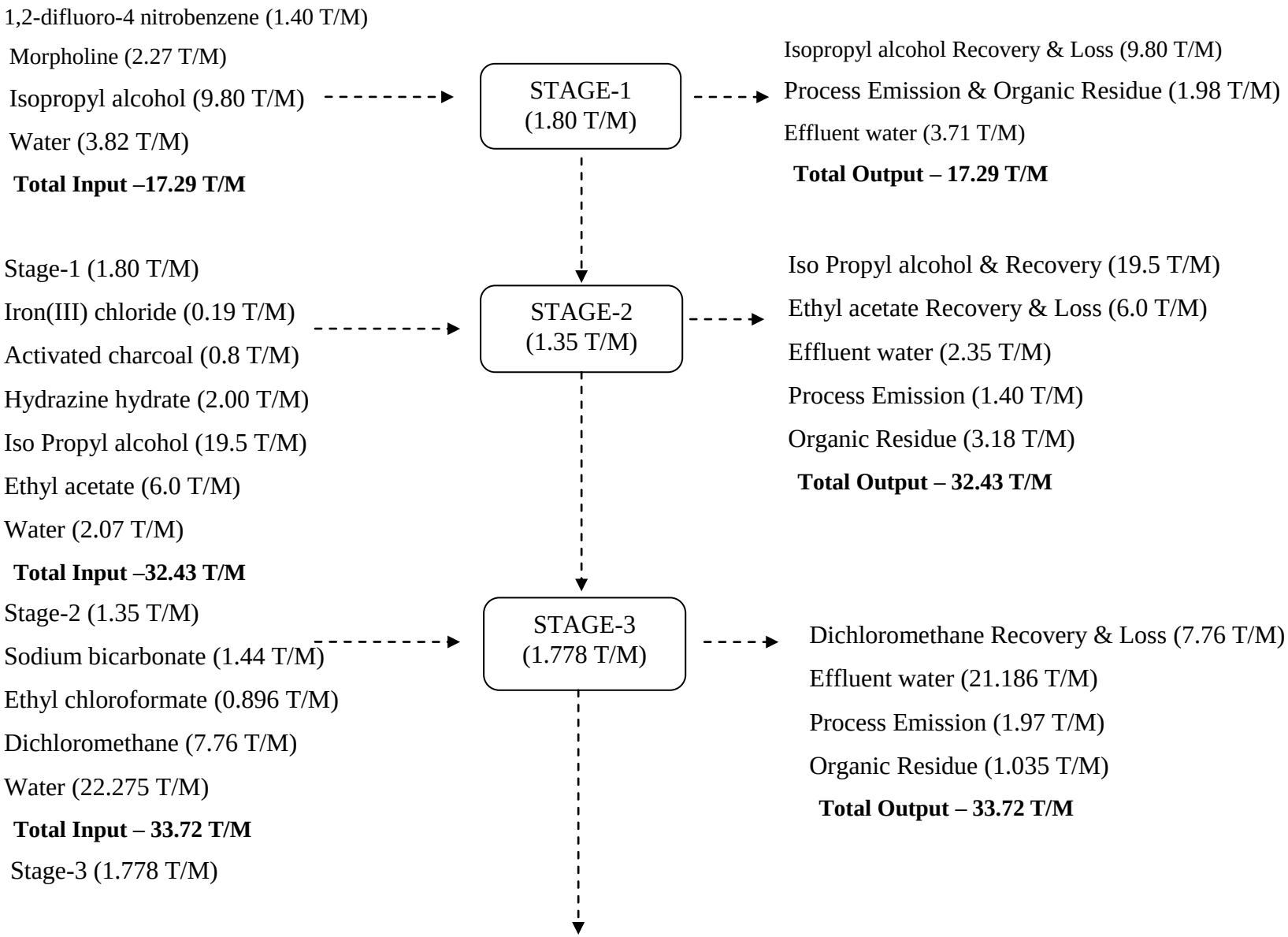
Stage-6:

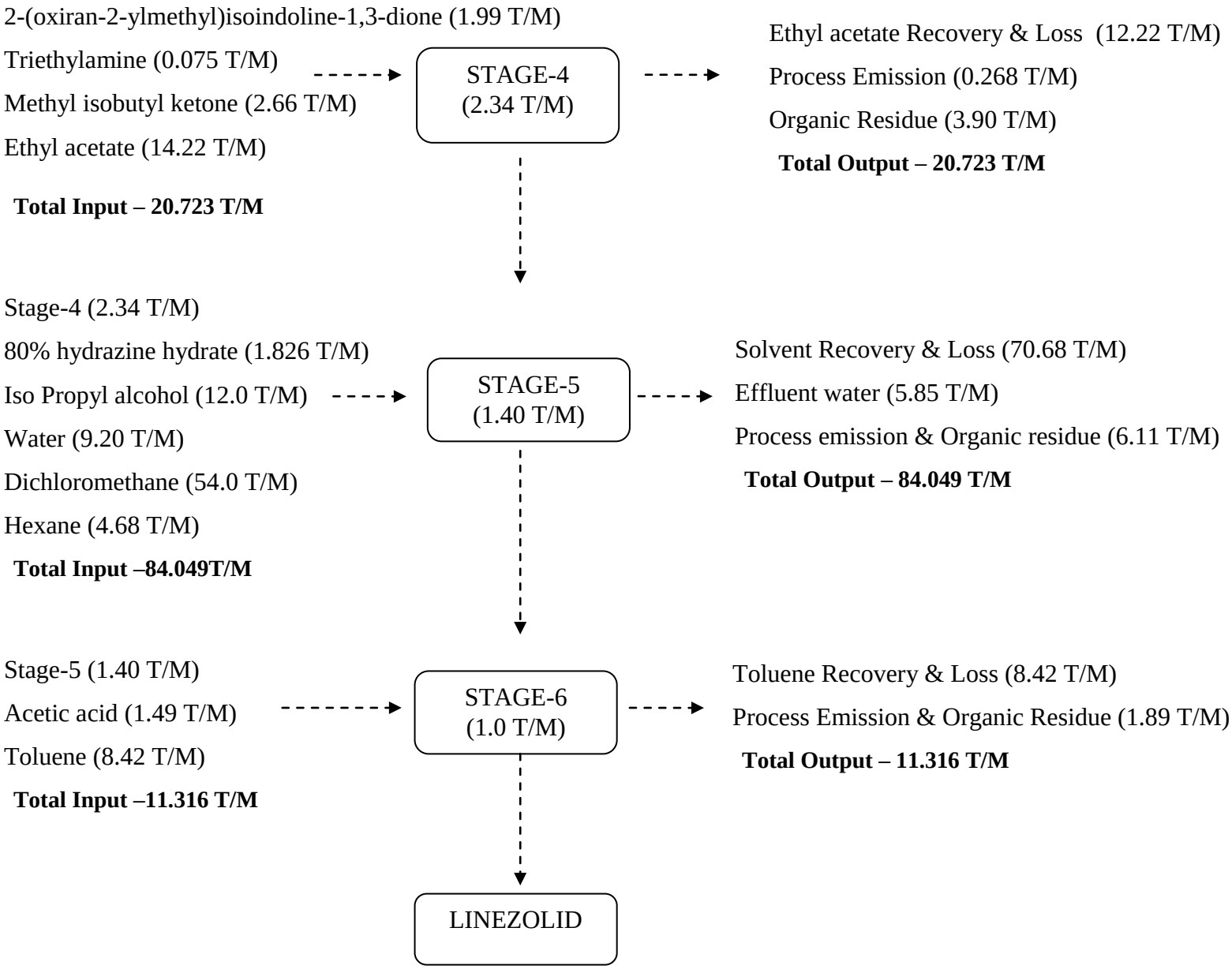


(*S*)-5-(aminomethyl)-3-(3-fluoro-4-morpholinophenyl)oxazolidin-2-one
MF: $C_{14}H_{18}FN_3O_3$
MW: 295.31

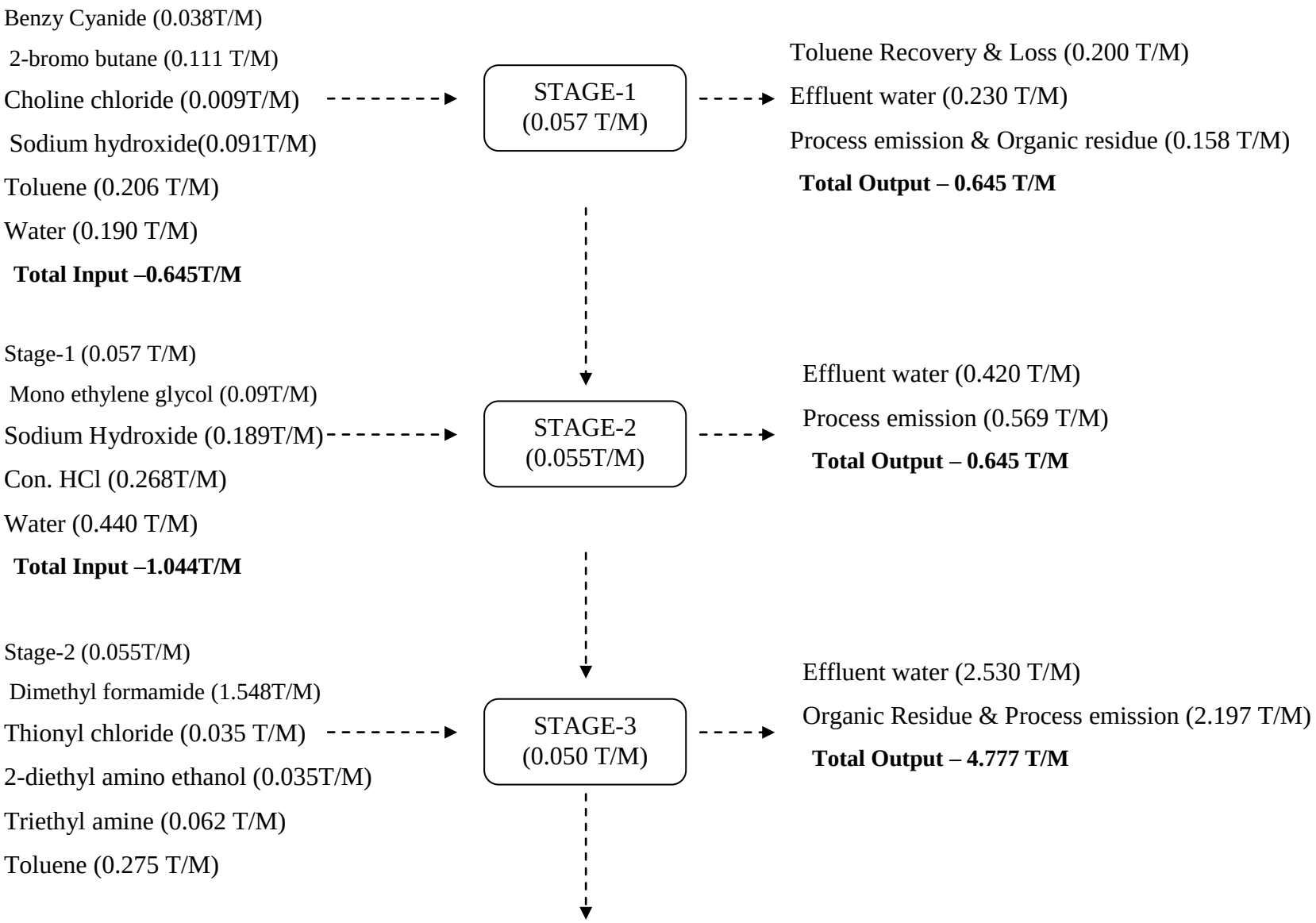
(*S*)-*N*-((3-(3-fluoro-4-morpholinophenyl)-2-oxooxazolidin-5-yl)methyl)acetamide
MF: $C_{16}H_{20}FN_3O_4$
MW: 337.35

Flow Chart


1,2-difluoro-4 nitrobenzene (1.40 T/M)
Morpholine (2.27 T/M)
Isopropyl alcohol (9.80 T/M)
Water (3.82 T/M)
Total Input –17.29 T/M
STAGE-1
(1.80 T/M)
Isopropyl alcohol Recovery & Loss (9.80 T/M)
Process Emission & Organic Residue (1.98 T/M)
Effluent water (3.71 T/M)
Total Output – 17.29 T/M
Stage-1 (1.80 T/M)
Iron(III) chloride (0.19 T/M)
Activated charcoal (0.8 T/M)
Hydrazine hydrate (2.00 T/M)
Iso Propyl alcohol (19.5 T/M)
Ethyl acetate (6.0 T/M)
Water (2.07 T/M)
Total Input –32.43 T/M
STAGE-2
(1.35 T/M)
Iso Propyl alcohol & Recovery (19.5 T/M)
Ethyl acetate Recovery & Loss (6.0 T/M)
Effluent water (2.35 T/M)
Process Emission (1.40 T/M)
Organic Residue (3.18 T/M)
Total Output – 32.43 T/M
Stage-2 (1.35 T/M)
Sodium bicarbonate (1.44 T/M)
Ethyl chloroformate (0.896 T/M)
Dichloromethane (7.76 T/M)
Water (22.275 T/M)
Total Input – 33.72 T/M
STAGE-3
(1.778 T/M)
Dichloromethane Recovery & Loss (7.76 T/M)
Effluent water (21.186 T/M)
Process Emission (1.97 T/M)
Organic Residue (1.035 T/M)
Total Output – 33.72 T/M
Stage-3 (1.778 T/M)


2-(oxiran-2-ylmethyl)isoindoline-1,3-dione (1.99 T/M)
Triethylamine (0.075 T/M)
Methyl isobutyl ketone (2.66 T/M)
Ethyl acetate (14.22 T/M)
Total Input – 20.723 T/M
STAGE-4
(2.34 T/M)
Ethyl acetate Recovery & Loss (12.22 T/M)
Process Emission (0.268 T/M)
Organic Residue (3.90 T/M)
Total Output – 20.723 T/M
Stage-4 (2.34 T/M)
80% hydrazine hydrate (1.826 T/M)
Iso Propyl alcohol (12.0 T/M)
Water (9.20 T/M)
Dichloromethane (54.0 T/M)
Hexane (4.68 T/M)
Total Input –84.049T/M
STAGE-5
(1.40 T/M)
Solvent Recovery & Loss (70.68 T/M)
Effluent water (5.85 T/M)
Process emission & Organic residue (6.11 T/M)
Total Output – 84.049 T/M
Stage-5 (1.40 T/M)
Acetic acid (1.49 T/M)
Toluene (8.42 T/M)
Total Input –11.316 T/M
STAGE-6
(1.0 T/M)
Toluene Recovery & Loss (8.42 T/M)
Process Emission & Organic Residue (1.89 T/M)
Total Output – 11.316 T/M
LINEZOLID

VALETHAMATE BROMIDE



Sodium hydroxide (0.025 T/M)

Water (2.742 T/M)

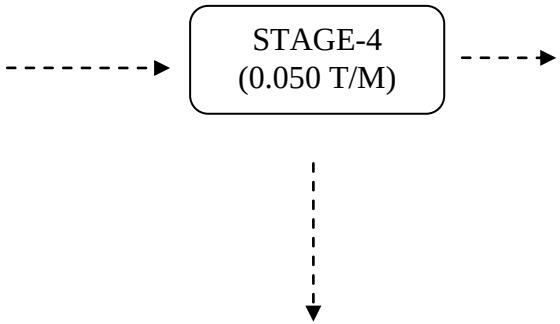
Total Input –4.777 T/M

Stage-3 (0.050T/M)

Methyl Bromide (0.030T/M)

Ethyl acetate (0.250T/M)

Total Input –0.33 T/M



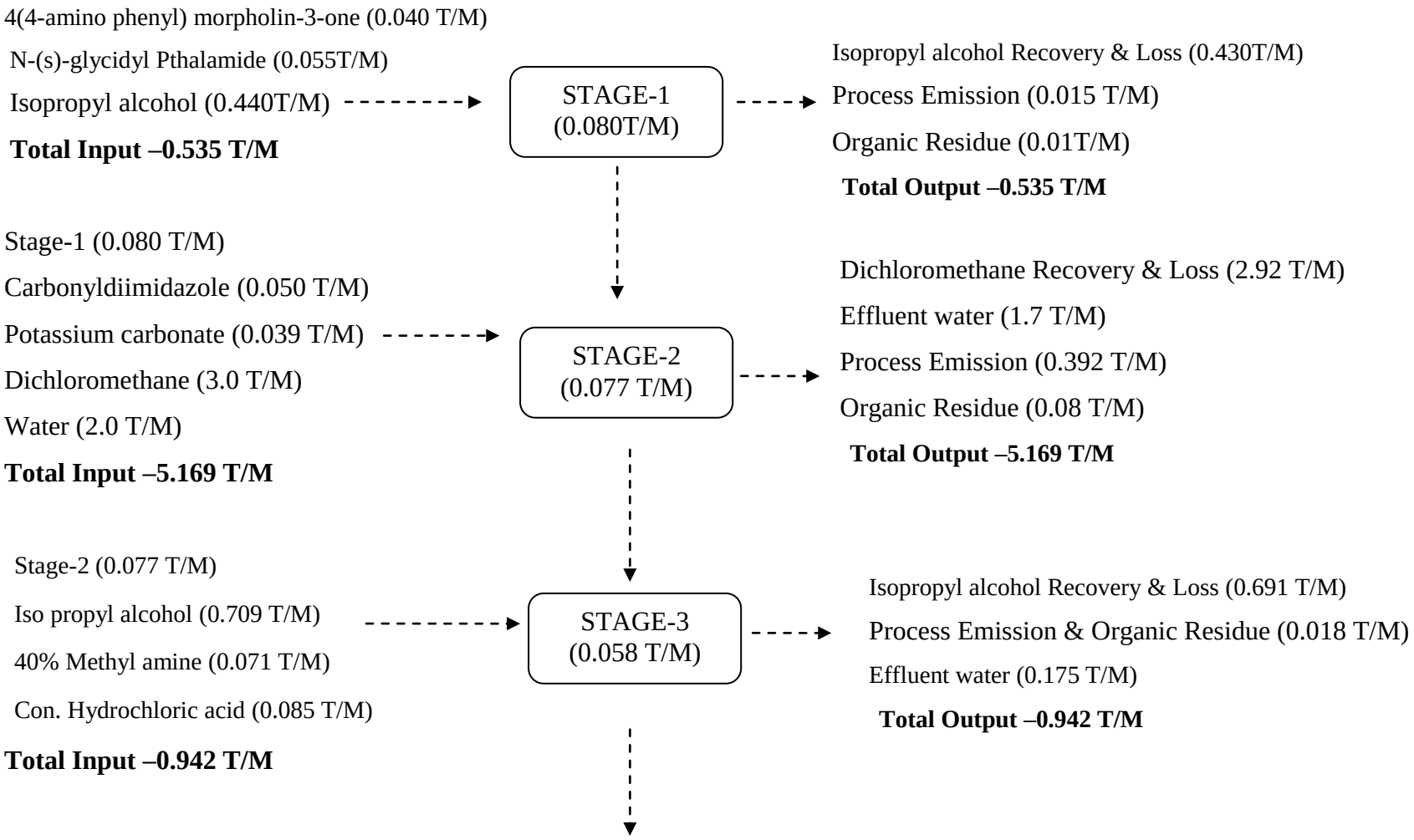
Ethyl acetate Recovery & Loss (0.240 T/M)

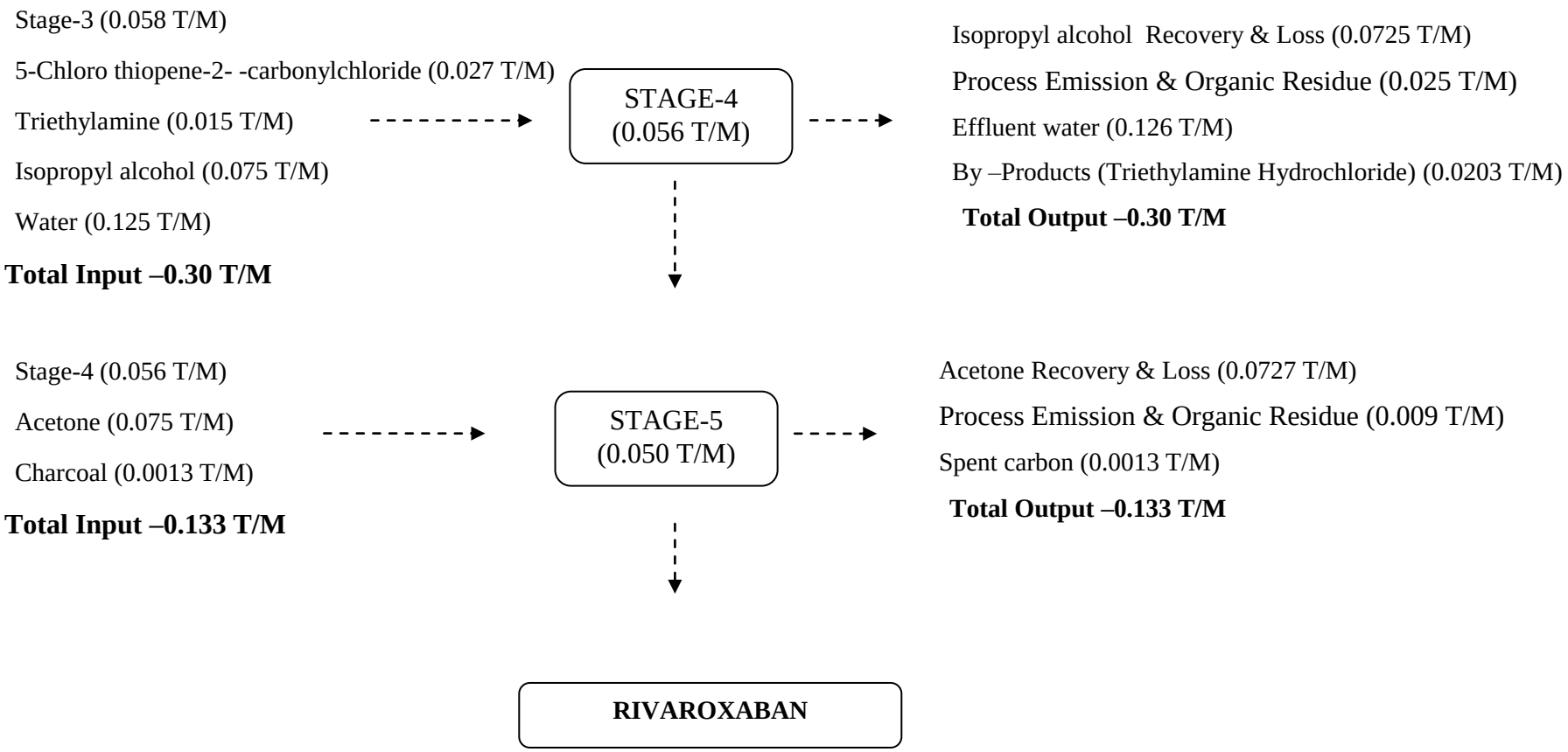
Organic Residue & Process emission (0.040 T/M)

Total Output – 0.33 T/M

VALETHAMATE BROMIDE

RIVAROXABAN




Stage-3 (0.058 T/M)
5-Chloro thiopene-2- -carbonylchloride (0.027 T/M)
Triethylamine (0.015 T/M)
Isopropyl alcohol (0.075 T/M)
Water (0.125 T/M)
Total Input –0.30 T/M
STAGE-4
(0.056 T/M)
Isopropyl alcohol Recovery & Loss (0.0725 T/M)
Process Emission & Organic Residue (0.025 T/M)
Effluent water (0.126 T/M)
By –Products (Triethylamine Hydrochloride) (0.0203 T/M)
Total Output –0.30 T/M
Stage-4 (0.056 T/M)
Acetone (0.075 T/M)
Charcoal (0.0013 T/M)
Total Input –0.133 T/M
STAGE-5
(0.050 T/M)
Acetone Recovery & Loss (0.0727 T/M)
Process Emission & Organic Residue (0.009 T/M)
Spent carbon (0.0013 T/M)
Total Output –0.133 T/M
RIVAROXABAN

ANNEXURE – XII

5 KLD ETP PROPOSAL

5 KLD ETP Process and Flow Chart

1. Bar Screen Chamber
To remove large-sized floating and suspended solids (such as plastics, rags, sticks, paper, etc.) from the influent before it enters the main treatment system. This protects downstream equipment from clogging or damage.

2. Oil and Grease Trap
To remove free and floating oil, grease, and other hydrocarbons from the wastewater, which could interfere with biological treatment and clog pipelines.

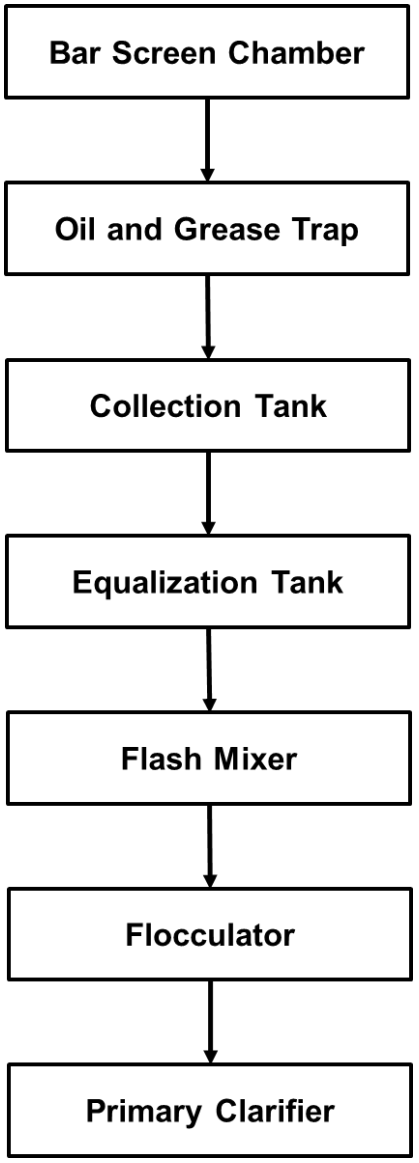
3. Collection Tank
The effluent from various sources is first collected in the collection tank. This tank serves to gather and temporarily hold wastewater to ensure a continuous and manageable flow for subsequent treatment.

4. Equalization Tank
From the collection tank, effluent flows into the equalization tank where flow rate and load fluctuations are balanced. Agitation or aeration may be used to keep solids in suspension and prevent settling or odor formation.

5. Flash Mixer
Coagulants are dosed into the effluent in the flash mixer to destabilize suspended particles. Rapid mixing ensures uniform chemical distribution, preparing the effluent for effective flocculation.

6. Flocculator
In this stage, gentle mixing allows small destabilized particles to collide and bind into larger flocs. Flocculating agents such as polyelectrolytes are typically added here to enhance floc formation.

7. Primary Clarifier
The flocculated effluent enters the primary clarifier where gravity settling separates the solids. Clarified water overflows to the next stage, while settled sludge is collected from the bottom for disposal or further treatment.



5 KLD ETP Process and Flow Chart (Contd.,)

8. Aeration Tank
In the aeration tank, the effluent undergoes biological treatment. Air is supplied to support aerobic microorganisms that degrade organic pollutants, reducing BOD and COD.

9. Secondary Clarifier
This stage separates the biological sludge from the treated effluent. The clear supernatant moves on to tertiary treatment, while part of the sludge is recycled to maintain microbial population, and the excess is removed.

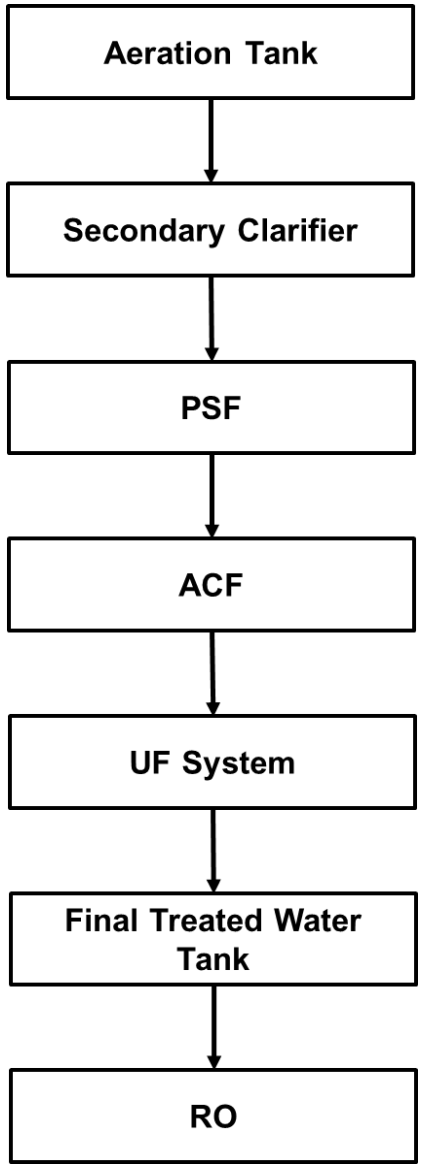
10. Pressure Sand Filter (PSF)
The effluent from the secondary clarifier is passed through a pressure sand filter to remove any remaining suspended solids and improve water clarity.

11. Activated Carbon Filter (ACF)
The PSF-treated water then flows through the ACF, which adsorbs color, odor, and residual organic matter, enhancing the final quality of the effluent.

12. UF System (Ultrafiltration)
Following the ACF, the water enters the UF system, where fine particulates, colloids, and microorganisms are removed through membrane filtration, ensuring a high-quality, reusable effluent.

13. Final Treated Water Tank
The treated water is finally stored in this tank. Depending on the design, it can be reused for non-potable purposes such as gardening.

14. Reverse Osmosis (RO) System
Treated water from the final tank is further purified in the RO system. This removes dissolved salts, heavy metals, and remaining organic contaminants, producing two streams: RO Permeate: High-purity water suitable for reuse or further polishing.RO Reject (Concentrate): A concentrated stream of rejected impurities.



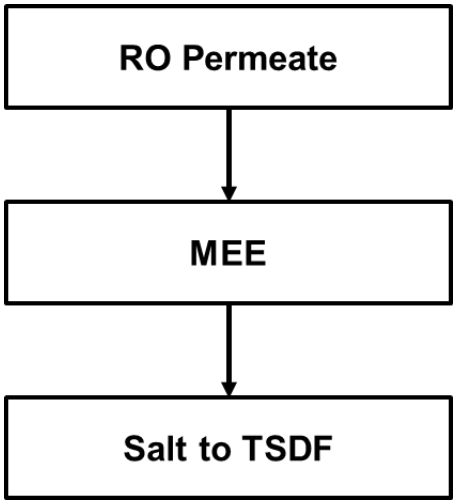
5 KLD ETP Process and Flow Chart (Contd.,)

15. RO Permeate

This stream can be used for Greenbelt development after achieving the TDS (<2100 mg/l).

16. Multiple Effect Evaporator (MEE)

The RO reject, which contains concentrated dissolved solids and impurities, is fed into the MEE. Through successive stages of evaporation under reduced pressure, water is recovered, and the final solid waste or concentrated brine is collected for disposal.



ANNEXURE – XIII

RISK ASSESSMENT REPORT

QUANTITATIVE RISK ASSESSMENT STUDY REPORT

M/S. JUVENUS DRUGS

PLOT NO. 38, SURVEY NO. 16 & 17, TANSIDCO INDUSTRIAL ESTATE
AT TINDIVANAM MEGA PHARMA CLUSTER, PELAKUPPAM VILLAGE,
TINDIVANAM TALUK, VILLUPURAM DISTRICT, TAMIL NADU

BY

VIGILANT ALLY LLP

DISCLAIMER

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ACKNOWLEDGEMENT

Our Ref: J077 Rev 00

Date: 24Th September 2025

M/S. JUVENUS DRUGS

Plot No. 38, Survey No. 16 & 17,

Tansidco Industrial Estate At Tindivanam Mega Pharma Cluster,

Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu

Dear Sir,

SUBJECT: QUANTITATIVE RISK ASSESSMENT STUDY REPORT FOR PROPOSED ACTIVE PHARMACEUTICAL INGREDIENTS & INTERMEDIATES MANUFACTURING UNIT

We are pleased to submit the Quantitative Risk Assessment Study report for the proposed active pharmaceutical ingredients & intermediates manufacturing unit . If you have any questions or comments, please contact the undersigned.

We thank you for allowing us the opportunity to perform this study and if we can be of any further assistance to you, please contact us.

Yours faithfully,

Vigilant Ally LLP





(Kavita Patwardhan)

Director – Technical

ABBREVIATIONS

Abbreviations	
ALARP	As Low As Reasonably Practicable
CCPS	Center for Chemical Process Safety
HSE	Health Safety Environment
IR	Individual Risk
IS	Isolatable Section
LFL	Low Flammability Limit
LOC	Loss of Containment
LP	Low Pressure
LSIR	Location Specific Individual Risk
P&ID	Piping and Instrumentation Diagram
PHAST	Process Hazard Analysis Software Tool
QRA	Quantitative Risk Analysis
UDM	Unified Dispersion Model
UFL	Upper Flammability Limit
VCE	Vapor Cloud Explosion

EXECUTIVE SUMMARY

Quantitative Risk Assessment Study Overview:

Consequence analysis gives results of impacts or reach of scenarios if occurred. The impact can be for long or for less duration, but the distances mentioned in the consequence results must be protected if the scenario occurs.

Fire & Toxic consequences were modelled in PHAST for all identified scenarios.

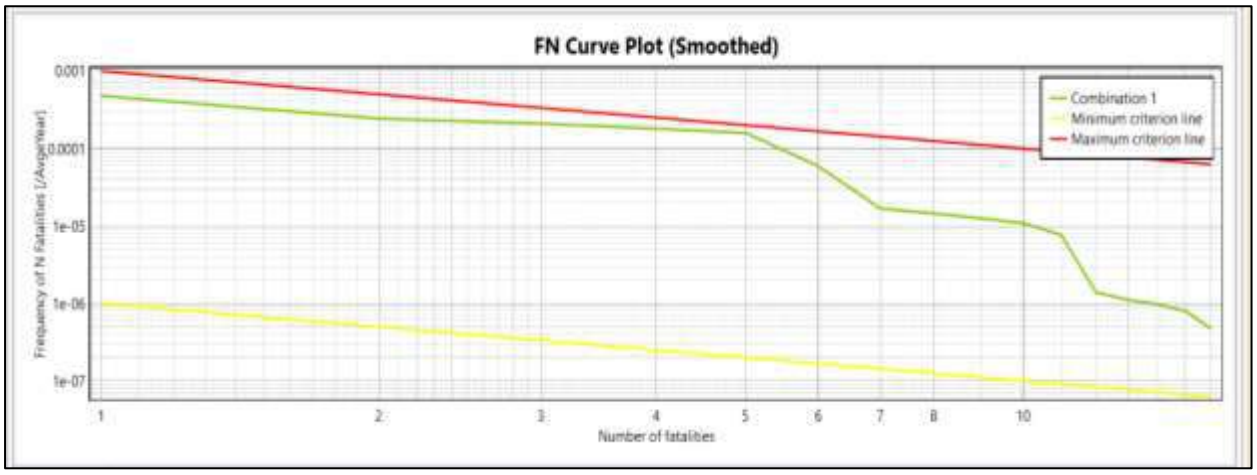
The results of the QRA are, used to assess the acceptability of the risk in relation to the benefits of the activity, to evaluate new developments on and off-site, to estimate the benefit of risk-reducing countermeasures and to determine zoning distances around an activity for land-use planning.

The Individual Risk Per Annum (IRPA) for personnel located in hazardous and populated areas has been calculated and assessed in accordance with UK HSE risk criteria.

As evident from the following table, none of the personnel are exposed to an unacceptable level of risk (i.e., greater than 1.0×10^{-3} per year). The IRPA values for all personnel categories fall within acceptable limits, indicating that the current risk control measures are effective and compliant with regulatory expectations."

S.No	Personnel located inside the facility	Presence Factor	LSIR Value	IRPA	Risk Level
1	Canteen Block	0.66	4.14E-07	2.73E-07	**ACCEPTABLE**
2	R&D	0.66	4.46E-06	2.93E-06	**ACCEPTABLE**
3	Warehouse	0.66	4.84E-06	3.19E-06	**ACCEPTABLE**
4	Production Area	0.66	5.73E-06	3.77E-06	**ACCEPTABLE**
5	Office Block	0.66	2.54E-07	3.31-07	**ACCEPTABLE**

The Societal Risk in the form of FN Curve is presented in the following Figure;



Based on the FN Curve analysis, the maximum envisaged scenario corresponds to one fatality occurring at a frequency of once per 10,000 years (1×10^{-4} per year). According to UK HSE guidelines, this places the risk within the ALARP (As Low As Reasonably Practicable) zone. Therefore, it is essential to ensure that engineering and administrative controls remain robust and effective throughout the operational life of the company. In addition, routine monitoring and maintenance of existing control measures shall be consistently carried out to sustain risk at ALARP levels.

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DEFINITIONS

1. **Dispersion** – The mixing and spreading of gases in air, causing clouds to grow is known as dispersion.
2. **Exposure** - Concentration or intensity that reaches the target person, usually expressed in terms of concentration or intensity and duration.
3. **Failure** – A system or component failure occurs when the delivered service deviates from the intended service. The cause of a failure is a fault, which resides, temporarily or permanently in the system or component.
4. **Flashing** - Part of a superheated liquid that evaporates rapidly due to a relatively rapid depressurization, until the resulting vapour/liquid mixture has cooled to below boiling point at the end pressure. Superheat is the extra heat of a liquid made available by decreasing the liquid's temperature, for instance, by vaporization, until the vapour pressure equals that of the surroundings.
5. **Frequency** - The number of times an outcome is expected to occur in a given period of time.
6. **Hazard**- A substance or circumstance which may cause injury or damage due to being explosive, flammable, poisonous, corrosive, oxidizing, or otherwise harmful.
7. **Ignition source** - A thing which is able to ignite a flammable cloud.
8. **Loss of Containment event** – An event resulting in the release of material to the atmosphere.
9. **Pasquill class** - classification to qualify the stability of the atmosphere, indicated by a letter ranging from A, for very unstable, to F, for stable.
10. **Quantitative Risk Assessment** - The process of hazard identification followed by a numerical evaluation of effects of incidents, and consequences and probabilities, and their combination into overall measures of risk.
11. **Release** - The discharge of a chemical from its containment, i.e., the process s and storage equipment in which it is kept.
12. **Individual risk** - the probability that in one year a person will become a victim of an accident if the person remains permanently and unprotected in a certain location.
13. **Societal risk** - The frequency (per year) that a group of at least a certain size will at one time become victims of an accident.

1 INTRODUCTION

M/S Juvenus Drugs. has appointed M/s Vigilant Ally LLP to carryout Quantitative Risk Assessment for Proposed Active Pharmaceutical Ingredients & Intermediates Manufacturing Unit.

This QRA report is prepared for the hazardous chemicals stored, handled and manufactured within M/S Juvenus Drugs proposed facility

The purpose of the study includes the following:

- To identify and assess those hazards and risks arising from their activities connected to the handing of hazardous chemicals and associated infrastructure that require management to comply with regulatory requirements, company policy and business requirements
- To eliminate or reduce to As Low As Reasonably Practical (ALARP) in terms of risk to human health, risk of injury, risk of damage to plant, equipment and environment, business interruption or loss etc.

1.1 About M/s Juvenus Drugs.

Juvenus Drugs is a trusted pharmaceutical manufacturer of "Low Volume High Value Active Pharmaceutical Intermediates" to support the API manufacturer globally through our innovative chemistry. We are always dealing with the challenging Chemistry to explore the innovative things. We assist our client in each phase of their research from Discovery, Research & development , Process development up to commercial manufacturing by cost effective and adhering always the Quality norms.

1.2 Project Objective of QRA

Objectives of the QRA study are to –

1. Identification of failure cases within the facilities during handling, storage, transport and processes of hazardous materials.
2. Evaluate process hazards emanating from the identified potential accident scenarios.
3. Analyze the damage effects to surroundings due to such incidents.
4. Assess the risk (individual and societal) that the surrounding population is subjected to, in the event of unforeseen release of hazardous chemicals from facility.
5. Suggest mitigating measures to reduce the hazard / risk.

The results are also useful in developing a meaningful emergency plan and also serve as a powerful training tool. The Risk assessment study has been carried out using the risk assessment software program "PHAST Risk/ SAFETI" developed by DNV GL.

2 SCOPE OF THE STUDY

The main scope of the study is to carry out the QRA including identification, screening and ranking of various risk scenarios, consequence analysis of the various risk scenarios, and probabilistic assessment of risks, recommendation and preparation of reports and relevant drawing showing damage and risk contours.

The scope of the QRA is given below;

1. Study and identify the hazards and loss of containment events
2. Calculation of physical effects of accidental scenarios, which includes frequency analysis for incident scenarios leading to hazards to people and facilities (flammable gas, fire & smoke, explosion, overpressure and toxic gas hazards) and consequence analysis for the identified hazards covering impact on people and potential escalation.
3. Individual risk quantification and contour mapping
4. Societal risk quantification and contour mapping
5. Hazard mitigation recommendations based on QRA

3 Overview Of Risk Assessment

Risk Assessment is proven valuable as a management tool in assessing the overall safety performance of the chemical process Industry. Although management systems such as engineering codes, checklists, and reviews by experienced engineers have provided substantial safety assurances, major incidents involving numerous casualties, injuries and significant damage can occur – as illustrated by recent world scale catastrophes. Risk Assessment techniques provide advanced quantitative means to supplement other hazard identification, analysis, assessment, and control and management methods to identify the potential for such incidents and to evaluate control strategies.

The underlying basis of risk Assessment is simple in concept. It offers methods to answer the following four questions:

1. What can go wrong?

2. What are the causes?

3. What are the consequences?

4. How likely is it?

This study tries to quantify the risks to rank them accordingly based on their severity and probability. The report should be used to understand the significance of existing control measures and to follow the measures continuously. Wherever possible the additional risk control measures should be adopted to bring down the risk levels.

3.1 QRA Concept

Risk in general is defined as a "measure of potential economic loss or human injury in terms of the probability of the loss or injury occurring and magnitude of the loss or injury if it occurs". Risk thus comprises of two variables:

- Magnitude of consequences and;
- The probability of occurrence.

3.2 Risk Assessment Procedure

Hazard identification and risk assessment involves a series of steps as follows:

Step 1: Identification of the Hazard

Hazard identification is a critical step in Risk Assessment. Many aids are available, including experience, engineering codes, checklists, detailed process knowledge, equipment failure experience, hazard index techniques, What-if Analysis, Hazard and Operability (HAZOP) Studies, Failure Mode and Effects Analysis (FMEA), and Preliminary Hazard Analysis (PHA). In this phase all potential incidents are identified and tabulated. Site visit and study of operations and documents like drawings, process write-up etc. are used for hazard identification.

Step 2: Assessment of the Risk

Consequence estimation is the methodology used to determine the potential for damage or injury from specific incidents. A single incident (e.g. rupture of a pressurized flammable liquid tank) can have many distinct incident outcomes (E.g. Unconfined Vapor Cloud Explosion (UVCE), Boiling Liquid Expanding Vapor Explosion (BLEVE), flash fire, etc.) Likelihood assessment is the methodology used to estimate the frequency or probability of occurrence of an incident. Estimates may be obtained from historical incident data on failure frequencies, from failure sequence models, such as fault trees and event trees or both. In this study the historical data developed by software models and those collected by CPR18E – Committee for Prevention of Disasters, Netherlands (Edition: PGS 3, 2005) are used. Risks arising from the hazards are evaluated for its tolerability to personnel, the facility and the environment. The acceptability of the estimated risk must then be judged based on IS-15656 criteria appropriate to the particular situation.

Step 3: Elimination or Reduction of the Risk

This involves identifying opportunities to reduce the likelihood and/or consequence of an accident Where deemed to be necessary.

Risk assessment combines the consequences and likelihood of all incident outcomes from all selected incidents to provide a measure of risk. The risk of all selected incidents are individually estimated and summed to give an overall measure of risk.

Risk-reduction measures include those to prevent incidents (i.e. reduce the likelihood of occurrence) to control incidents (i.e. limit the extent and duration of a hazardous event) and to mitigate the effects (i.e. reduce the consequences). Preventive measures, such as using inherently safer designs and ensuring asset integrity, should be used wherever practicable.

In many cases, the measures to control and mitigate hazards and risks are simple and obvious and involve modifications to conform to standard practice. The general hierarchy of risk reducing measures is:

- Prevention (by distance or design);
- Detection (E.g. fire and gas, Leak detection);
- Control (E.g. emergency shutdown and controlled depressurization);
- Mitigation (E.g. fire fighting and passive fire protection);
- Emergency response (In case safety barriers fail).

3.3 Input For QRA

To carry out the CRA study the following basic data will be used:

- Process parameters such as operating pressure, temperature & flow rate of equipment's and process pipelines as well as the composition of the process streams etc.
- Manning details at strategic locations at site and meteorological details
- Failure frequencies of leak sources, Ignition probabilities, operating probabilities etc.

- Isolation and detection time, Impact criteria for consequences such as fire, explosion and toxic concentration.

3.4 Chemicals under QRA Study

A wide range of chemicals are handled and stored at the site; among these, ten raw materials have been specifically identified as both flammable and toxic, requiring enhanced safety measures and monitoring

All the hazardous solvent will be stored in HDPE barrels under room temperature

Table 1 Hazardous Properties of Chemicals

Sr. No.	Chemical Name	State at Room Temperature	Flash Point (°C)	Hazard Type	Hazardous Properties of Chemical
1	Isopropyl alcohol	Liquid	12	Flammable	Highly flammable; vapors can form explosive mixtures with air. Irritating to eyes and respiratory tract.
2	Acetone	Liquid	−20	Flammable	Extremely volatile and flammable. Can cause dizziness and respiratory irritation. May defat skin on contact.
3	Methylene dichloride	Liquid	39–40	Toxic	Volatile and toxic. Can cause central nervous system depression, liver damage, and is a potential carcinogen
4	Tetrahydrofuran	Liquid	−14	Flammable, Toxic	Forms explosive peroxides upon prolonged exposure to air. Toxic fumes; irritates eyes, skin, and respiratory tract.
5	n-Hexane	Liquid	−26	Flammable, Toxic	Neurotoxic with prolonged exposure. Highly flammable. Can cause peripheral neuropathy and skin irritation.

Sr. No.	Chemical Name	State at Room Temperature	Flash Point (°C)	Hazard Type	Hazardous Properties of Chemical
6	Toluene	Liquid	4	Flammable	Flammable and volatile. Can affect the central nervous system. May cause developmental toxicity with chronic exposure.
7	Ethyl acetate	Liquid	−4	Flammable	Flammable and volatile. Can cause eye and respiratory irritation. May lead to narcosis at high concentrations.
8	Acetonitrile	Liquid	2	Flammable, Toxic	Toxic and volatile. Can release cyanide upon metabolism. Affects liver and central nervous system.
9	Chloroform	Liquid	Nonflammable	Toxic, Reactive	Nonflammable but highly toxic. Can cause liver and kidney damage. Suspected carcinogen and may react with strong bases
10	Pet-ether	Liquid	−26	Flammable	Extremely flammable. Contains a mixture of hydrocarbons; inhalation can cause dizziness, nausea, and CNS effects.

3.5 Software Used:

PHAST and PHAST Risk (SAFETI) 9.0 Version.

The software developed by DNV is used for risk assessment studies involving flammable and toxic hazards where individual and societal risks are also to be identified. It enables the user to assess the physical effects of accidental releases of toxic or flammable chemicals.

PHAST is used for consequence calculations and PHAST Risk (SAFETI) is used for risk calculations. It contains a series of up to date models that allow detailed modeling and quantitative assessment of release rate pool evaporation, atmospheric dispersion, vapor cloud explosion, combustion, heat radiation effects from fires etc., The software is developed based on the hazard model given in TNO Yellow Book as the basis.

The software is developed based on the various incidents that had occurred over past 25 years. VAL has used the latest version of PHAST software for developing the consequences and risks for each model.

4 QRA METHODOLOGY

This section gives information about the methodology adopted for the QRA study.

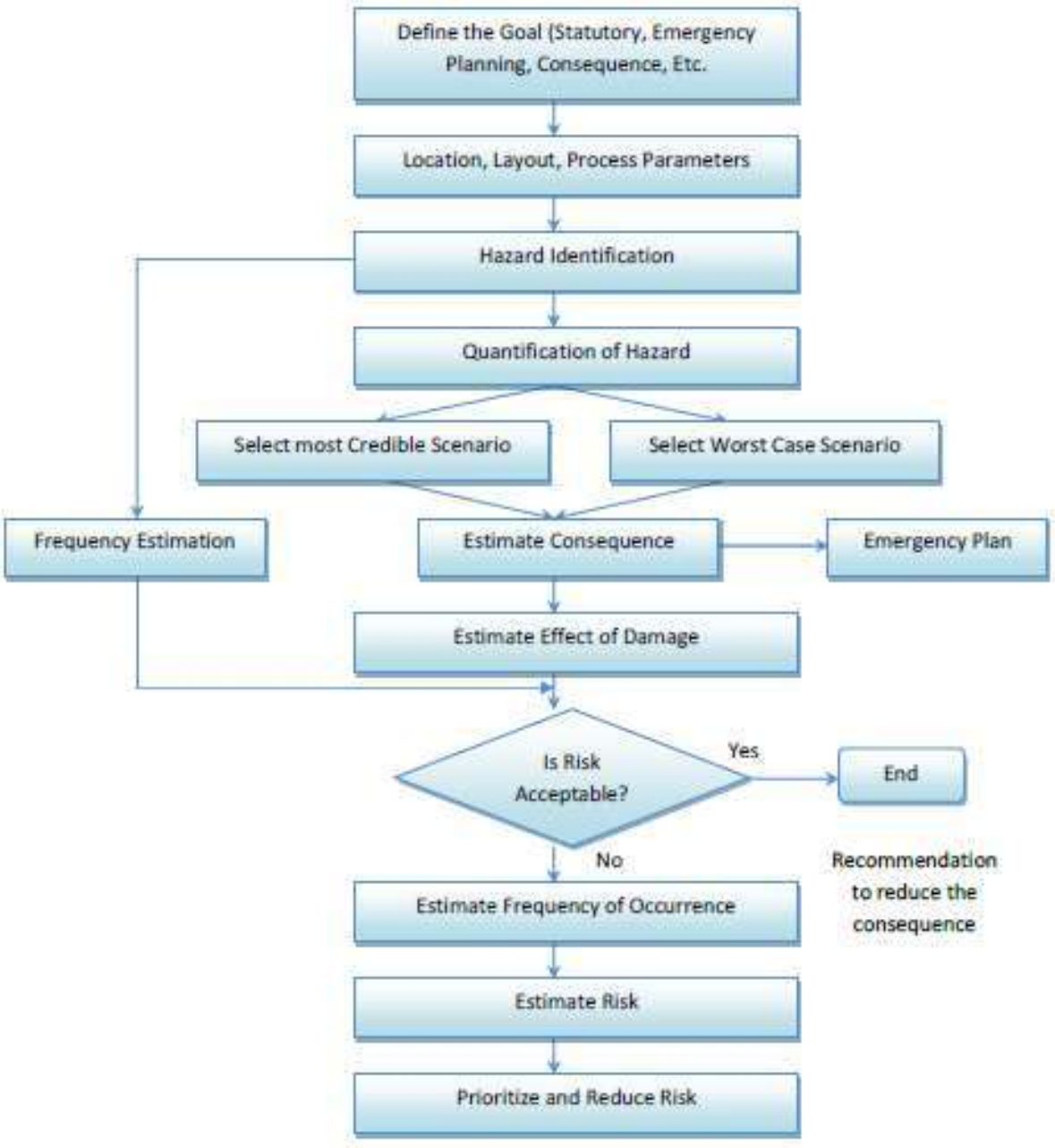


Figure 1 QRA Methodology

4.1 Detailed Methodology

Detailed methodology adopted for this QRA is explained as under –

1. Hazard Identification – A hazard is an undesired situation or event which may cause harm to people or to the environment, or damage to property. The main hazard from the facility is that of an uncontrolled release of hydrocarbons which may subsequently be ignited leading to fire.
2. Development of accident events – For the purposes of modeling, each hazard identified is further divided into scenarios or events e.g., Leaks, Ruptures etc.;
3. Consequence Modeling – The consequences (i.e., extent of hazards) arising from realization of these accidental events such as Jet Fires, Pool Fires, Toxic / Flammable Gas dispersion are calculated based on various models;
4. Source Term Modeling **–** Source term modeling has been carried out for each section to determine the release profile and release parameters for various loss of containment scenarios. Following inputs were considered for the source term modeling –
    a. Isolatable inventory and isolatable time
    b. Material flowing through
    c. Process Parameters
    d. Release Size (Hole mm)
    e. Release direction
    f. Weather conditions

    These parameters were determined based on the material flowing through, layout/ facility and assumptions developed for this project.
5. Frequency Analysis – The frequency of occurrence (i.e., likelihood of occurrence within a given period) of each accidental event occurring is estimated from historical data.
6. Ignition Probabilities **-** Based on the source term modeling results ignition probabilities were determined in line with criteria. The potential consequence events those can arise from loss of containment scenarios are driven by the ignition probability.
7. Risk Analysis – Based on the fatalities arising from the consequences and the frequency calculated for an accidental event, the risk from the hazard is determined in terms of individual risk;
8. Risk Summation – Risks associated with these accidental events are integrated to quantify the risk levels at the facility;
9. Benchmarking – The risks are benchmarked against Risk Acceptance Criteria to arrive at the list of events associated with “unacceptable” and “acceptable” risks;

5 HAZARD IDENTIFICATION

A classical definition of hazard states that hazard is in fact the characteristic of system/plant/process that presents potential for an accident. Hence all the components of a system/plant/process need to be thoroughly examined in order to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

In Risk Analysis terminology a hazard is something with the potential to cause harm. Hence the Hazard Identification step is an exercise that seeks to identify what can go wrong at the major hazard installation or process in such a way that people may be harmed. The output of this step is a list of events that need to be passed on to later steps for further analysis.

In order to identify hazards posed by the facility, it is very important to identify the type of hazards posed by the materials being handled. Material Composition plays very important role in the material property and thereby on the consequences.

A technique commonly used to generate an incident list is to consider potential leaks and major releases from fractures of all process pipelines and associated facilities. The containment is defined as one or several devices, any parts which are permanently in open contact with one another, and which are intended to contain one or multiple substances. A Loss of Containment is one containment system that will not lead to the release of significant quantities of hazardous substance from other containment systems.

The following data were collected to envisage scenarios:

- Composition of materials stored in storage tanks/drums/flowing through pipeline;
- Inventory of materials stored in storage tanks/drums/vessels/tank trucks;
- Flow rate of materials passing through pipelines;
- Storage tanks/pipeline conditions (phase, temperature, pressure);
- Connecting piping and piping dimensions.

Accidental release of flammable liquids/gases can result in severe consequences. Delayed ignition of flammable gases can result in blast overpressures covering large areas. This may lead to extensive loss of life and property. In contrast, fires have localized consequences. Fires can be put out or contained in most cases; there are few mitigating actions one can take once a flammable gas or a vapor cloud gets released. Major accident hazards arise, therefore, consequent upon the release of flammable gases.

5.1 Scenarios

A list of failure cases was prepared based on process knowledge, engineering judgment, experience, past incidents associated with such facilities and considering the general mechanisms for loss of containment.

The leak sizes are considered based upon the failure database for various facilities as under,

Table 2Leak sizes distribution

Leak Sizes		
Leak Description	Representative Hole Diameter	Remarks
Small (0 – 10 mm)	5 mm	Represents release due to failure of small-bore piping (instrument tapping, drain connection etc.).
Medium (10 – 50 mm)	25 mm	Represents leaks from flange joints and pump seals.
Large (50 – 150 mm)	100 mm	Represents release due to failure of large section of equipment or piping (e.g., damage due to external impact, failure of flexible pipe/ hose).
Rupture	>150mm	Represents release due to failure of large section of equipment or piping equivalent to its rupture / full bore release.

Above leak sizes are taken from Centre of Chemical Process Safety (CCPS) AIChE

Scenarios considered for QRA Report are as under –

Table 3 List of Scenarios for QRA

Sr No	Loss of containment	Storage Condition	Scenario
SC# 1.	Isopropyl alcohol	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 2.	Acetone	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 3.	Methylene dichloride	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.

Sr No	Loss of containment	Storage Condition	Scenario
SC# 4.	Tetrahydrofuran	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 5.	n-Hexane	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 6.	Toluene	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 7.	Ethyl acetate	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 8.	Acetonitrile	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 9.	Chloroform	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.
SC# 10.	Pet-ether	HDPE Drums	• Loss of Containment due to drum leak or full inventory exposure due to unsafe handling by operator.

6 METEOROLOGICAL DATA

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

6.1 Atmospheric Stability Classes

The tendency of the atmosphere to resist or enhance vertical motion and thus turbulence is termed as stability. Stability is related to both the change of temperature with height (the lapse rate) driven by the boundary layer energy budget, and wind speed together with surface characteristics (roughness).

A neutral atmosphere neither enhances nor inhibits mechanical turbulence. An unstable atmosphere enhances turbulence, whereas a stable atmosphere inhibits mechanical turbulence.

Stability classes are defined for different meteorological situations, characterized by wind speed and solar radiation (during the day) and cloud cover during the night. The so called Pasquill-Turner stability classes of dispersion estimates include Six (6) stability classes as below:

A – Very Unstable B – Unstable C – Slightly Unstable

D – Neutral E – Stable F – Very Stable

The typical stability classes for various wind speed and radiation levels during entire day are presented in table below -

Table 4Typical Pasquill Stability classes

Wind Speed (m/s)	Day : Solar Radiation			Night : cloud Cover		
	Strong	Moderate	Slight	Thin< 40%	Moderate	Overcast > 80%
<2	A	A-B	B	-	-	D
2-3	A-B	B	C	E	F	D
3-5	B	B-C	C	D	E	D
5-6	C	C-D	D	D	D	D
>6	C	D	D	D	D	D

6.2 Wind data

The wind conditions considered for the study are **2/F and 5/D.**

The following weather parameters will be taken as input for consequence modeling & risk calculation.

Ambient temperature: 33^0C (Average annual temperature)

Minimum Temperature: 16^0C

Maximum Temperature: 42^0C

Average Relative humidity: 60% (Average annual relative humidity)

Average Solar Radiation Flux: 1.380 Kw/m2

7 PROBABILITY ESTIMATIONS

Frequency analysis was conducted for each of the release scenarios identified based on the number of potential leak sources contained within each isolatable section. Leaks may occur from various components such as pipes, valves and flanges. Each component has a generic historical leak frequency per single item such as a leak frequency per flange-year or per meter of pipe per year.

7.1 Ignition Probability Estimation

Only a small portion of the potential releases will ignite to become a fire or explosion hazard. The others will disperse, evaporate or be controlled manually before getting in contact with an ignition source, but may poses toxic risks to those exposed. The probability that a release is ignited depends upon the size of the release and the presence of ignition sources within the release area.

Delayed ignition probabilities are classified by PHAST Risk into following categories:

- Fixed ignition point – This could relate to a fixed ignition point such as burners, hot surfaces, open flames, welding in the workshop etc. Considering that the new and existing facilities are classified for hazardous area, fixed ignition points would be limited.
- Electrical lines
- Static generation & Lightening

7.1.1 Immediate Ignition Probability:

Immediate ignition can be considered as the situation where the fluid ignites immediately on release through auto-ignition or because the accident which causes the release also provided an ignition source. Immediate ignition probability is assumed based on the CPR 18E - Guidelines for Quantitative Risk Assessment, developed by the Committee for the Prevention of Disasters, Netherlands.

Table 5 Probability of Immediate Ignition

Substance	Release rate, continuous	Release rate, instantaneous	Probability direct ignition
Flammable gases and liquids with flash point < 0 °C and boiling point < 35 °C with medium/ high reactivity	< 10 kg/s	< 1000 kg/s	0.2
	10 - 100 kg/s	1000 – 10.000 kg/s	0.5
	> 100 kg/s	>10.000 kg/s	0.7
	< 10 kg/s	< 1000 kg/s	0.02

Substance	Release rate, continuous	Release rate, instantaneous	Probability direct ignition
Flammable gases and liquids with flash point < 0 °C and boiling point < 35 °C with low reactivity	10 - 100 kg/s	1000 – 10.000 kg/s	0.04
	> 100 kg/s	>10.000 kg/s	0.09
Flammable liquid with flash point below 21 °C	All discharges	All discharges	0.065
Flammable liquid with flash point equal or higher than 21 °C but below 55 C	All discharges	All discharges	0.01
Flammable liquid with flash point higher than 55 °C	All discharges	All discharges	0

7.1.2 Delayed Ignition Probability:

Delayed ignition is the result of the build-up of a flammable vapour cloud which is ignited by a source remote from the release point. It is assumed to result in flash fires or explosions, and also to burn back to the source of the leak resulting in a jet fire and/or a pool fire. Delayed ignition probability is assumed based on the CPR 18E - Guidelines for Quantitative Risk Assessment, developed by the Committee for the Prevention of Disasters, Netherlands.

Table 6 Probability of Delayed Ignition

Source type	Ignition source	Probability of ignition
Point source	Adjacent process installation	0.5
	Flare	1.0
	Oven (outside)	0.9
	Oven (inside)	0.45
	Boiler (outside)	0.45
	Boiler (inside)	0.23
Line source	high-voltage cable (per 100 m)	0.2
	Ship	0.5
Population source	Households (per person)	0.01
	Offices (per person)	0.01

8 IMPACT CRITERIA

8.1 Effect Of Release

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

1. Dispersion of flammable vapor with wind till it reaches its lower flammability limit (LFL) or finds a source of ignition before reaching LFL, which will result in a flash fire or explosion.
2. Spillage of liquid flammable chemicals will result in a pool of liquid, which will evaporate taking heat from the surface, forming a flammable atmosphere above it. Ignition of this pool will result in pool fire causing thermal radiation hazards.
3. Catastrophic failure of tanks/ pressurized vessels, rotary equipment and valves etc. can result in equipment fragments flying and hitting other equipment of the plant.
4. Release of toxic compounds results in the toxic vapour cloud traveling over long distances, affecting a large area, before it gets sufficiently diluted to harmless concentration in the atmosphere.
5. The material is in two phases inside the containment - liquid & vapor. Depending on the location of the leak liquid or vapor will be released from the containment.
    a. If vapor is released a vapor cloud will form by the mixing of the vapor and air. The size of the vapor cloud will depend on the rate of release, wind speed; wind direction & atmospheric stability will determine the dispersion and movement of the vapor cloud.
    b. If liquid is released there will be some flashing as the boiling point of liquid is below the ambient temperature. The vapor formed by immediate flashing will behave as vapor release. The liquid will fall on the ground forming a pool. There will be vaporization from the pool due to the heat gained from the atmosphere & ground.

The behavior of material released by loss of containment depends on the following factors:

- Physical properties of the material
- Conditions of material in containment (pressure and temperature)
- Phase of material released (liquid or gas)
- Inventory of material released
- Weather parameters (temperature, humidity, wind speed, atmospheric stability)
- Material with boiling point below ambient condition

Impact criteria relate the modeling of the hazard effects to the resultant consequences to personnel and asset, and determines the nature and detail of results required from the simulation.

The impact criteria for personnel and equipment are summarized in the following sub-sections.

8.2 Radiation criteria

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

Table 7 Fetal Radiation Level

Radiation Level(KW/m$^{2)}$	Fatality		
	1%	50%	99%
	Exposure In Seconds		
4.0	150	370	930
12.5	30	80	200
37.5	8	20	50

Table 8Fetal radiation exposure level (Details)

Radiation (KW/m2)	Damage to Equipment	Damage to People
1.2	No damage	Solar heat at noon
1.6	PVC insulated cables damaged	Minimum level of pain threshold
2.0	No damage	No damage
4.0	No damage	Causes pain if duration is longer than 20 secs. But blistering is unlikely
6.4	No damage	Pain threshold reached after 8 secs. Second degree burns after 20 secs.
12.5	Minimum energy to ignite wood with a flame; Melts plastic tubing.	1% lethality in one minute. First degree burns in 10 secs
16.0	No damage	Severe burns after 5 secs.

Radiation (KW/m2)	Damage to Equipment	Damage to People
25.0	Minimum energy to ignite wood at identifying long exposure without a flame.	100% lethality in 1 minute. Significant injury in 10 secs.
37.5	Severe damage to plant	100% lethality in 1 minute. 50% lethality in 20 secs. 1% lethality in 10 secs.

Reference: CCPS, Guidelines for Chemical Process Quantitative Risk Analysis

The actual results would be less severe due to the various assumptions made in the models arising out of the flame geometry, emissivity, angle of incidence, view factor and others. The radiation output of the flame would be dependent upon the fire size, extent of mixing with air and the flame temperature. Some fraction of the radiation is absorbed by carbon dioxide and water vapor in the intervening atmosphere. Finally, the incident flux at an observer location would depend upon the radiation view factor, which is a function of the distance from the flame surface, the observer's orientation and the flame geometry.

8.3 Overpressure criteria

There is no simple relationship between overpressures and damage levels. However, some typical effects are shown in table below –

Table 9Over Pressure Damage Criteria with Damage to People

Over Pressure (mbar)	Mechanical Damage to Equipments	Damage To People
300	Heavy damage to plant & structure	1% death from lung damage >50% eardrum damage >50% serious wounds from flying objects
100	Repairable damage	>1% eardrum damage >1% serious wounds from flying objects
30	Major glass damage	Slight injury from flying glass
10	10% glass damage	No damage

Table 10 Over Pressure Damage Criteria with Damage to Equipment

Over Pressure		*Mechanical damage to Equipment*
Bar	K Pa	
0.0014	0.14	Annoying noise (137 dB if of low frequency 10–15 Hz)
0.0021	0.21	Occasional breaking of large glass windows already under strain
0.0028	0.28	Loud noise (143 dB), sonic boom, glass failure
0.0069	0.69	Breakage of small windows under strain
0.0103	1.03	Typical pressure for glass breakage
0.0207	2.07	Safe distance" (probability 0.95 of no serious damage below this value);projectile limit; some damage to house ceilings; 10% window glass broken
0.0276	2.76	Limited minor structural damage

Over Pressure		*Mechanical damage to Equipment*
Bar	K Pa	
0.03-0.069	3.4-6.9	Large and small windows usually shattered; occasional damage to window frames
0.048	4.8	Minor damage to house structures
0.069	6.9	Partial demolition of houses, made uninhabitable
0.138	13.8	Corrugated asbestos shattered; corrugated steel or aluminum panels, fastenings fail, followed by buckling; wood panels (standard housing)fastenings fail, panels blown in
0.09	9.0	Steel frame of clad building slightly distorted
0.138	13.8	Partial collapse of walls and roofs of houses
0.207	20.7	Concrete or cinder block walls, not reinforced, shattered
0.158	15.8	Lower limit of serious structural damage
0.172	17.2	50% destruction of brickwork of houses
0.207	20.7	Heavy machines (3000 lb) in industrial building suffered little damage; steel frame building distorted and pulled away from foundations.
0.207-0.276	20.7-27.6	Frameless, self-framing steel panel building demolished; rupture of oil tanks
0.276	27.6	Cladding of light industrial buildings ruptured
0.345	34.5	Wooden utility poles snapped; tall hydraulic press (40,000 lb) in building slightly damaged
0.345-0.482	34.5-48.2	Nearly complete destruction of houses
0.482	48.2	Loaded, lighter weight (British) train wagons overturned
0.482-0.551	48.2-55.1	Brick panels, 8 –12 in. thick, not reinforced, fail by shearing or flexure

Over Pressure		*Mechanical damage to Equipment*
Bar	K Pa	
0.62	62.0	Loaded train boxcars completely demolished
0.689	68.9	Probable total destruction of buildings; heavy machine tools (7,000 lb) moved and badly damaged, very heavy machine tools (12,000 lb) survive

As per the guidelines of CPR 18 E Purple Book:

- The lethality of a jet fire and pool fire is assumed to be 100% for the people who are caught in the flame. Outside the flame area, the lethality depends on the heat radiation distances.
- For the flash fires lethality is taken as 100% for all the people caught outdoors and for 10% who are indoors within the flammable cloud. No fatality has been assumed outside the flash fire area.
- Overpressure more than 0.3 bar corresponds approximately with 50% lethality.
- An overpressure above 0.2 bar would result in 10% fatalities.
- An overpressure less than 0.1 bar would not cause any fatalities to the public.
- 100% lethality is assumed for all people who are present within the cloud proper.

8.4 Toxic Dispersion criteria

The Probit constants of different toxic species will be sourced from TNO probit equation.

Impact distances for QRA will be established based on the following toxic concentrations to determine physical effects of hazard events:

STEL Concentration (for 15 minutes) short-term, acute, reversible effects;

IDLH concentration (for 30 minutes) long-terms or irreversible effects which may lead to fatality

8.5 Risk

Risk is defined as the probability that within a fixed time period, usually one year, an unwanted effect occurs. Consequently, risk is a dimensionless number. However, risk is often expressed in units of frequency, 'per year'. Since failure frequencies are low, the probability that an unwanted effect will occur within a fixed time period of one year is, practically speaking, equal to the frequency of occurrence per year.

Risk is the unwanted consequences of an activity connected with the probability of occurrence.

8.6 Risk Criteria

In India, there are no defined criteria for risk acceptance. However, in IS 15656 – Code of Practice for Hazard Identification and Risk Analysis, following table summarizes the risk criteria adopted in some countries.:

Table 11 Risk Criteria in some countries

Authority and Application	Maximum Tolerable Risk (Per Year)	Negligible Risk (Per Year)
VROM, The Netherlands (New)	1.0E-6	1.0E-8
VROM, The Netherlands (Existing)	1.0E-5	1.0E-8
HSE, UK (Existing Hazardous Industry)	**1.0E-4**	**1.0E-6**
HSE, UK (New Industries)	1.0E-5	1.0E-6
HSE, UK (Substance Transport)	1.0E-4	1.0E-6
HSE, UK (New Housing Near Plants)	3 x 1.0E-6	3 x 1.0E-7
Hong Kong Government (New Plants)	1.00E-5	Not Used

To achieve the above risk acceptance criteria, ALARP principle was followed while suggesting risk reduction recommendations.

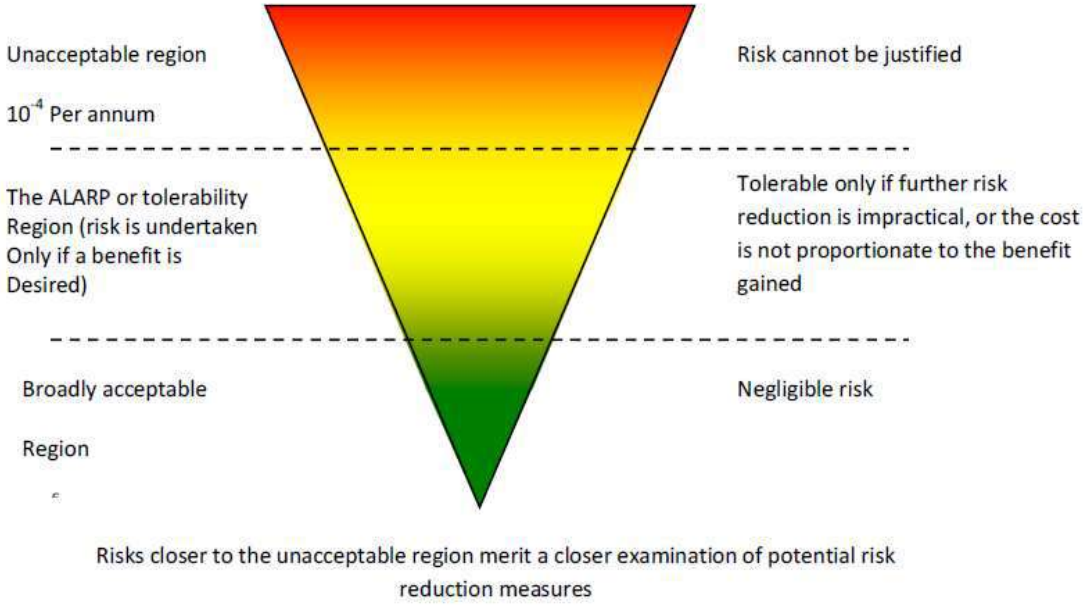


Figure 2 Individual Risk (IR) Acceptance Criteria

9 CONSEQUENCE ANALYSIS

Consequence analysis is carried out to determine the extent of spread (dispersion) by accidental release which may lead to jet fire or explosion resulting into generating heat radiation, overpressures, explosion impact etc.

9.1 Release Duration

CCPS QRA guidelines, chapter 7.2 – Consequence analysis, also mentions about leak duration. The duration of a release is dependent upon length of the following distinct time periods within its history –

• Time to detect;

• Time to isolate;

• Time to discharge remaining inventory.

The total release duration is the sum of these three periods.

We have considered 5 min release duration for actual closure of valve after detection and isolation of leak to control and restrict the inventory release to atmosphere.

9.2 Release Rates

A release is modeled using a representative hole size or by fixing the release rate for a given scenario. In this assessment, the former method was used as the hole size is a major factor in influencing the characteristics of a release and determines the initial hydrocarbon mass release rate as well as release duration.

Based on the hole sizes, material properties and operating / storage conditions, the corresponding initial release rates for fire modeling are obtained from PHAST.

Release rate is a direct function of operating pressure and hole size. As the hole size increases, release rate is also increased. Also, the sections where the pressure is high, release rate is also high.

9.3 Types of outcome events

9.3.1 Unignited Gas Release / Dispersion

A vapor cloud may be formed when a vaporizing liquid is released for an extended duration. If the gas cloud does not immediately ignite, it disperses based on the prevalent wind direction, speed and stability category (i.e. degree of turbulence).

The cloud dispersion simulation is carried out for the following objective:

It provides the distance (from the leak) at which the concentration of flammable material falls below the Lower Flammability Limit (LFL).

9.3.2 Flash Fire

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

9.3.3 Pool Fire

The released flammable material which is a liquid stored below its normal boiling point, will collect in a pool. The geometry of the pool will be dictated by the surroundings. If the liquid is stored under pressure above its normal boiling point, then a fraction of the liquid will flash into vapour and the remaining portion will form a pool in the vicinity of the release point. Once sustained combustion is achieved, liquid fires quickly reach steady state burning. The heat release rate is a function of the liquid surface area exposed to air. An unconfined spill will tend to have thin fuel depth (typically less than 5 mm) which will result in slower burning rates. A confined spill (not applicable in this project) is limited by the boundaries (e.g. a dyke area) and the depth of the resulting pool is greater than that for an unconfined spill.

Pool fires are less directional and so may affect a larger area although it is mostly influenced by wind conditions. They will also cause structural failure of equipment although the time taken is longer than jet fires.

9.3.4 Toxic Effects

Hazardous chemicals containing toxic material like CO/H2S/Sox/NOx form a toxic plume, which when exposed to can cause adverse health effects or fatalities, depending on the level of exposure. The effects and severity of exposure normally depend on the duration of exposure and the concentration of the toxic substance. Short-term exposures to high concentrations result in acute effects while long term exposures to low concentrations result in chronic effects.

9.4 Consequence Results

9.4.1 Dispersion Results

Path	Weather	Distance to UFL [m]	Distance to LFL [m]	Distance to LFL fraction [m]
Study\IPA	Category 2/F	2.00487	4.77587	7.25438
	Category 5/D	2.30584	8.14317	14.7245
Study\Acetone	Category 2/F	4.97525	11.1484	15.2108
	Category 5/D	5.6476	19.2175	28.8772
Study\Methylene dichloride	Category 2/F	6.99662	9.07472	11.9316
	Category 5/D	6.00581	8.89905	13.8917
Study\Tetrahydro furan	Category 2/F	5.68947	12.8555	17.6815
	Category 5/D	6.86212	22.5341	33.0549
Study\n-Hexane	Category 2/F	5.68947	12.8555	17.6815
	Category 5/D	6.86212	22.5341	33.0549
Study\Toluene	Category 2/F	1.96037	5.07653	7.38436

Path	Weather	Distance to UFL [m]	Distance to LFL [m]	Distance to LFL fraction [m]
	Category 5/D	2.26121	8.78845	15.3847
Study\Ethyl acetate	Category 2/F	4.97525	11.1484	15.2108
	Category 5/D	5.6476	19.2175	28.8772
Study\Acetonitrile	Category 2/F	2.03697	5.47893	9.06363
	Category 5/D	2.39326	7.10657	13.821
Study\Pet-ether	Category 2/F	15.3844	29.6121	39.2287
	Category 5/D	17.134	40.4343	57.0358

9.4.2 Late Pool Fire Results

Path	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\IPA	Category 2/F	15.9286	41.25	26.1876	12.2585
	Category 5/D	15.9677	42.7043	28.4331	13.3406
Study\Acetone	Category 2/F	15.7938	47.539	29.7581	13.6493
	Category 5/D	15.6871	49.2039	32.5439	15.2482
Study\Methylene dichloride	Category 2/F	12.1305	15.0755	7.37555	Not reached at height of interest
	Category 5/D	11.9354	17.3331	7.23278	Not reached at height of interest
Study\Tetrahydro furan	Category 2/F	17.2863	41.3424	23.4835	15.0683
	Category 5/D	17.1877	42.5397	24.3469	16.774
Study\n-Hexane	Category 2/F	17.2863	41.3424	23.4835	15.0683
	Category 5/D	17.1877	42.5397	24.3469	16.774

Path	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\Toluene	Category 2/F	15.1615	37.7656	18.4242	9.47347
	Category 5/D	15.2038	41.1451	20.5366	9.42809
Study\Ethyl acetate	Category 2/F	15.7938	47.539	29.7581	13.6493
	Category 5/D	15.6871	49.2039	32.5439	15.2482
Study\Acetonitrile	Category 2/F	15.8317	24.402	15.2204	Not reached at height of interest
	Category 5/D	15.8271	25.0901	17.0351	Not reached at height of interest
Study\Pet-ether	Category 2/F	17.3753	42.6	24.6981	15.7914
	Category 5/D	16.8467	43.0617	25.8374	17.8644

9.4.3 Flash Fire Results

Path	Weather	Distance downwind to LFL [m]	Distance downwind to LFL Fraction [m]
Study\IPA	Category 2/F	4.77587	7.25438
	Category 5/D	8.14317	14.7245
Study\Acetone	Category 2/F	11.1484	15.2108
	Category 5/D	19.2175	28.8772
Study\Methylene dichloride	Category 2/F	9.07472	11.9316
	Category 5/D	8.89905	13.8917
Study\Tetrahydro furan	Category 2/F	12.8555	17.6815
	Category 5/D	22.5341	33.0549
Study\n-Hexane	Category 2/F	12.8555	17.6815
	Category 5/D	22.5341	33.0549
Study\Toluene	Category 2/F	5.07653	7.38436

Path	Weather	Distance downwind to LFL [m]	Distance downwind to LFL Fraction [m]
	Category 5/D	8.78845	15.3847
Study\Ethyl acetate	Category 2/F	11.1484	15.2108
	Category 5/D	19.2175	28.8772
Study\Acetonitrile	Category 2/F	5.47893	9.06363
	Category 5/D	7.10657	13.821
Study\Pet-ether	Category 2/F	29.6121	39.2287
	Category 5/D	40.4343	57.0358

9.4.4 Explosion Results

Path	Weather	Overpressure level [bar]	Maximum distance [m]	Diameter [m]
Study\IPA	Category 5/D	0.02068 0.1379 0.2068	23.9651 12.7142 12.035	27.9302 5.42842 4.07002
Study\Acetone	Category 2/F	0.02068 0.1379 0.2068	52.1964 18.2012 16.1489	84.3929 16.4023 12.2978
	Category 5/D	0.02068 0.1379 0.2068	75.8462 28.9339 26.6983	131.692 17.8677 13.3965
Study\Methylene dichloride	Category 2/F	0.02068 0.1379 0.2068	40.2279 15.875 14.4048	60.4558 11.75 8.80969
	Category 5/D	0.02068 0.1379 0.2068	51.4183 18.0499 16.0355	82.8365 16.0998 12.071

Path	Weather	Overpressure level [bar]	Maximum distance [m]	Diameter [m]
Study\Tetrahydro furan	Category 2/F	0.02068 0.1379 0.2068	57.4957 19.2311 16.9211	94.9913 18.4622 13.8423
	Category 5/D	0.02068 0.1379 0.2068	85.5083 32.732 29.546	131.017 25.464 19.0919
Study\n-Hexane	Category 2/F	0.02068 0.1379 0.2068	57.4957 19.2311 16.9211	94.9913 18.4622 13.8423
	Category 5/D	0.02068 0.1379 0.2068	85.5083 32.732 29.546	131.017 25.464 19.0919
Study\Toluene		0.02068 0.1379 0.2068	28.9678 13.6865 12.764	37.9356 7.37304 5.52802
Study\Ethyl acetate	Category 2/F	0.02068 0.1379 0.2068	52.1964 18.2012 16.1489	84.3929 16.4023 12.2978

Path	Weather	Overpressure level [bar]	Maximum distance [m]	Diameter [m]
	Category 5/D	0.02068 0.1379 0.2068	75.8462 28.9339 26.6983	131.692 17.8677 13.3965
Study\Acetonitrile		0.02068 0.1379 0.2068	No hazard No hazard No hazard	0 0 0
Study\Pet-ether	Category 2/F	0.02068 0.1379 0.2068	142.083 51.7841 46.3329	224.166 43.5682 32.6658
	Category 5/D	0.02068 0.1379 0.2068	165.711 65.7034 61.7738	271.422 31.4069 23.5477

9.4.5 Toxic Results

Toxic Concentration Level	Exposure Threshold	Distance from Source
AEGL-3 (Life-threatening)	~500 ppm (10 min)	55 meters
AEGL-2 (Irreversible effects)	~200 ppm (10 min)	121 meters
AEGL-1 (Discomfort threshold)	~50 ppm (10 min)	228 meters
IDLH (Immediately Dangerous to Life or Health)	500 ppm	60 meters
ERPG-2 (Emergency Response Planning Guideline)	200 ppm	120 meters

10 RISK ANALYSIS

A Quantitative Risk Analysis (QRA) is a method used to determine the risk caused by the use, handling, transport and storage of hazardous substances. The results of the QRA are, for example, used to assess the acceptability of the risk in relation to the benefits of the activity, to evaluate new developments on and off-site, to estimate the benefit of risk-reducing countermeasures and to determine zoning distances around an activity for land-use planning.

The LSIR was estimated based on component failure frequencies and event probability for release scenarios. Note that the LSIR levels represent the cumulative risk from all the major accident events at the project facilities without taking into account personnel exposure factor, vulnerability and probability of escape.

The overall Location Specific Risk is developed considering all scenarios pertaining to all Isolatable Sections and are provided in Sections below.

10.1 Individual Risk Per Annum (IRPA)

Individual Risk Per Annum (IRPA) is calculated based on the presence of personnel near/within the hazardous facilities.

IRPA = ∑ LSIR x presence factor

Presence factor for this facility was calculated with the following assumptions.

No of Days in a year	365
No. of days as weekends (Sunday)	52
No. of Festivals	13
No. of working days	313
No. of hours in a day	24
No. of hours in a shift	8

$$Presence\ Factor = \frac{No.of\ working\ days}{No.of\ days\ in\ a\ year} \times \frac{No.of\ hours\ in\ a\ shift}{No.of\ hours\ in\ a\ day}$$

Presence Factor = (300/365)* Fraction of time spent in a day/ shift = 0.82*0.8 = 0.66

The calculated IRPA to the personnel in hazardous area i.e. for populated locations; are calculated and presented below and assessed by comparing with UK HSE risk criteria. It is clear from following table , none of the personnel are exposed to unacceptable risk i.e. risk greater than 1.0E-03 per year. The IRPA to all the personnel categories are in acceptable limits.

Table 12 Individual Risk Outcomes

S.No	Personnel located inside the facility	Presence Factor	LSIR Value	IRPA	Risk Level
1	Canteen Block	0.66	4.14E-07	2.73E-07	**ACCEPTABLE**
2	R&D	0.66	4.46E-06	2.93E-06	**ACCEPTABLE**
3	Warehouse	0.66	4.84E-06	3.19E-06	**ACCEPTABLE**
4	Production Area	0.66	5.73E-06	3.77E-06	**ACCEPTABLE**
5	Office Block	0.66	2.54E-07	3.31-07	**ACCEPTABLE**

10.2 Societal Risk

Assessment of societal risk is even more important than assessment of individual risk because the involve the likelihood of multiple fatalities. Societal risk is the risk to any person or group of persons who are not connected to project facilities and are outside the facility fence line.

It helpful to consider group risk in the demonstration that risks are ALARP. This allows consideration to be given to events, which, although low in frequency, may cause multiple injuries or fatalities. Group risk can be presented in the form of a plot of cumulative frequency versus number of fatalities (F-N curve).

where,

F= frequency (experienced or predicted)

N=no. of multiple fatalities

It should be noted that 'N' included indirect deaths caused as a result of the main event occurring and can therefore be difficult to predict. E.g. many people may die years after exposure to a toxic chemical.

The Societal Risk in the form of FN Curve is presented in the following Figure;

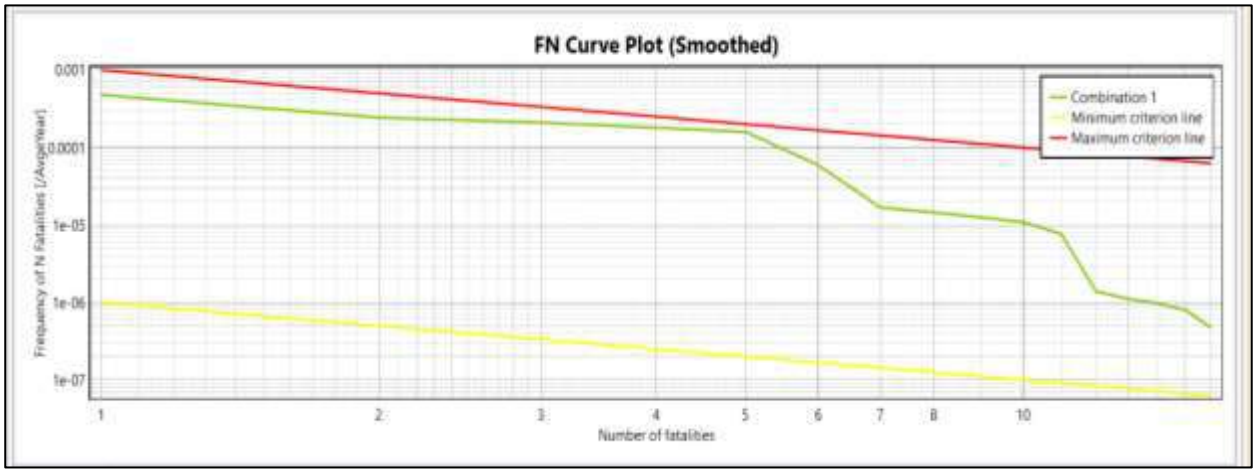


Figure 3 FN Curve

Based on the FN Curve analysis, the maximum envisaged scenario corresponds to one fatality occurring at a frequency of once per 10,000 years (1×10^{-4} per year). According to UK HSE guidelines, this places the risk within the ALARP (As Low As Reasonably Practicable) zone. Therefore, it is essential to ensure that engineering and administrative controls remain robust and effective throughout the operational life of the company. In addition, routine monitoring and maintenance of existing control measures shall be consistently carried out to sustain risk at ALARP levels.

11 RECOMMENDATIONS

The facility can be operated safely if Operational Discipline is strictly maintained.

Some of the points in this regard are as follows –

- No quantity of raw materials in excess of the stipulated quantities should be stored in the plant (this possibility always exists since many times 'convenience overrides safety' and to save manpower, more that required / desired quantities are brought and stored in the running plant
- Considering the hazard potential, lot of thrust should be given on the instrumentation and interlocks, without compromising on the quality of the hardware used for instrumentation
- SOPs should be written specifically (quality of some of the existing SOPs scrutinized was very poor, not only from correctness of language point of view but these failed to convey the correct / safe meaning of the intent of doing the activity.
- Strict adherence to all SOPs by all levels of employees should be ensured. Any deviation cab result in serious results and hence should be strictly reprimanded.
- P.M. schedules should be drawn and followed very rigorously. A small lapse will prove to be disastrous.
- All elements of Process Safety Management (particularly Process Hazard Identification, Management of Change) should be strictly adhered to.

11.1 Risk Reduction Measures

Safety Measures for Transportation and Unloading of Hazardous Chemicals

- Solvent unloading standard procedure will in place and will be implemented for safe unloading of road tanker.
- Drum handling trolleys will be used for transportation of drums up to plant and internal handling from storage to process area.
- Display Boards will be provided on all storage tanks which include the name of the chemicals and its major hazardous characteristics.
- Fire extinguishers will be provided as required.
- First aids boxes will also be provided at different places wherever required.
- Area will be declared as "NO SMOKE ZONE".

Safety Measures for Preventive Maintenance

The safety measures in the form of the general Do's & Don'ts for safety:

- Do not work on equipments without permission from plant head and maintenance head.
- Make sure equipment is empty and flushed with nitrogen and air.
- Check VOC content for flammable / toxic and make sure that no flammable / toxic vapour contents.
- Keep proper and adequate fire extinguisher near work area.
- Use proper PPE.
- Work in any equipment must be conducted in presence of supervisor.

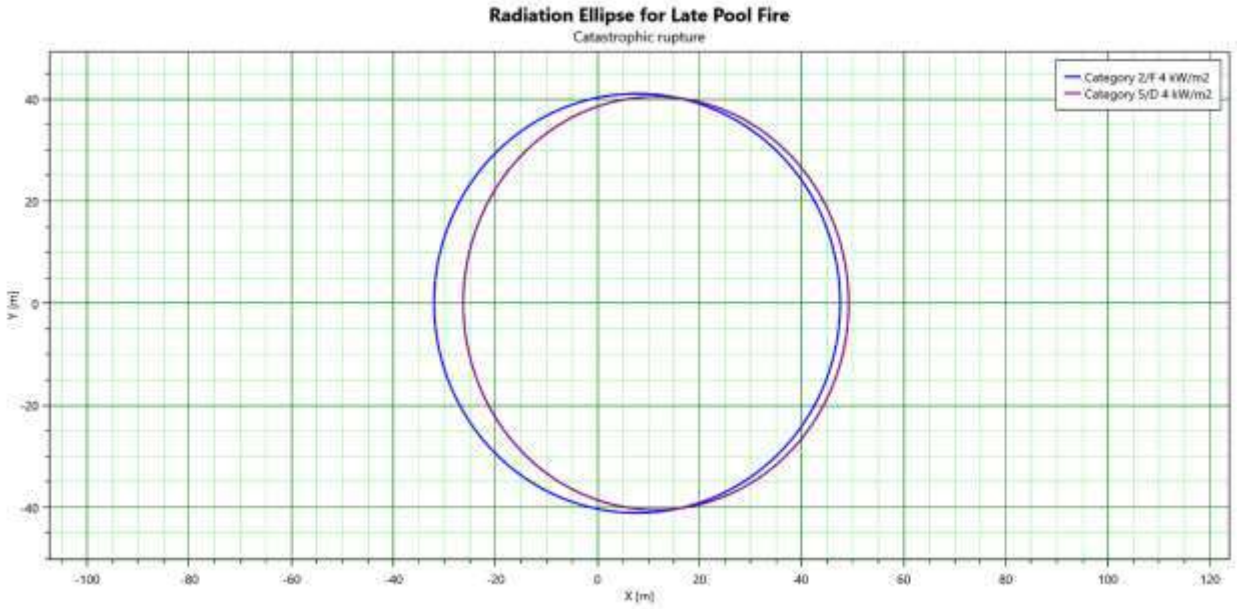
- Additional safety measures in form of the checklist covering Do's & Don'ts of preventive maintenance, strengthening of HSE, manufacturing utility staff for safety related measures will be updated timely and will be made available to all concern department & personnel.

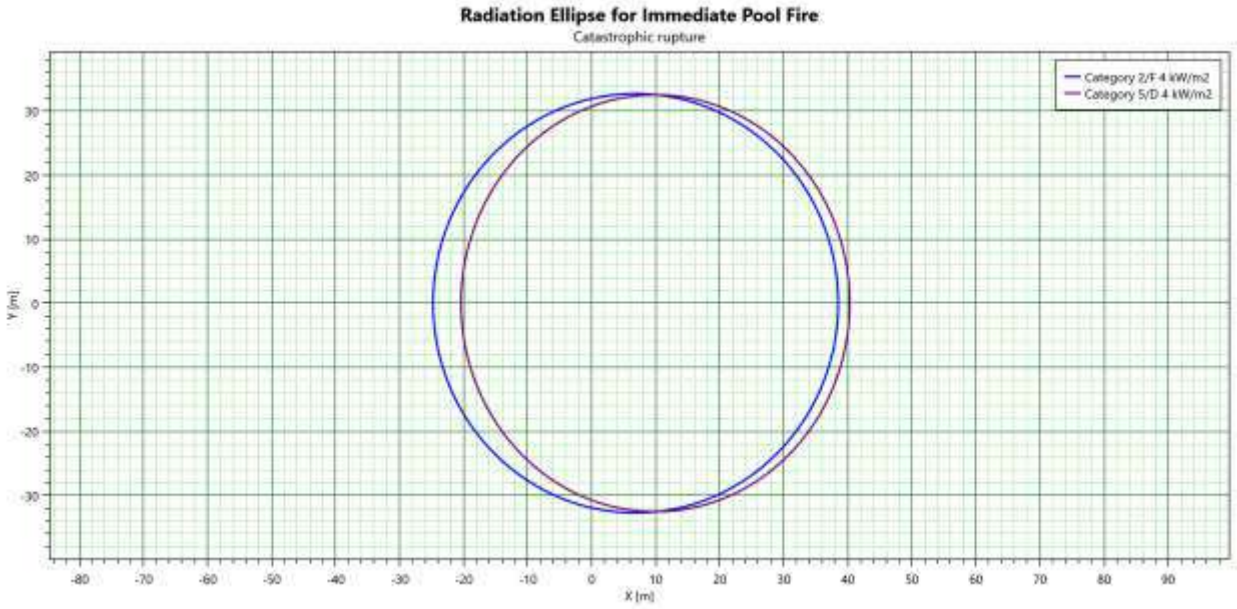
Safety measures to prevent spillage/leakage of toxic chemicals

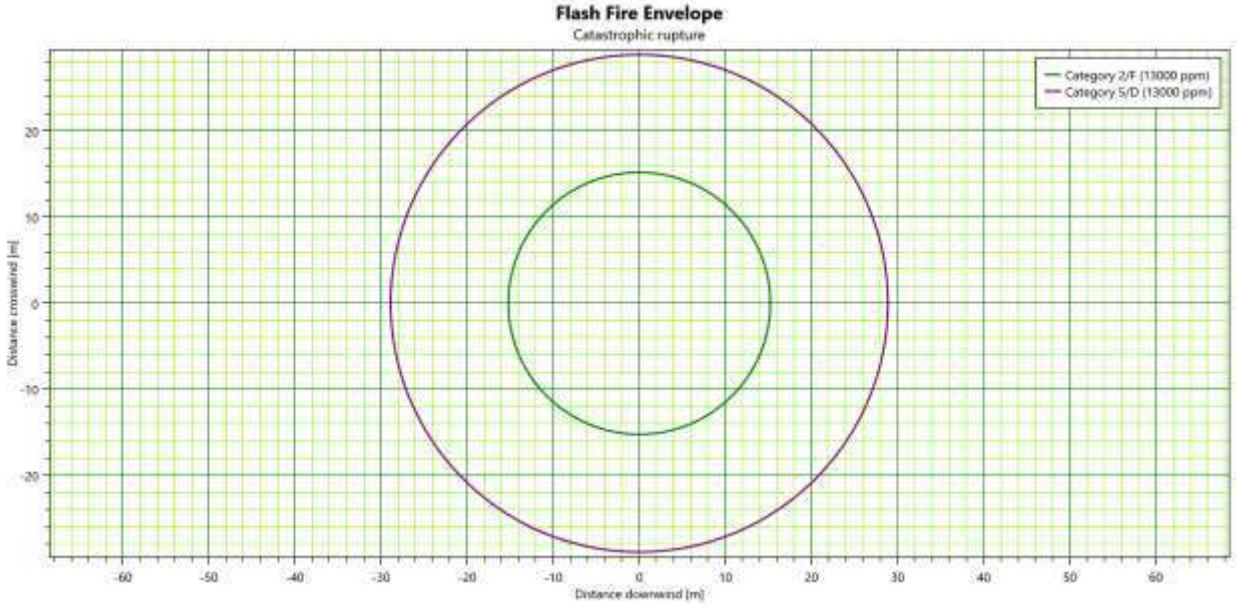
The preventive maintenance will be planned and carried out as per plan to avoid the failure of valve, pipelines and other component of transferring line. The spillage will be confined to the dyke area underneath the vessel. The resultant splash of such chemicals will result in exposure of toxic chemicals to employees. Decontamination facilities (Safety shower and eye wash fountains) will be provided in the plant area, which can be used to decontaminate the affected employees. Suitable decontamination procedure will be used to decontaminate the spilled or leaked material. The SOP for decontamination will be available with all related department.

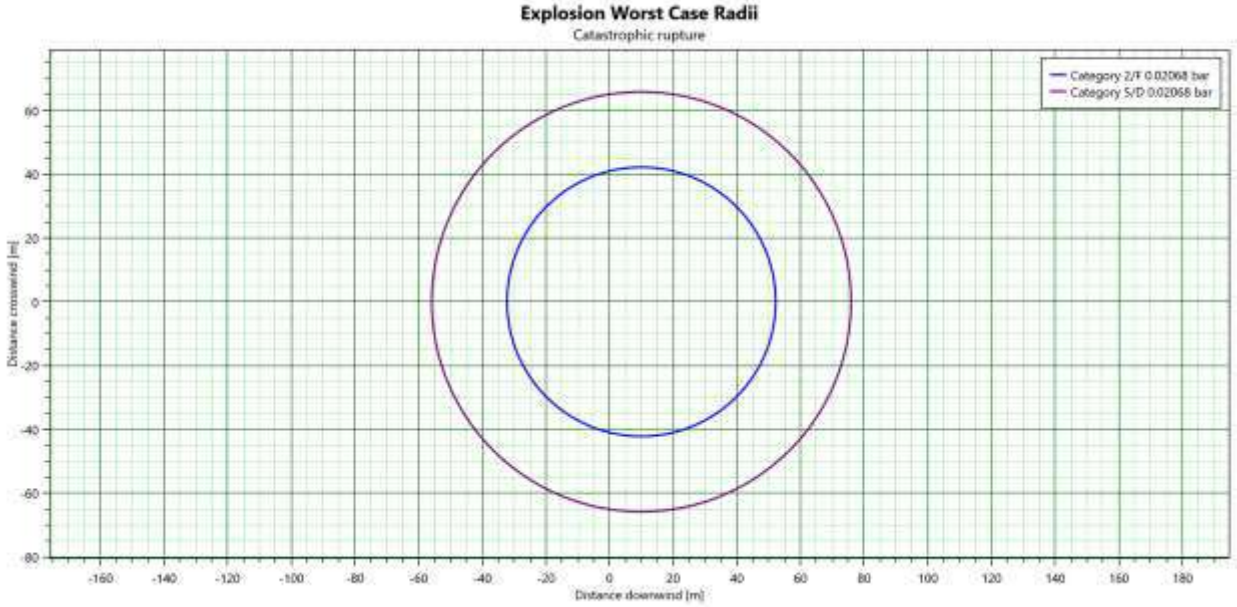
12 GRAPHICAL PRESENTATION

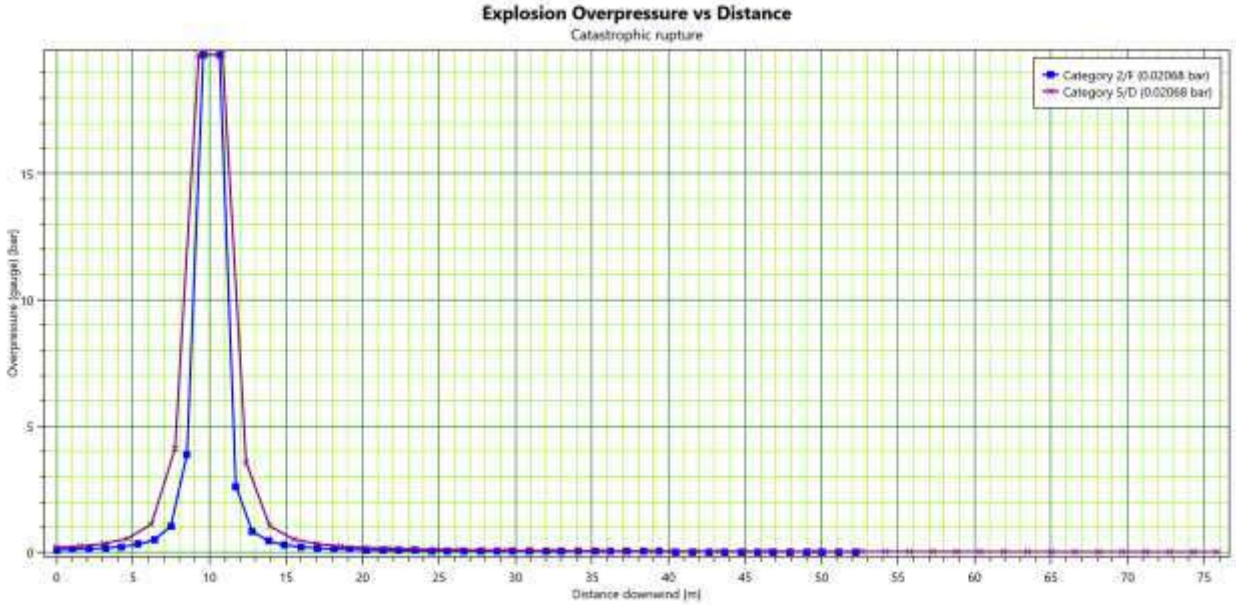
12.1 Acetone

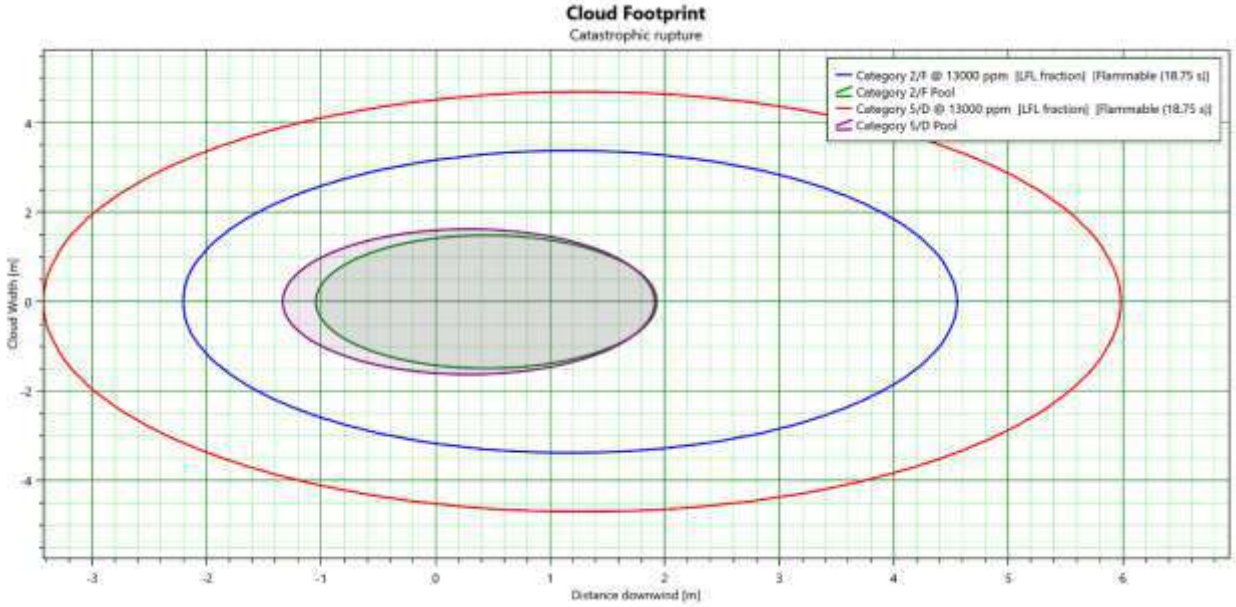




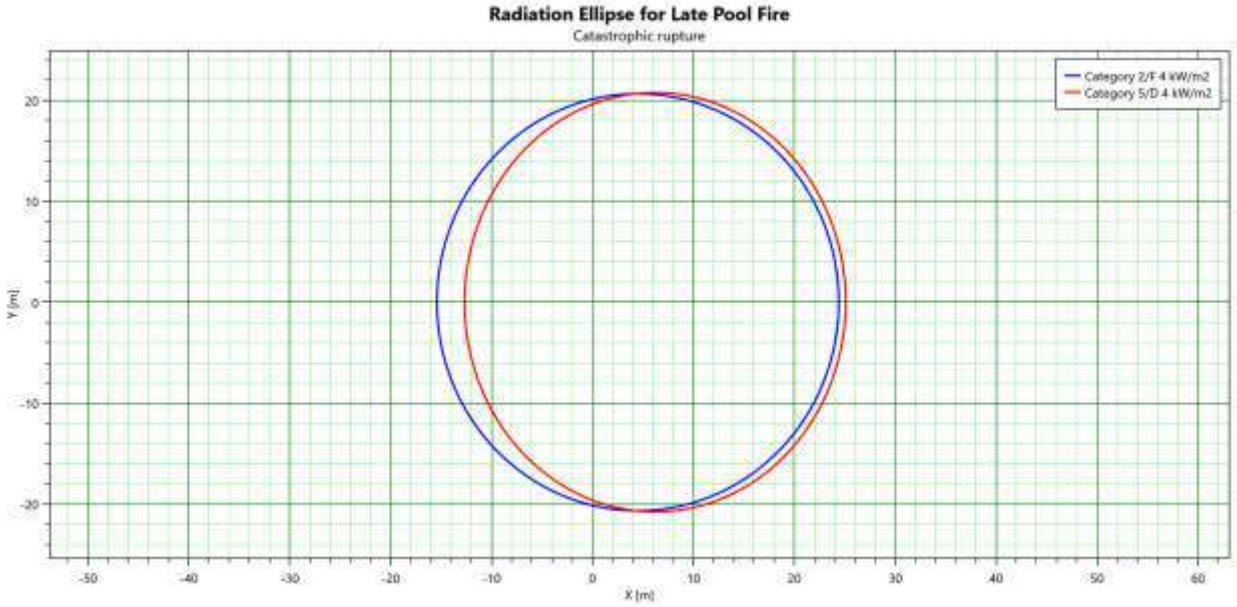

Flash Fire Envelope
Catastrophic rupture
Category 2/F (13000 ppm)
Category 5/D (13000 ppm)
Distance crosswind [m]
Distance downwind [m]

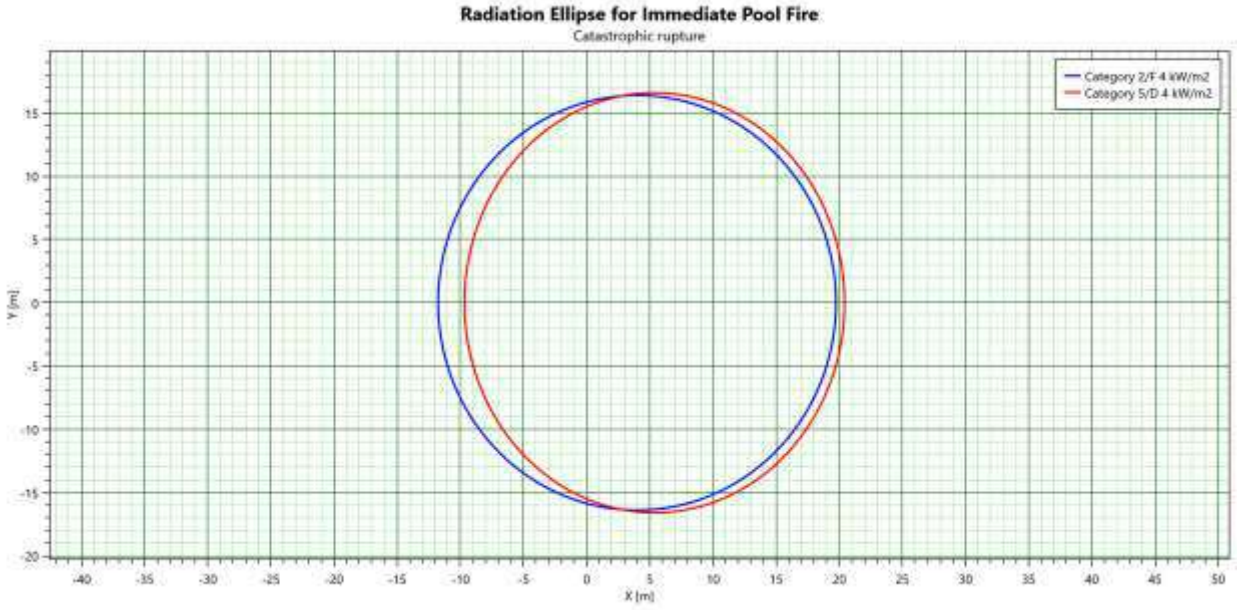

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F 0.02068 bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

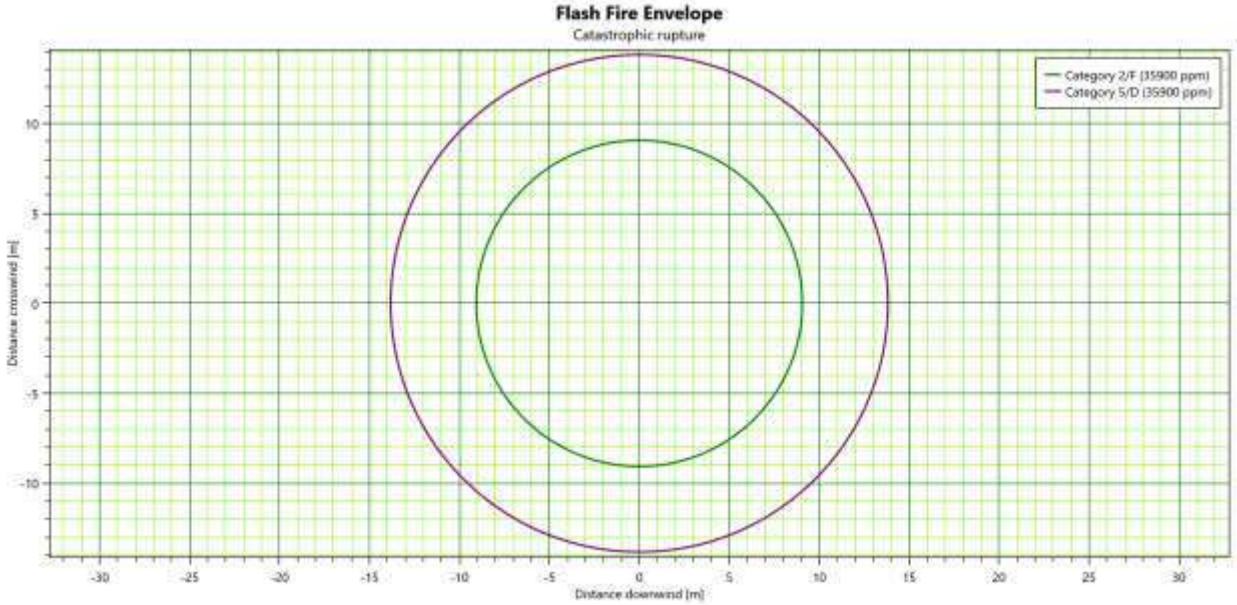

Explosion Overpressure vs Distance
Catastrophic rupture
Category 2/F (0.02068 bar)
Category 5/D (0.02068 bar)
Overpressure (gauge) [bar]
Distance downwind [m]

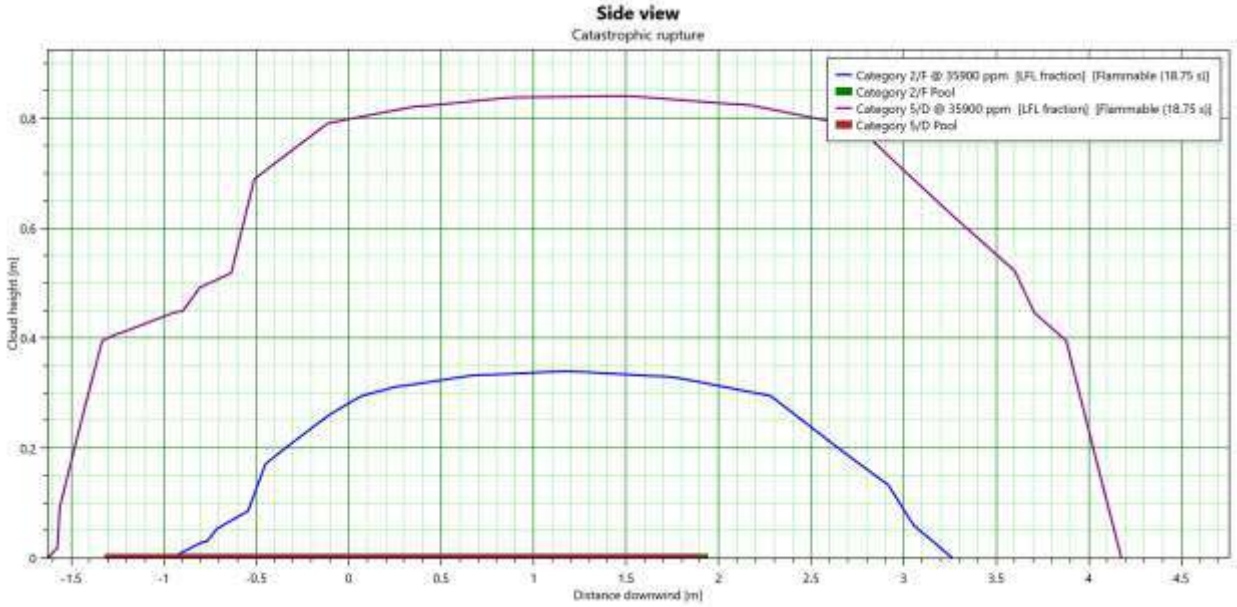

Cloud Footprint
Catastrophic rupture
Category 2/F @ 13000 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 13000 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

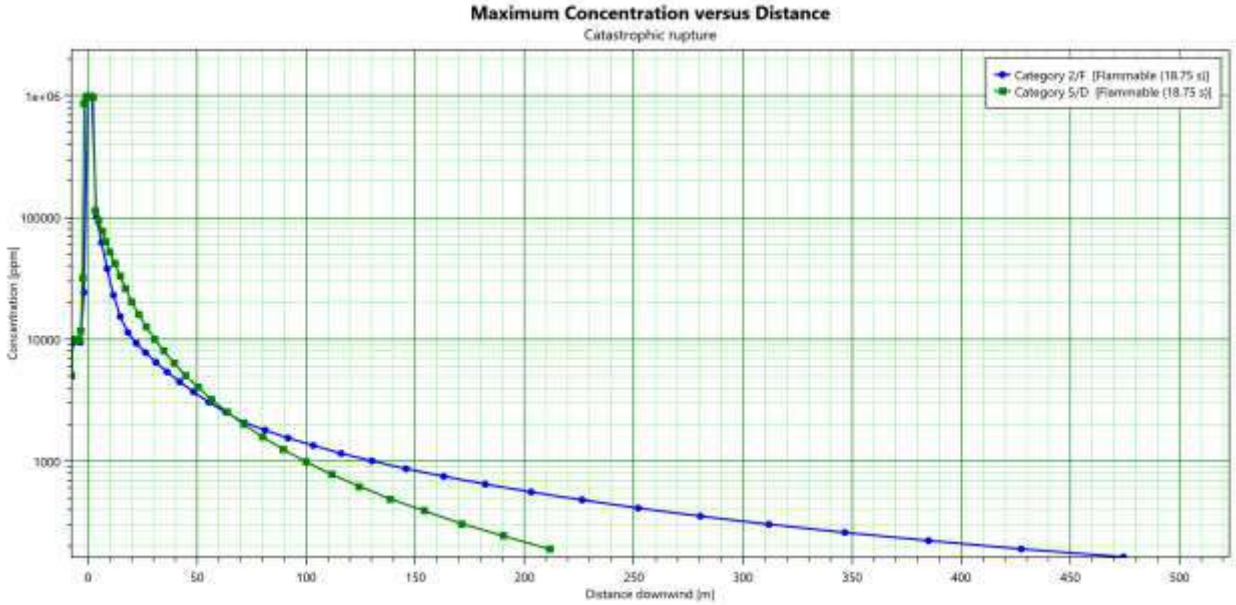
12.2 acetonitrile

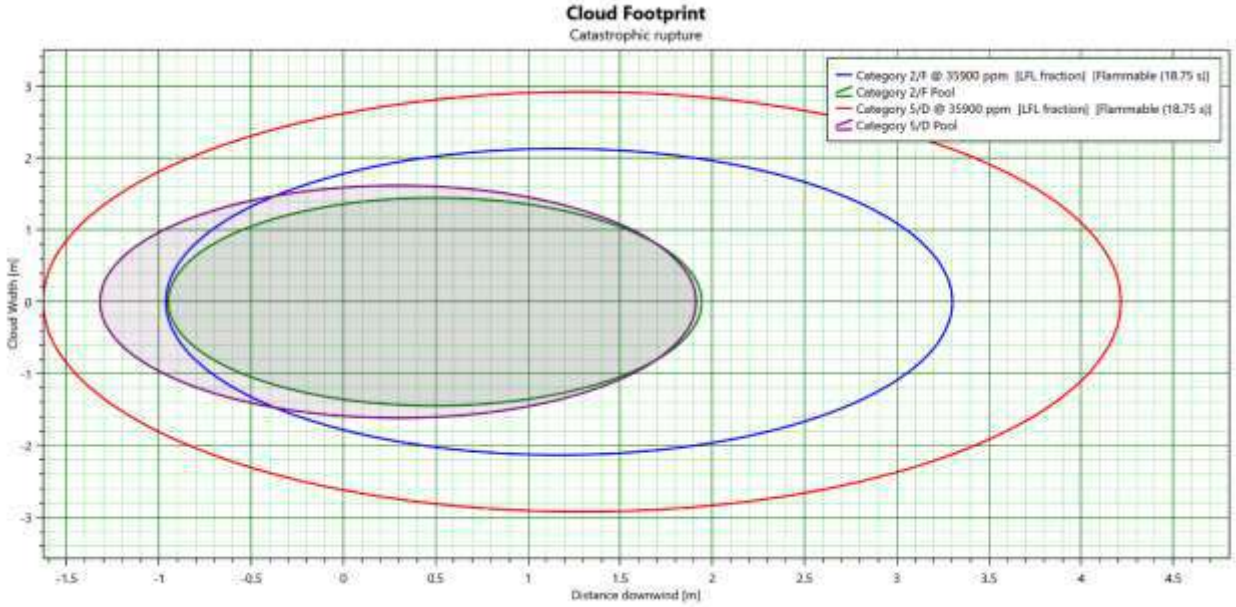





Flash Fire Envelope
Catastrophic rupture
Category 2/F (35900 ppm)
Category 5/D (35900 ppm)
Distance crosswind [m]
Distance downwind [m]

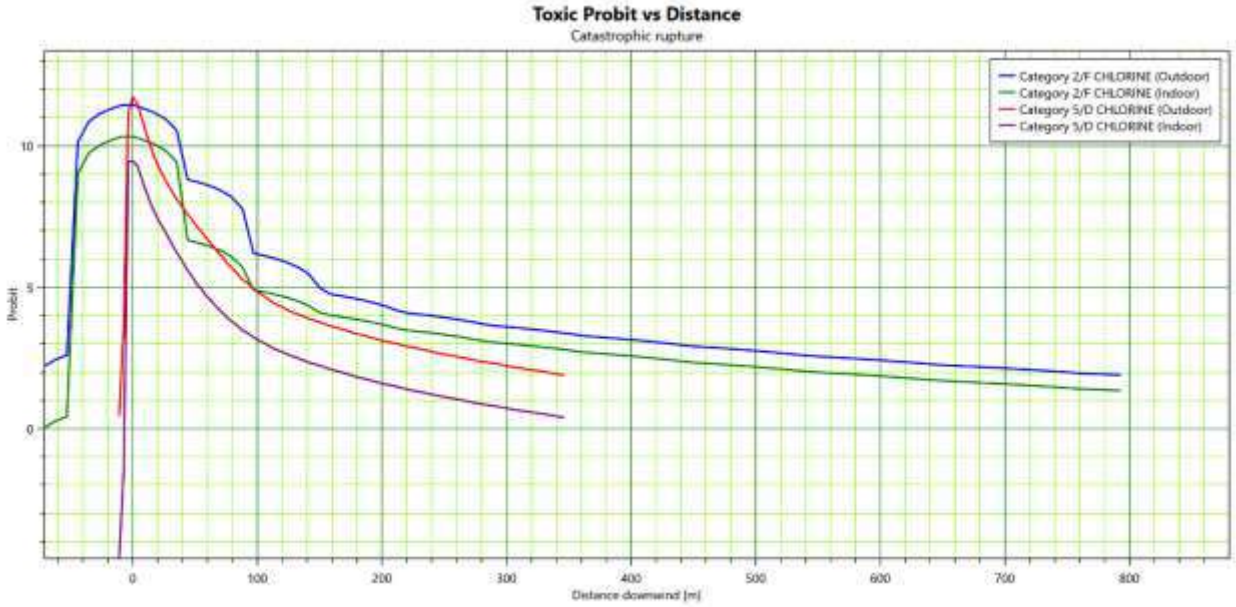

Side view
Catastrophic rupture
Category 2/F @ 35900 ppm [LFL fraction] [Flammable (18.75 s)]
Category 2/F Pool
Category 5/D @ 35900 ppm [LFL fraction] [Flammable (18.75 s)]
Category 5/D Pool
Cloud height [m]
Distance downwind [m]

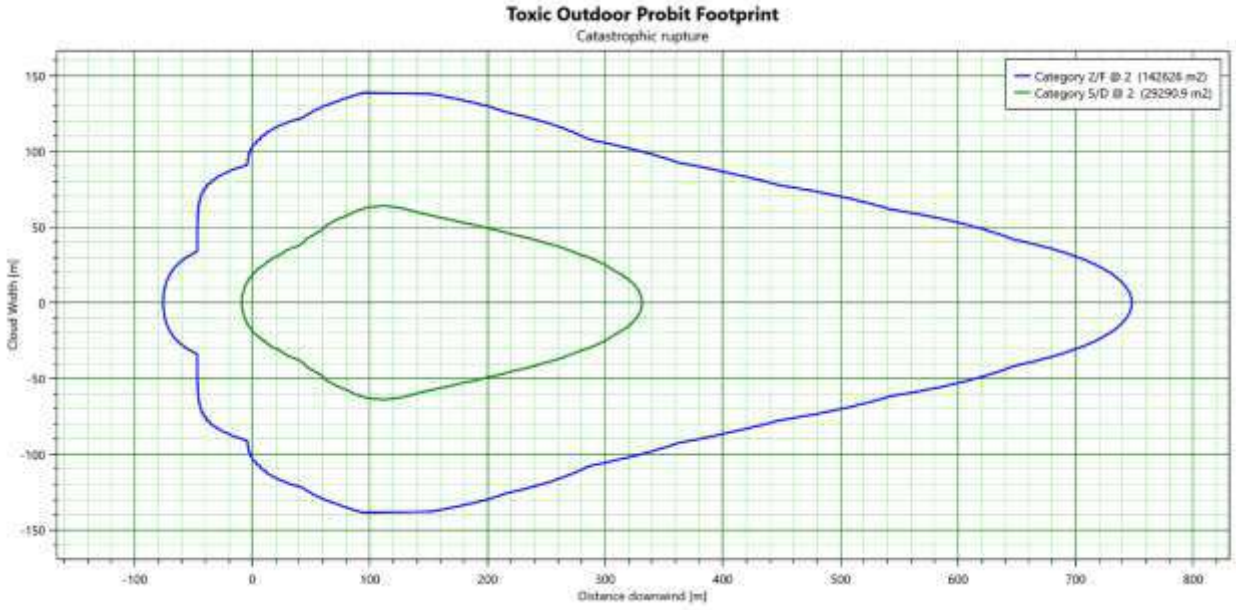

Maximum Concentration versus Distance
Catastrophic rupture
Category 2/F (Flammable (18.75 s))
Category 5/D (Flammable (18.75 s))
Concentration [ppm]
1e+06
100000
10000
1000
0
50
100
150
200
250
300
350
400
450
500
Distance downwind [m]

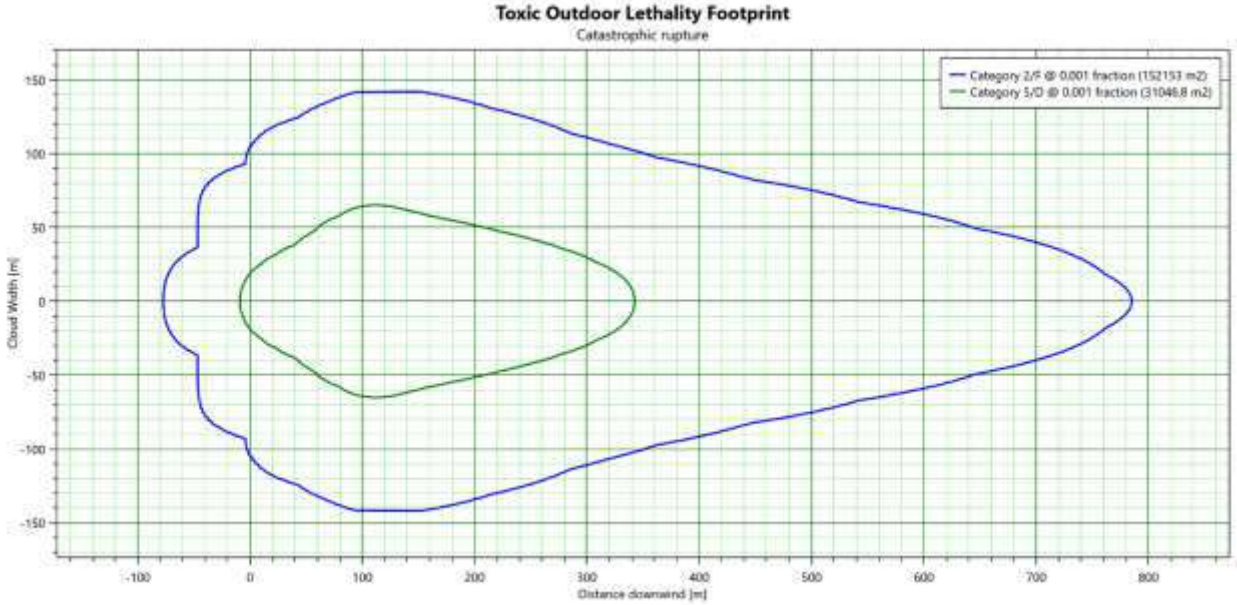

Cloud Footprint
Catastrophic rupture
Category 2/F @ 35900 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 35900 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width [m]
3
2
1
0
-1
-2
-3
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Distance downwind [m]

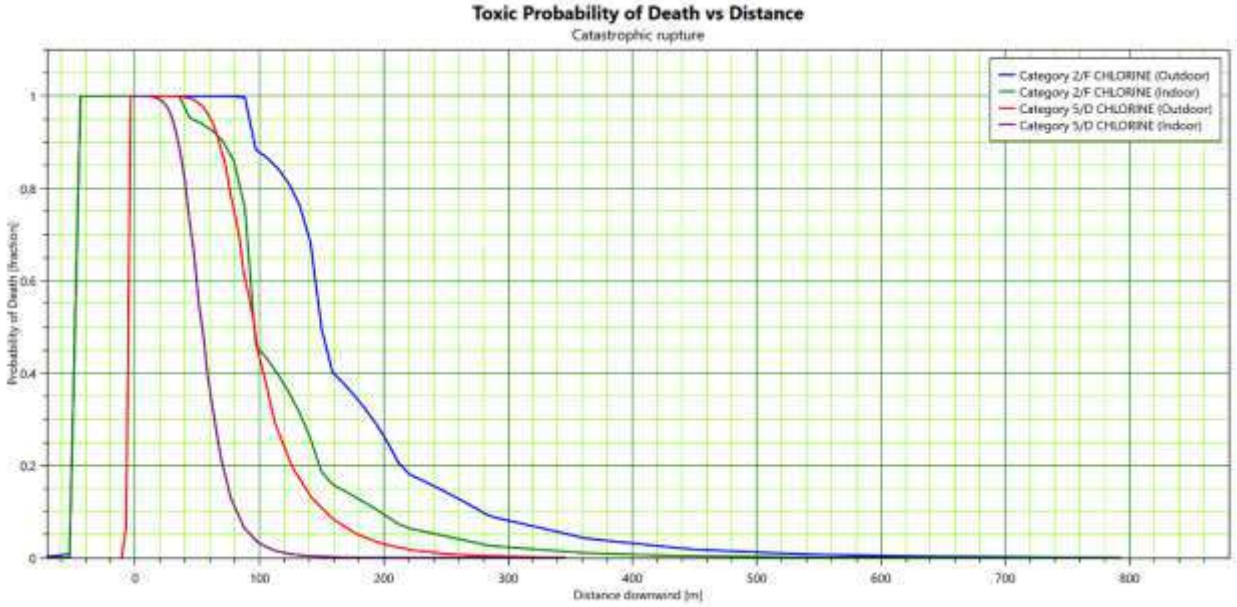

Concentration vs Time at Given Distance
Catastrophic rupture
Category 2/F (Flammable (18.75 s))
Category 5/D (Flammable (18.75 s))
Concentration [ppm]
4000
3000
2000
1000
500
1000
1500
2000
2500
3000
3500
4000
Time [s]

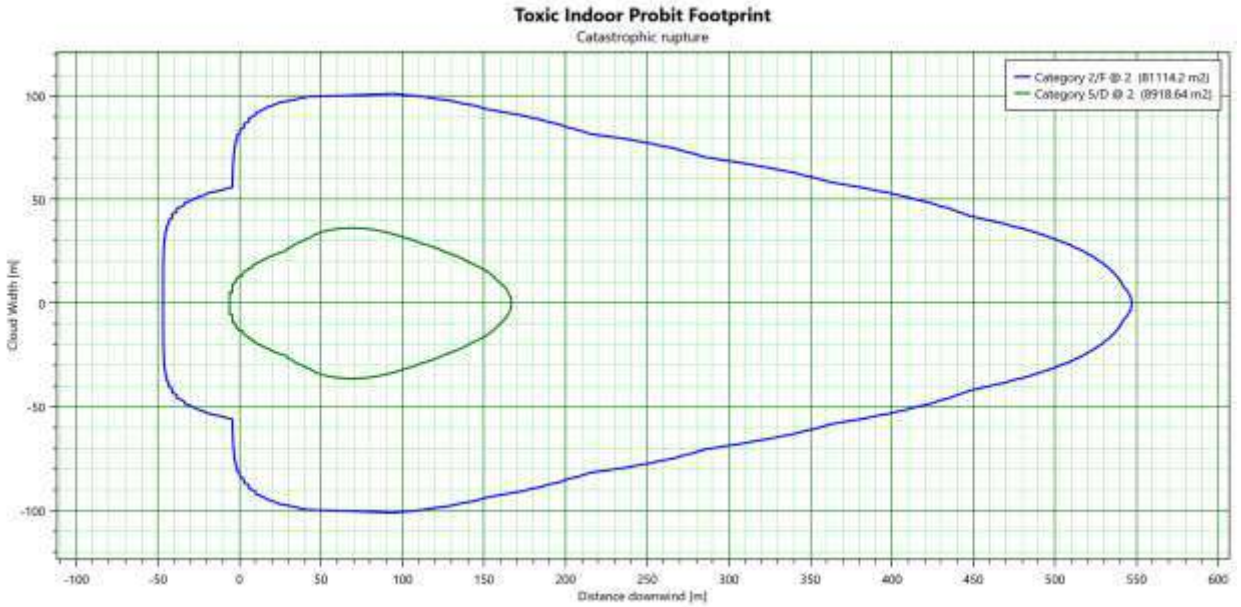
12.3 chloroform

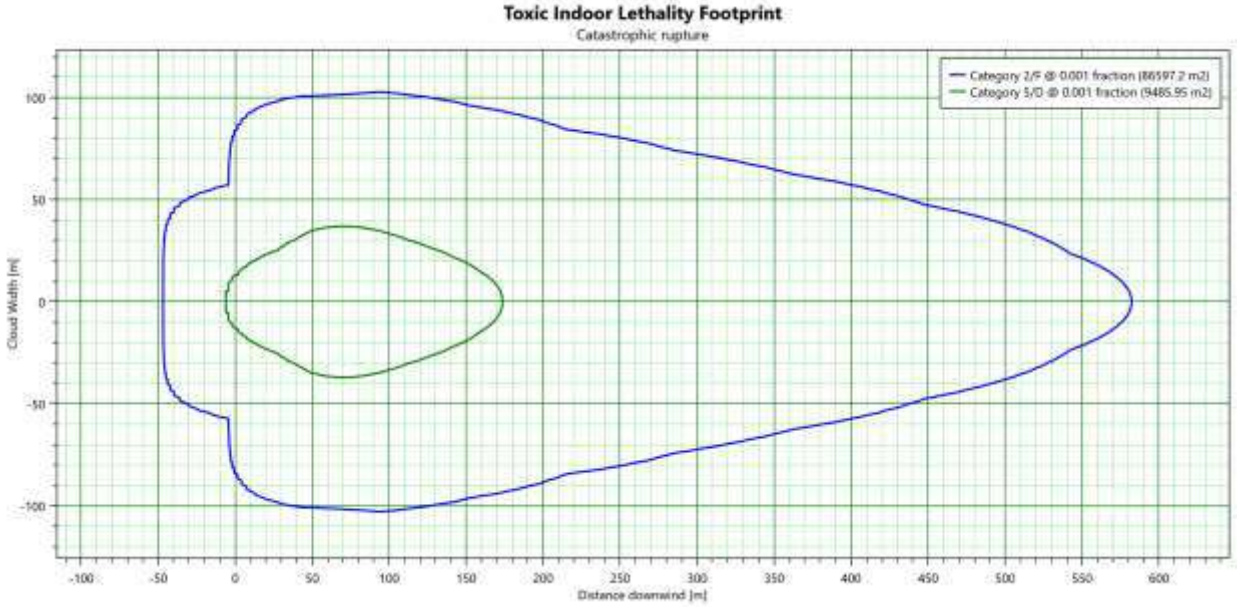


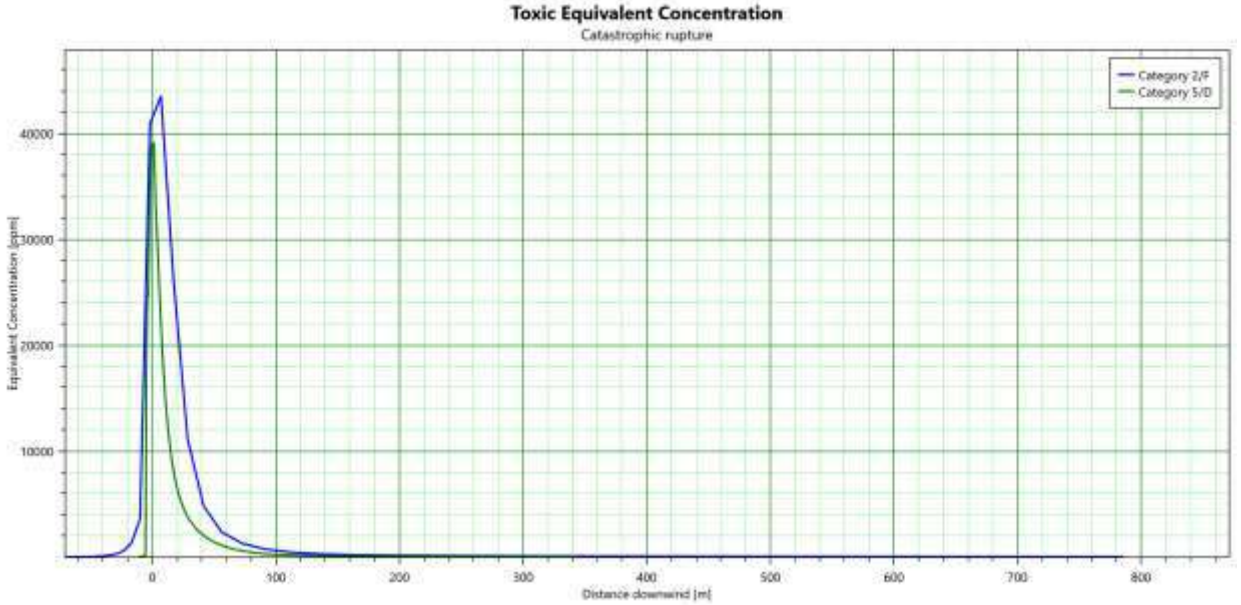


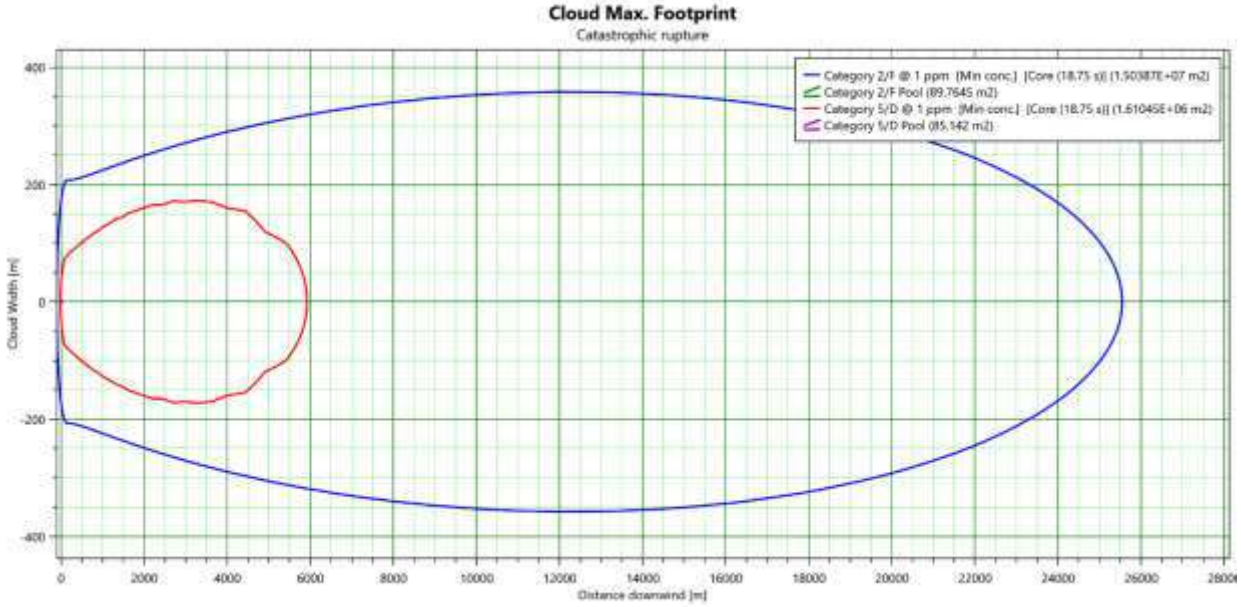

Toxic Outdoor Lethality Footprint
Catastrophic rupture
Category 2/F @ 0.001 fraction (152153 m2)
Category 5/D @ 0.001 fraction (31046.8 m2)
Cloud Width [m]
Distance downwind [m]

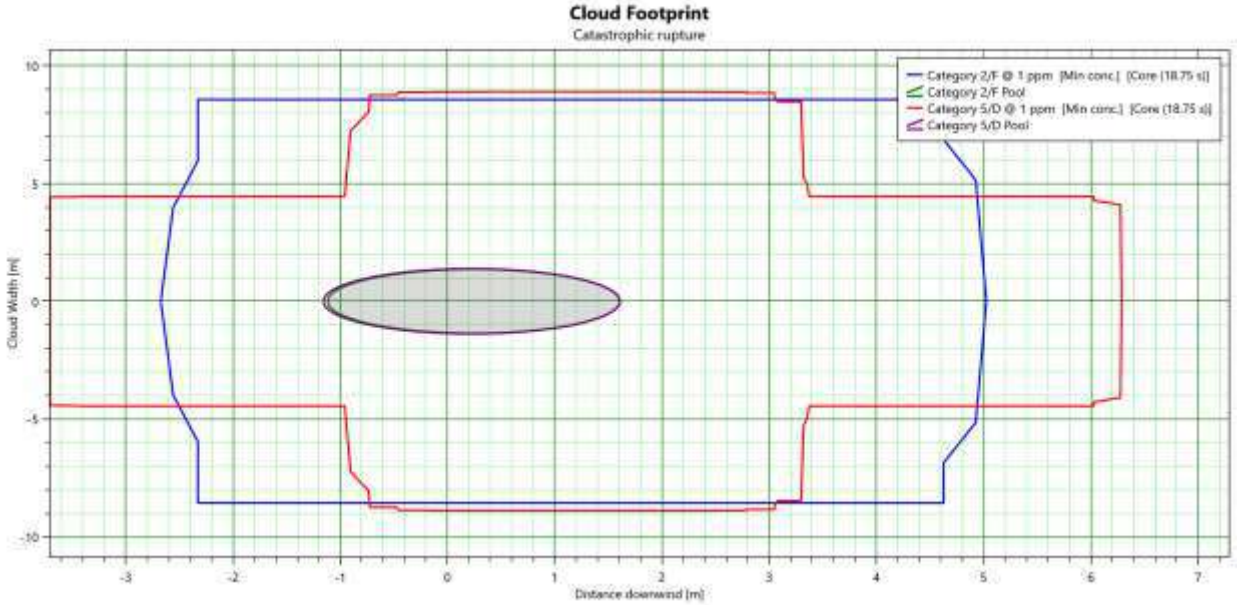

Toxic Probability of Death vs Distance
Catastrophic rupture
Category 2/F CHLORINE (Outdoor)
Category 2/F CHLORINE (Indoor)
Category 5/D CHLORINE (Outdoor)
Category 5/D CHLORINE (Indoor)
Probability of Death [fraction]
Distance downwind [m]

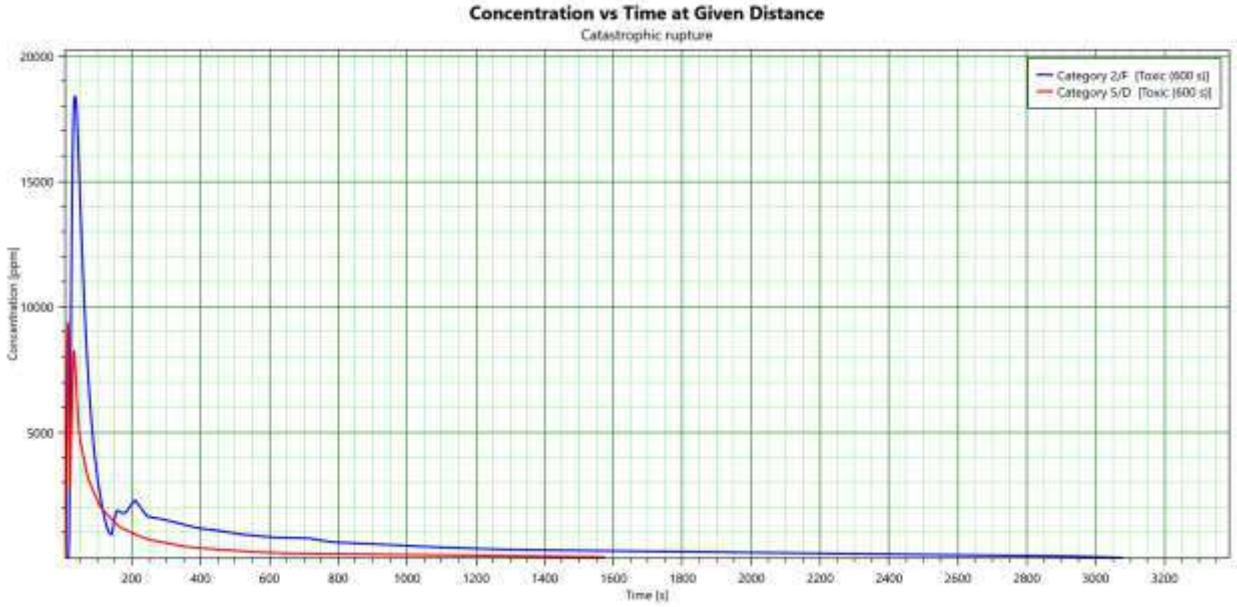

Toxic Indoor Probit Footprint
Catastrophic rupture
Category 2/F @ 2 (81114.2 m2)
Category 5/D @ 2 (8918.64 m2)
Cloud Width [m]
Distance downwind [m]


Toxic Indoor Lethality Footprint
Catastrophic rupture
Category 2/F @ 0.001 fraction (86597.2 m2)
Category 5/D @ 0.001 fraction (9485.95 m2)
Cloud Width [m]
Distance downwind [m]

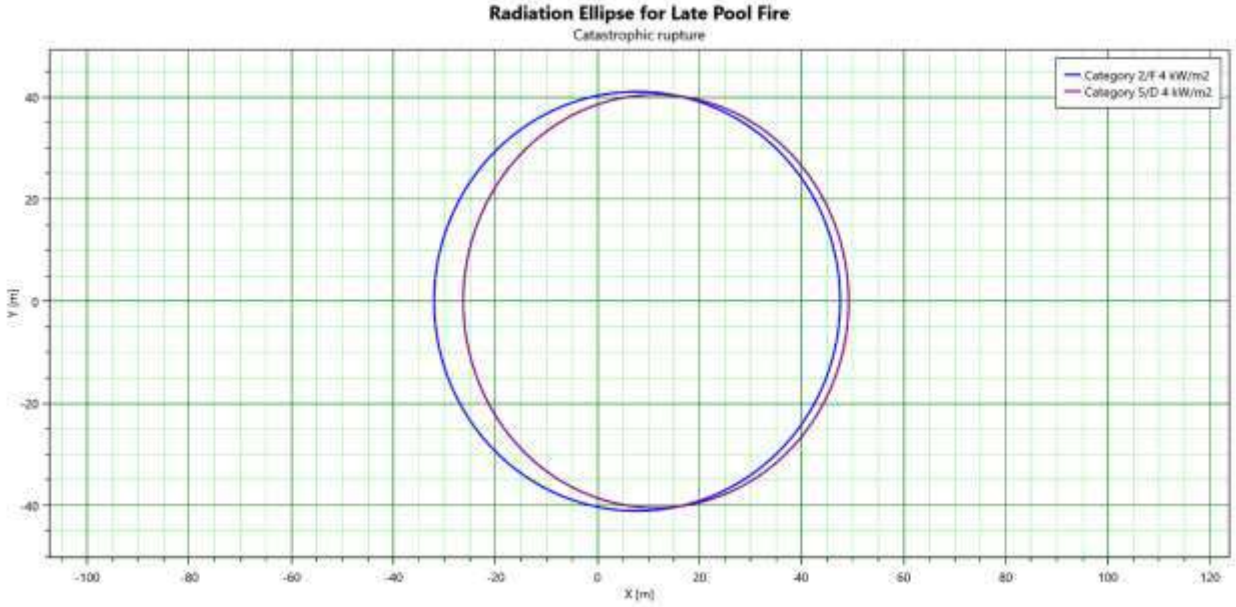

Toxic Equivalent Concentration
Catastrophic rupture
Category 2/F
Category 5/D
Equivalent Concentration [ppm]
40000
30000
20000
10000
0
100
200
300
400
500
600
700
800
Distance downwind [m]

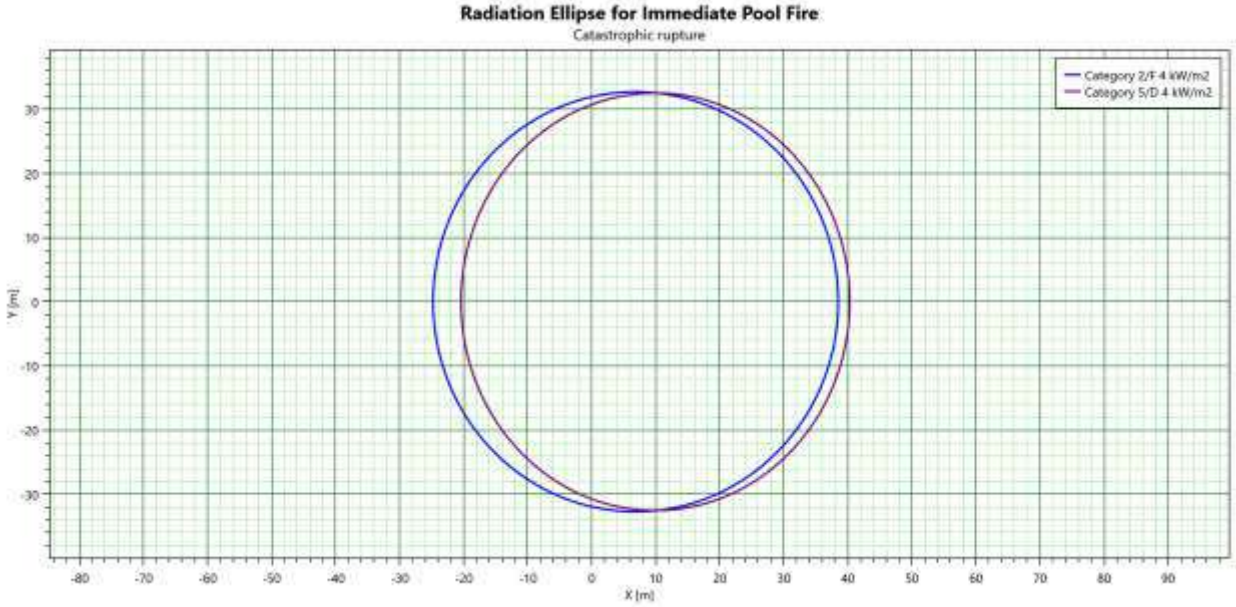

Cloud Max. Footprint
Catastrophic rupture
Category 2/F @ 1 ppm (Min conc.) (Core (18.75 s)) (1.50387E+07 m2)
Category 2/F Pool (89.7645 m2)
Category 5/D @ 1 ppm (Min conc.) (Core (18.75 s)) (1.61045E+06 m2)
Category 5/D Pool (85.142 m2)
Cloud Width [m]
400
200
0
-200
-400
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000
26000
Distance downwind [m]

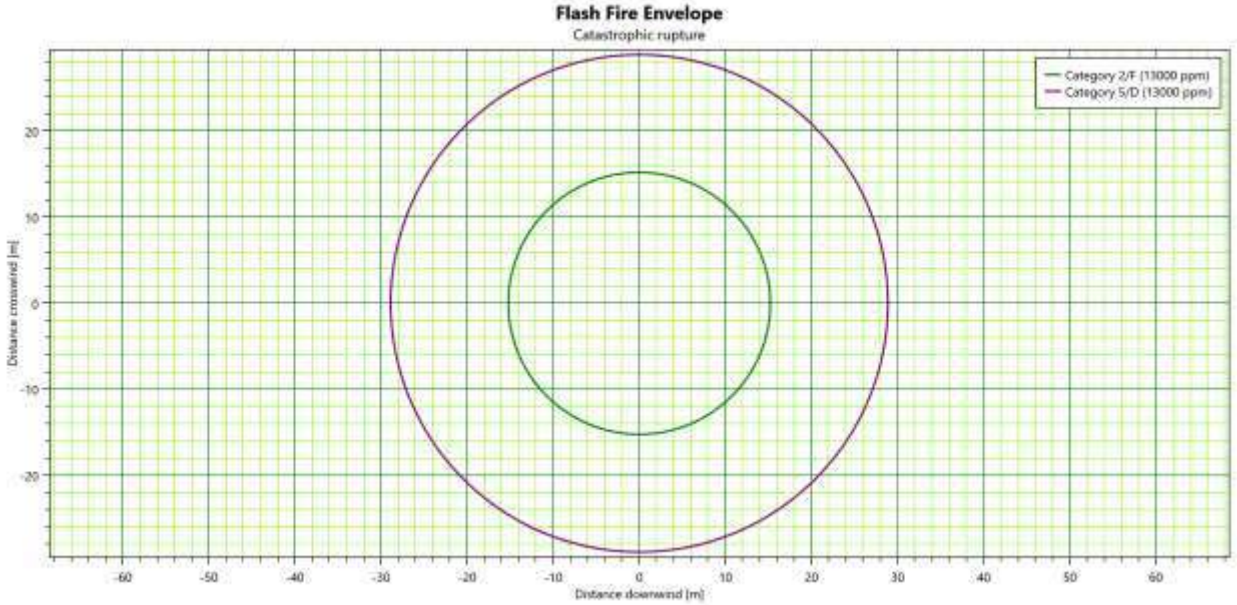

Cloud Footprint
Catastrophic rupture
Category 2/F @ 1 ppm [Min conc.] [Core (18.75 s)]
Category 2/F Pool
Category 5/D @ 1 ppm [Min conc.] [Core (18.75 s)]
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

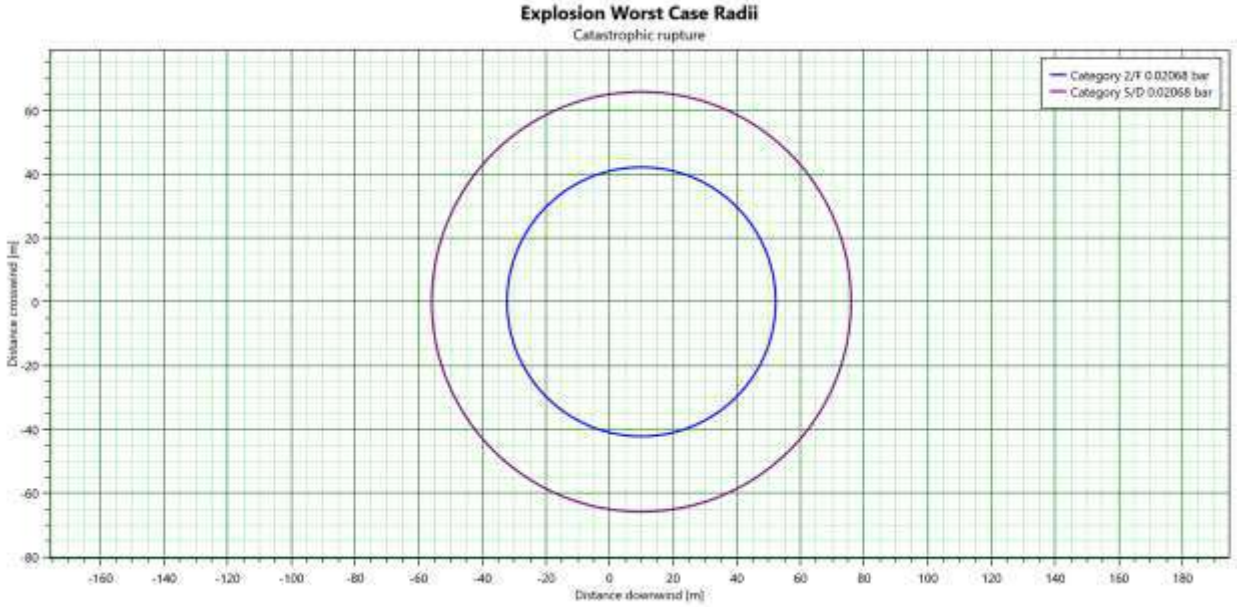

Concentration vs Time at Given Distance
Catastrophic rupture
Category 2/F [Toxic (600 s)]
Category 5/D [Toxic (600 s)]
Concentration [ppm]
Time [s]

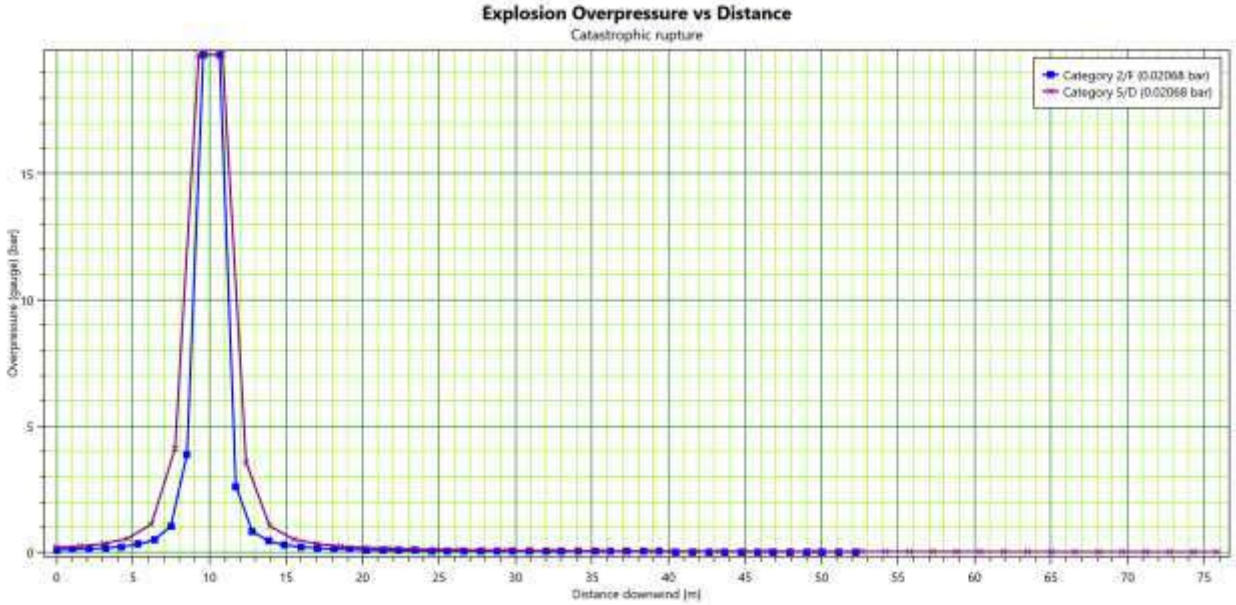
12.4 ethyl acetate

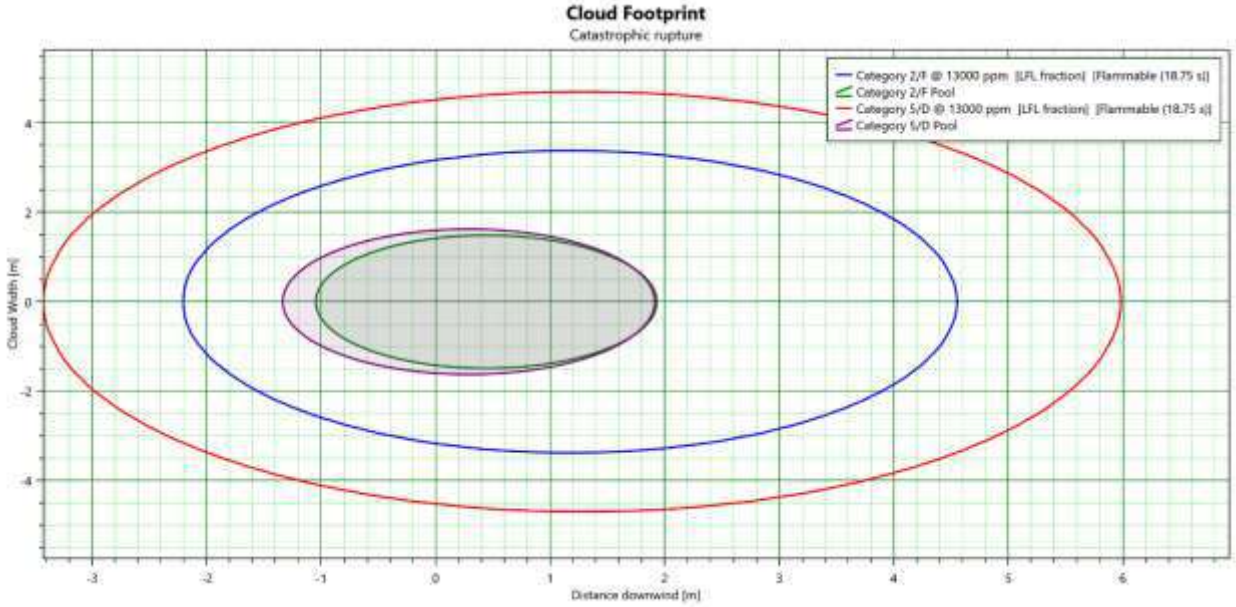




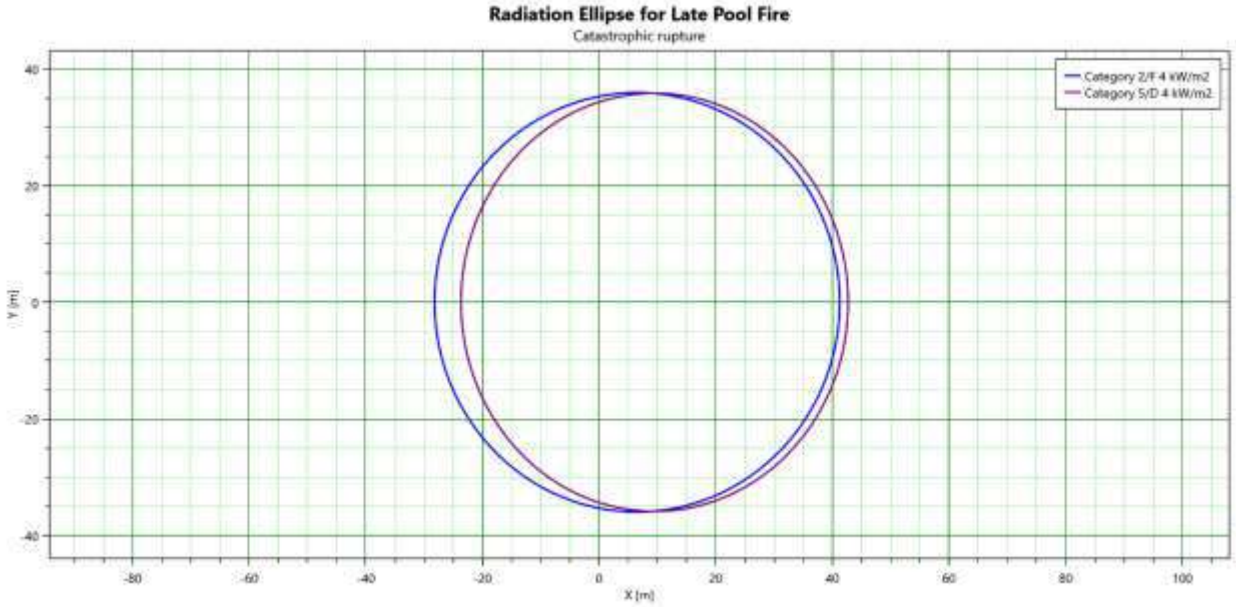

Flash Fire Envelope
Catastrophic rupture
Category 2/F (13000 ppm)
Category 5/D (13000 ppm)
Distance crosswind [m]
Distance downwind [m]

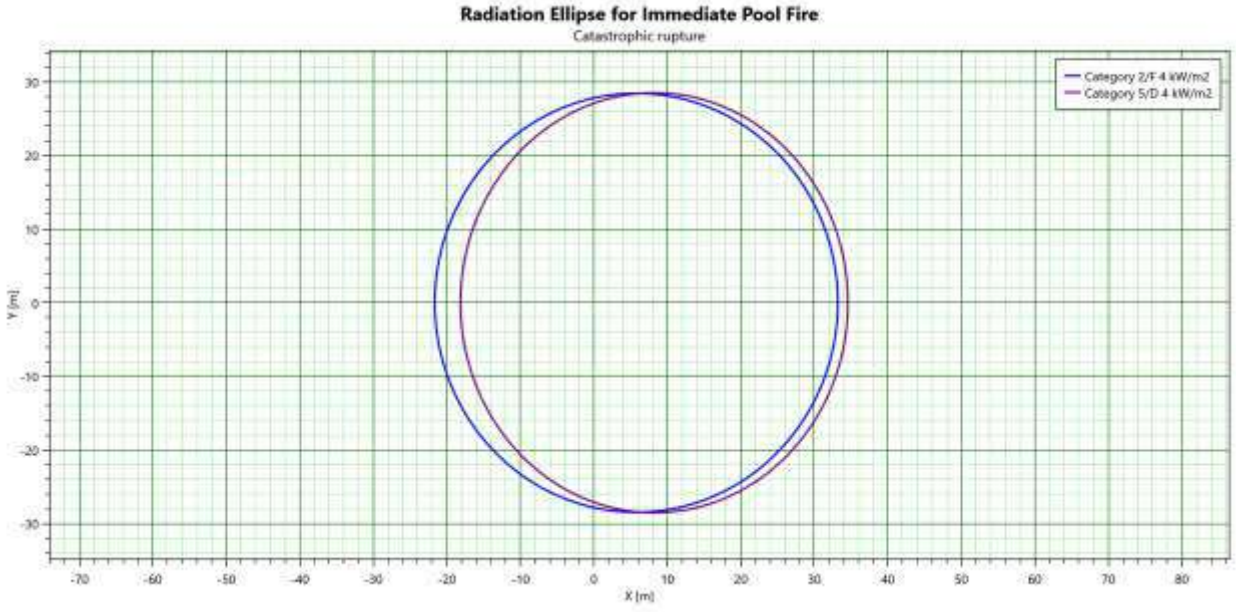

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F 0.02068 bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

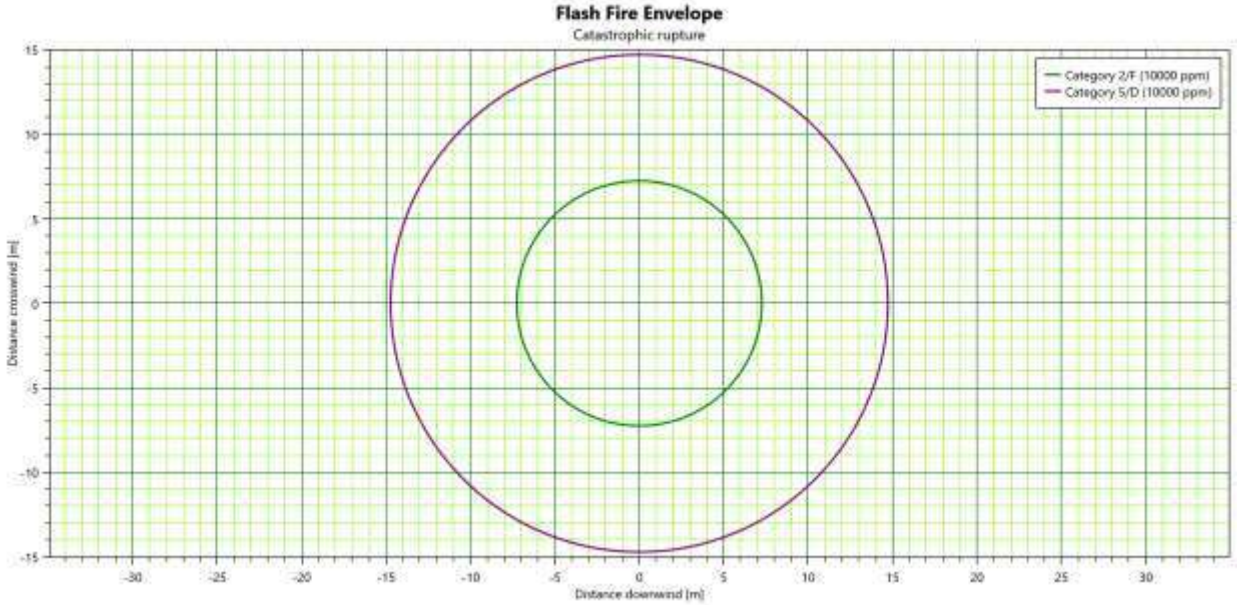

Explosion Overpressure vs Distance
Catastrophic rupture
Category 2/F (0.02068 bar)
Category 5/D (0.02068 bar)
Overpressure (gauge) [bar]
Distance downwind [m]

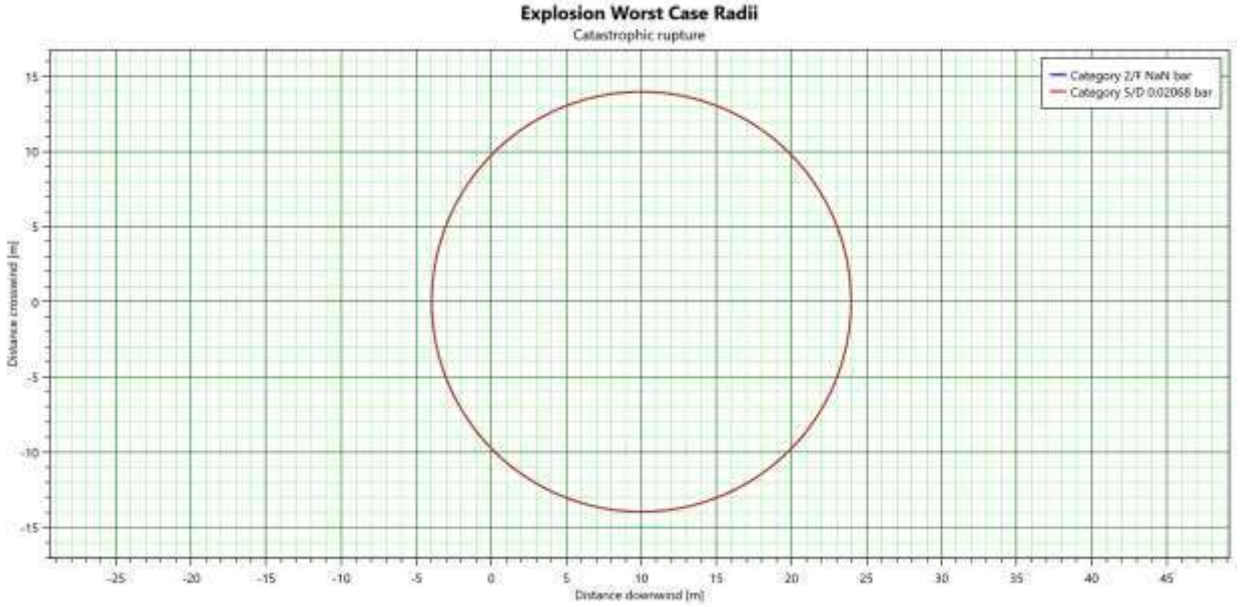

Cloud Footprint
Catastrophic rupture
Category 2/F @ 13000 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 13000 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

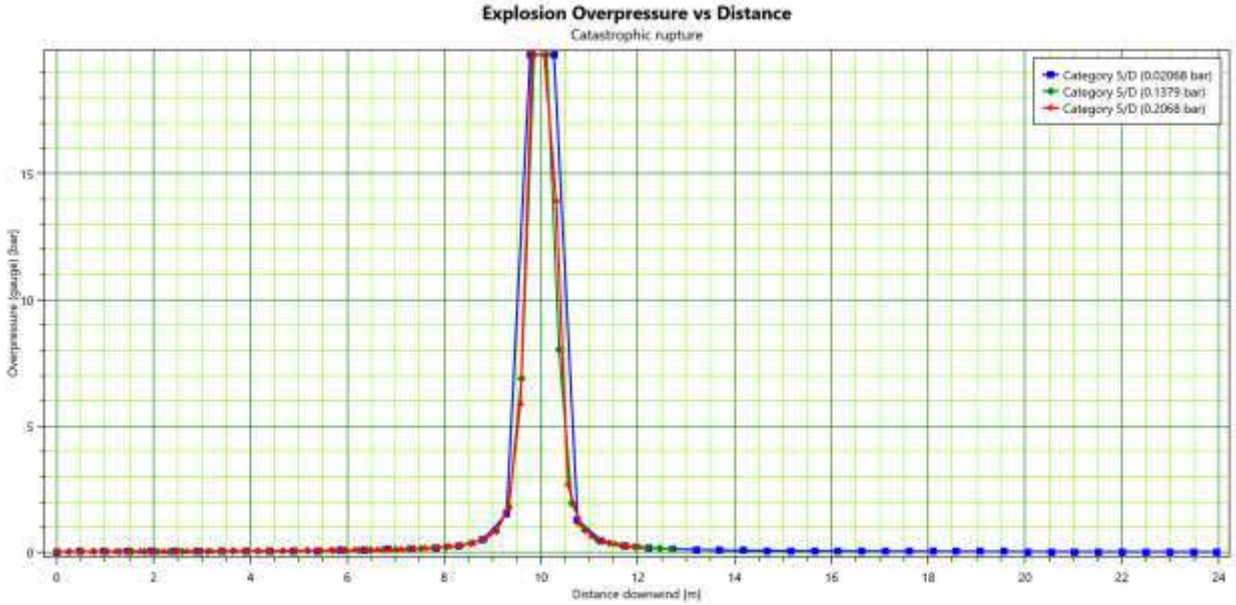
12.5 IPA

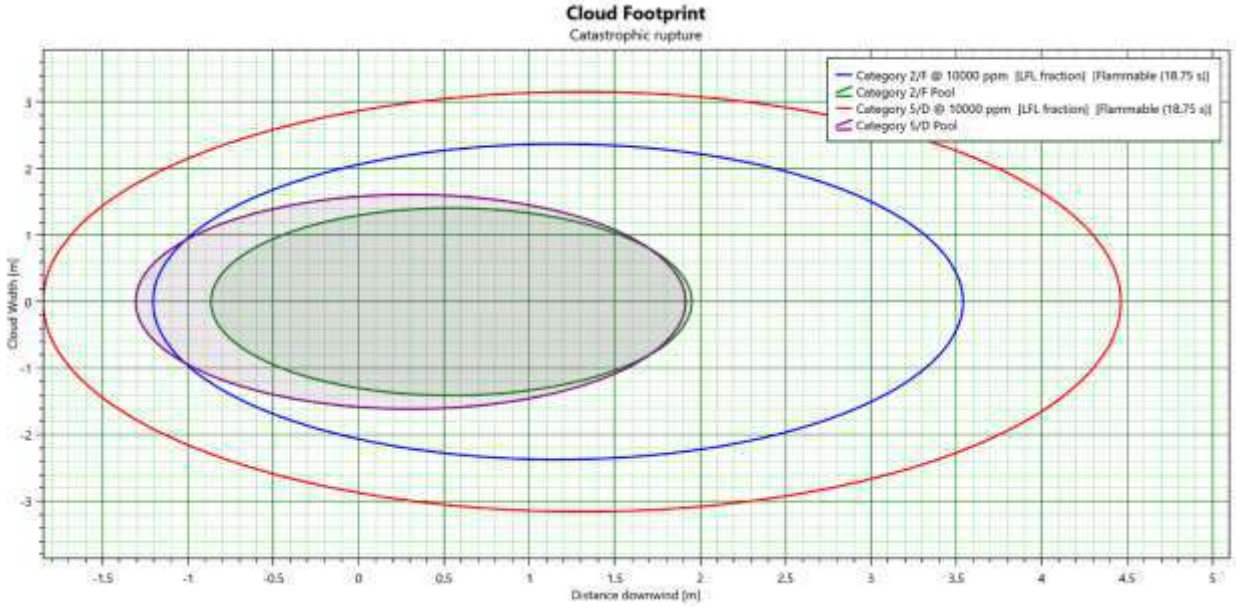

Radiation Ellipse for Late Pool Fire
Catastrophic rupture
Category 2/F 4 kW/m2
Category 5/D 4 kW/m2
Y [m]
X [m]


Radiation Ellipse for Immediate Pool Fire
Catastrophic rupture
Category 2/F 4 kW/m2
Category 5/D 4 kW/m2
Y [m]
X [m]

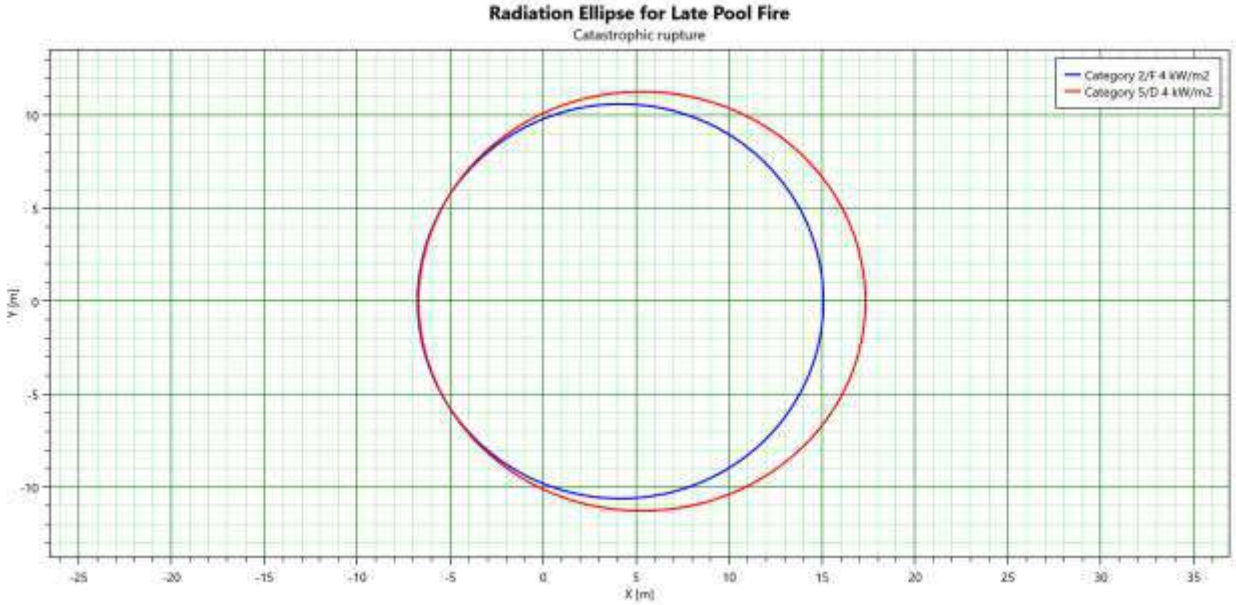

Flash Fire Envelope
Catastrophic rupture
Category 2/F (10000 ppm)
Category 5/D (10000 ppm)
Distance crosswind [m]
Distance downwind [m]

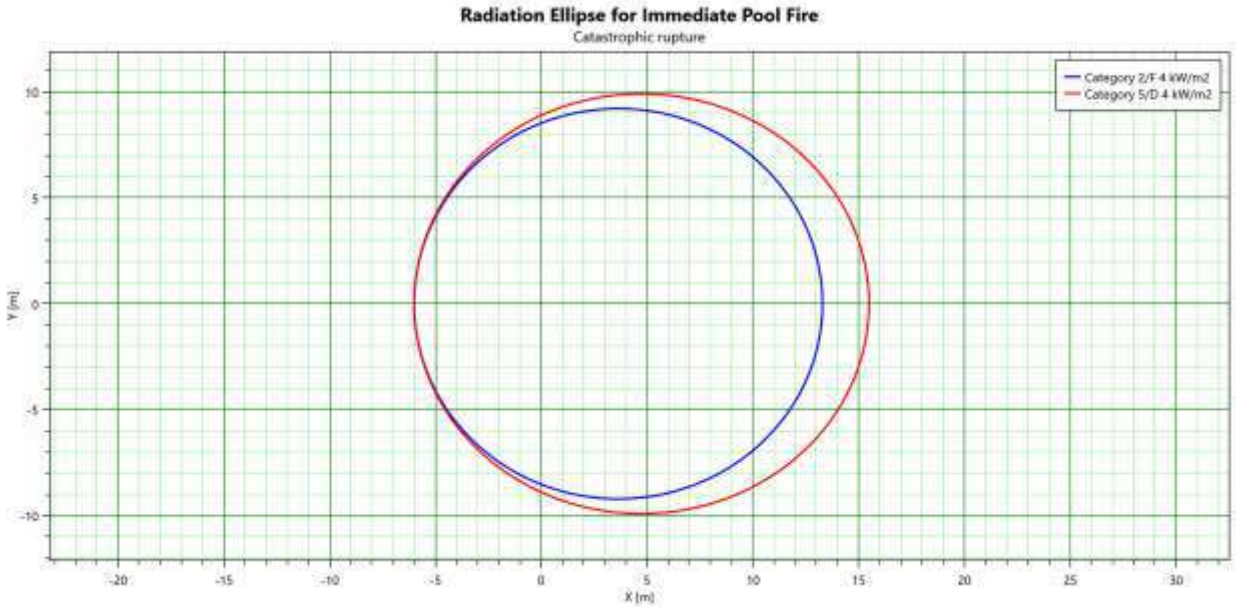

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F NaN bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

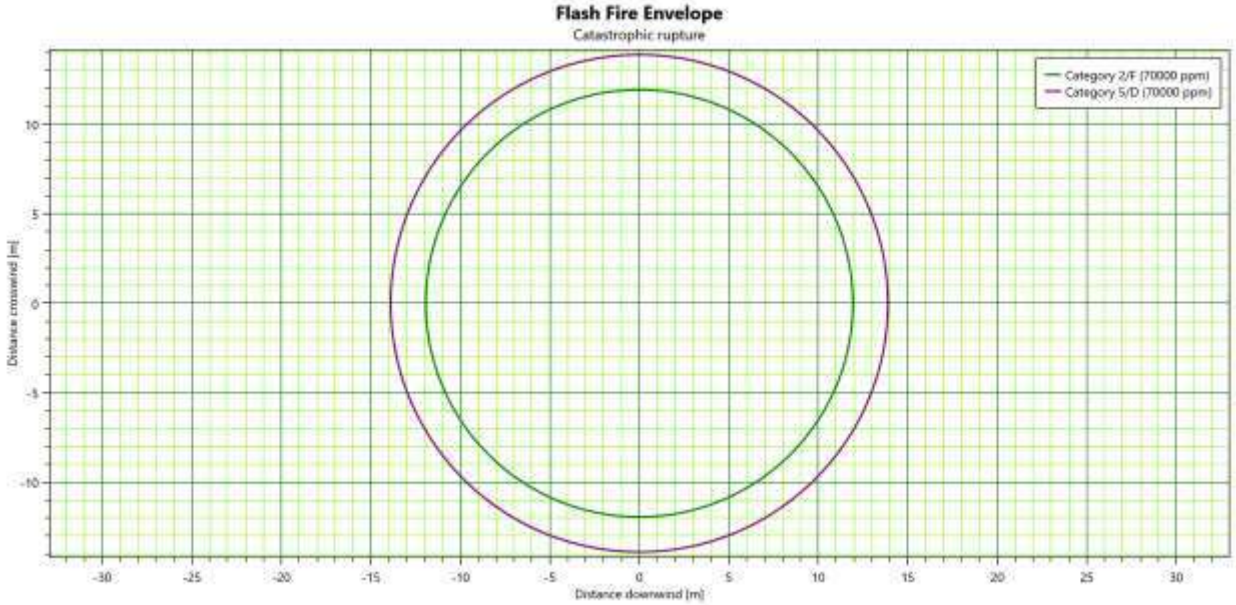

Explosion Overpressure vs Distance
Catastrophic rupture
Category 5/D (0.02068 bar)
Category 5/D (0.1379 bar)
Category 5/D (0.2068 bar)
Overpressure (gauge) (bar)
Distance downwind (m)

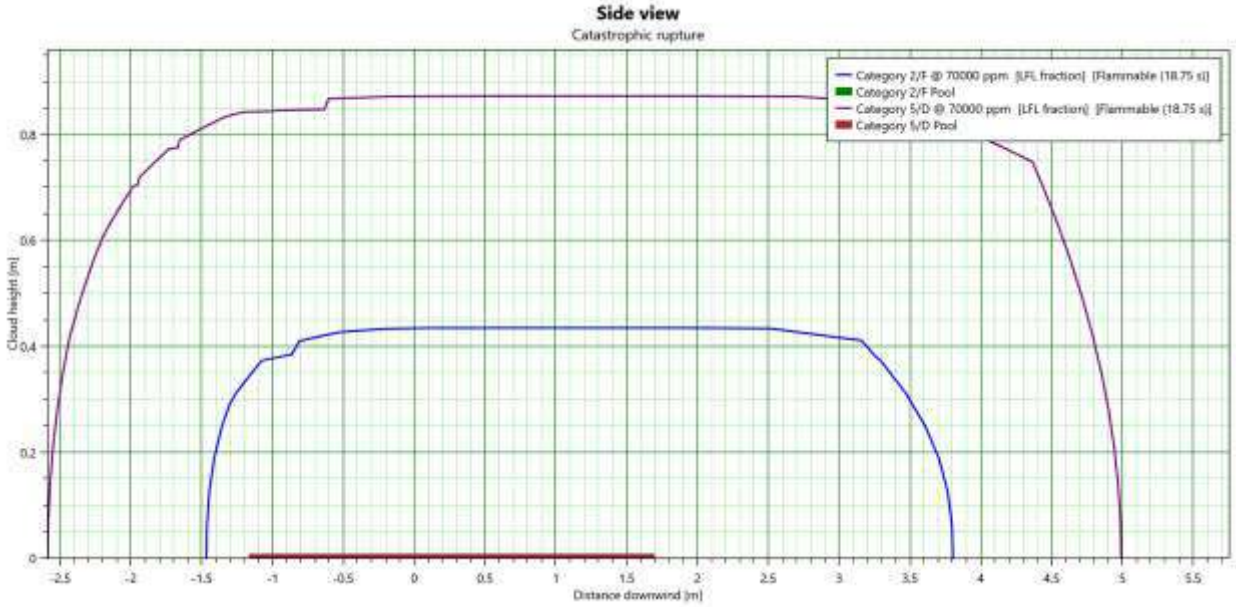

Cloud Footprint
Catastrophic rupture
Category 2/F @ 10000 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 10000 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width (m)
Distance downwind (m)

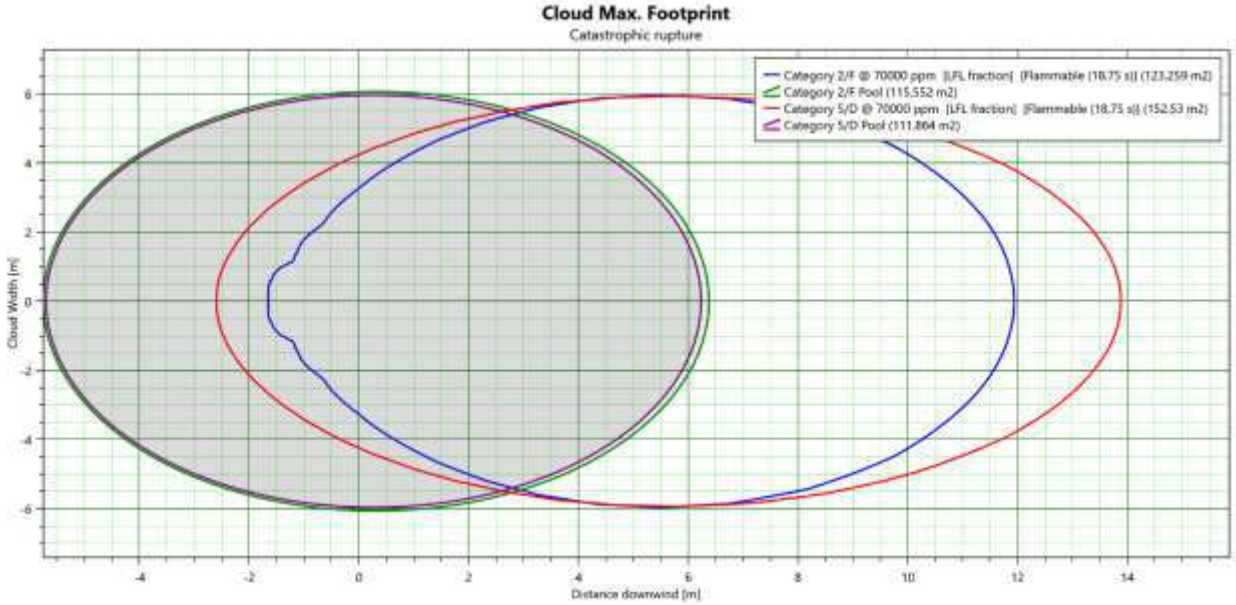
12.6 Methylene dichloride

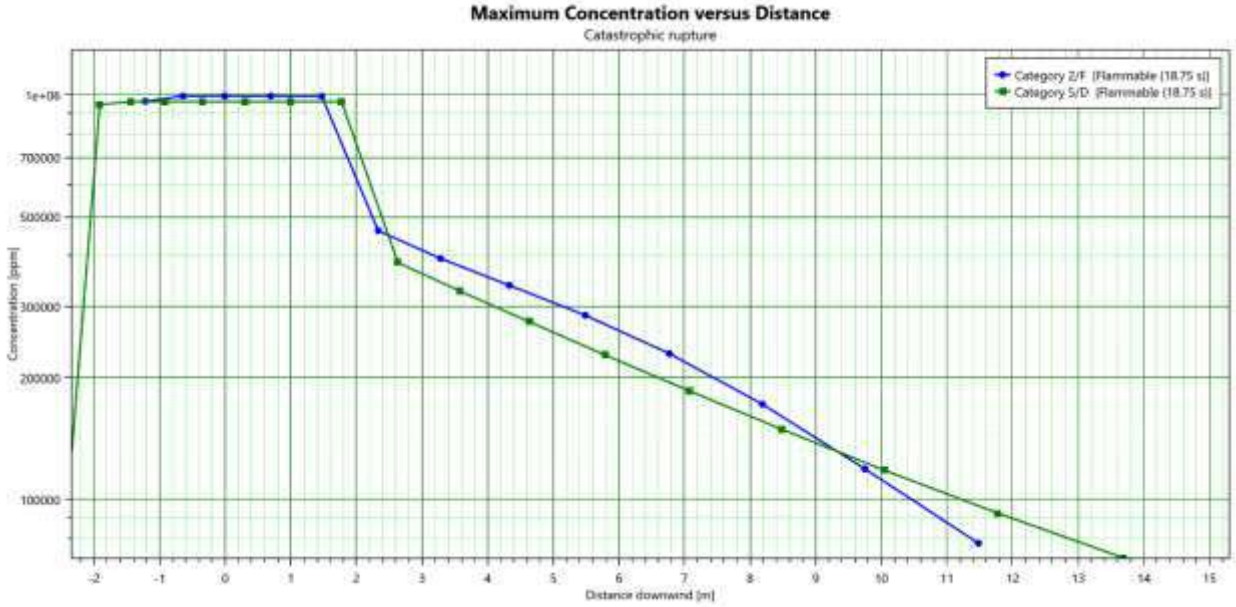


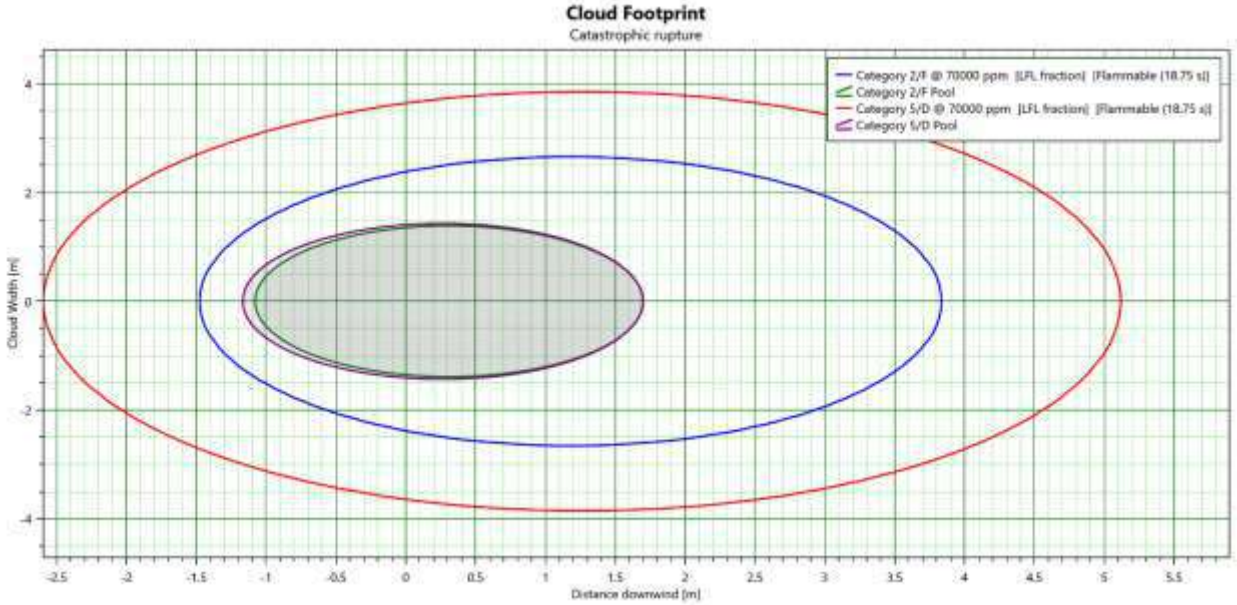



Flash Fire Envelope
Catastrophic rupture
Category 2/F (70000 ppm)
Category 5/D (70000 ppm)
Distance crosswind [m]
Distance downwind [m]

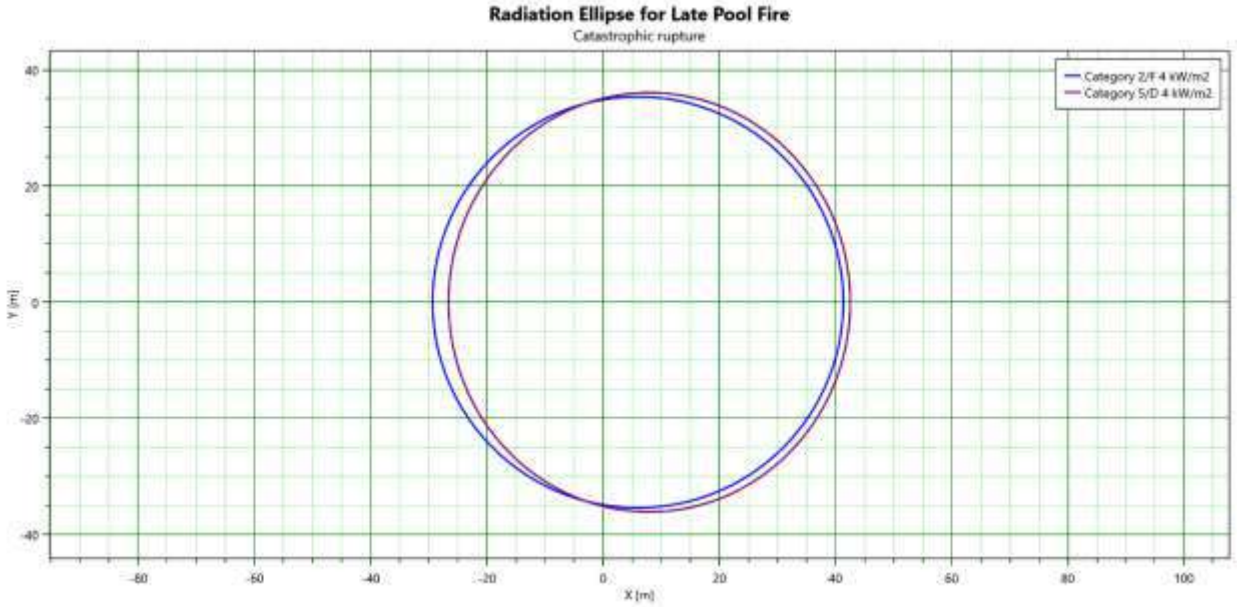

Side view
Catastrophic rupture
Category 2/F @ 70000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 2/F Pool
Category 5/D @ 70000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 5/D Pool
Cloud height [m]
Distance downwind [m]

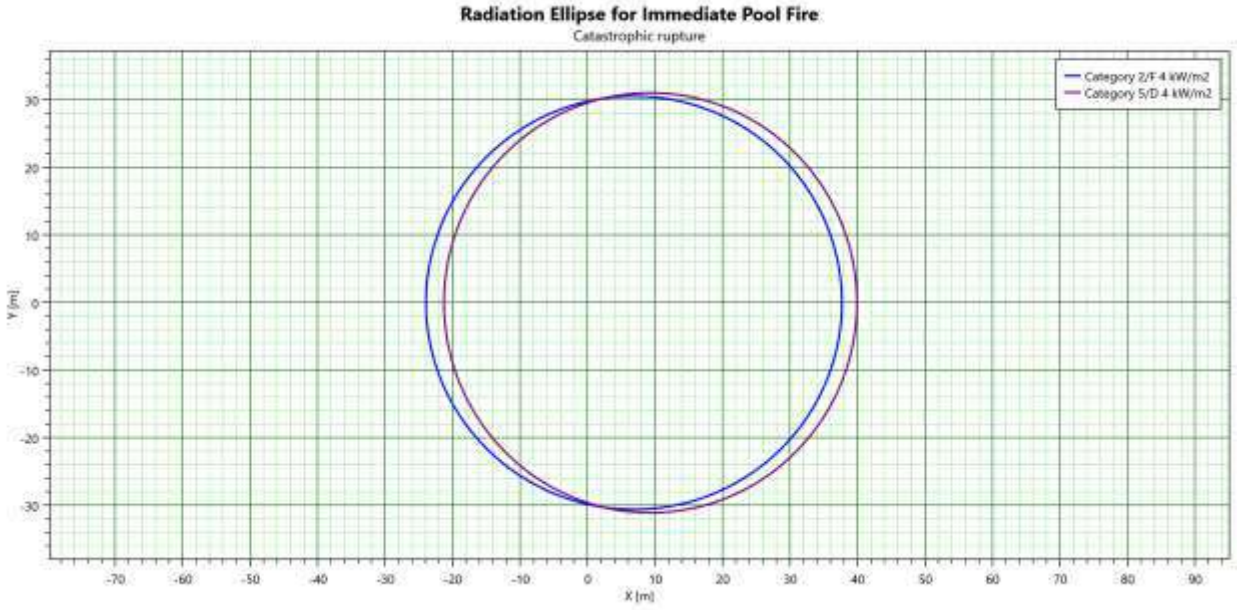

Cloud Max. Footprint
Catastrophic rupture
Category 2/F @ 70000 ppm [LFL fraction] [Flammable (18.75 s)] (123.259 m2)
Category 2/F Pool (115.552 m2)
Category 5/D @ 70000 ppm [LFL fraction] [Flammable (18.75 s)] (152.53 m2)
Category 5/D Pool (111.864 m2)
Cloud Width [m]
Distance downwind [m]

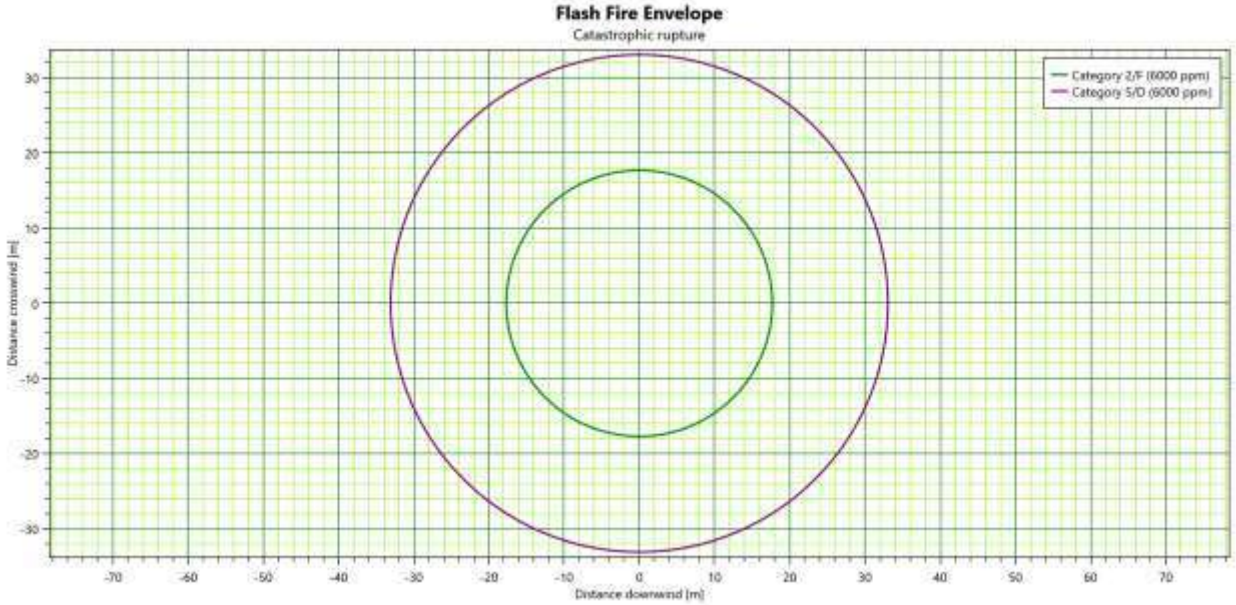

Maximum Concentration versus Distance
Catastrophic rupture
Category 2/F [Flammable (18.75 s)]
Category 5/D [Flammable (18.75 s)]
Concentration [ppm]
Distance downwind [m]

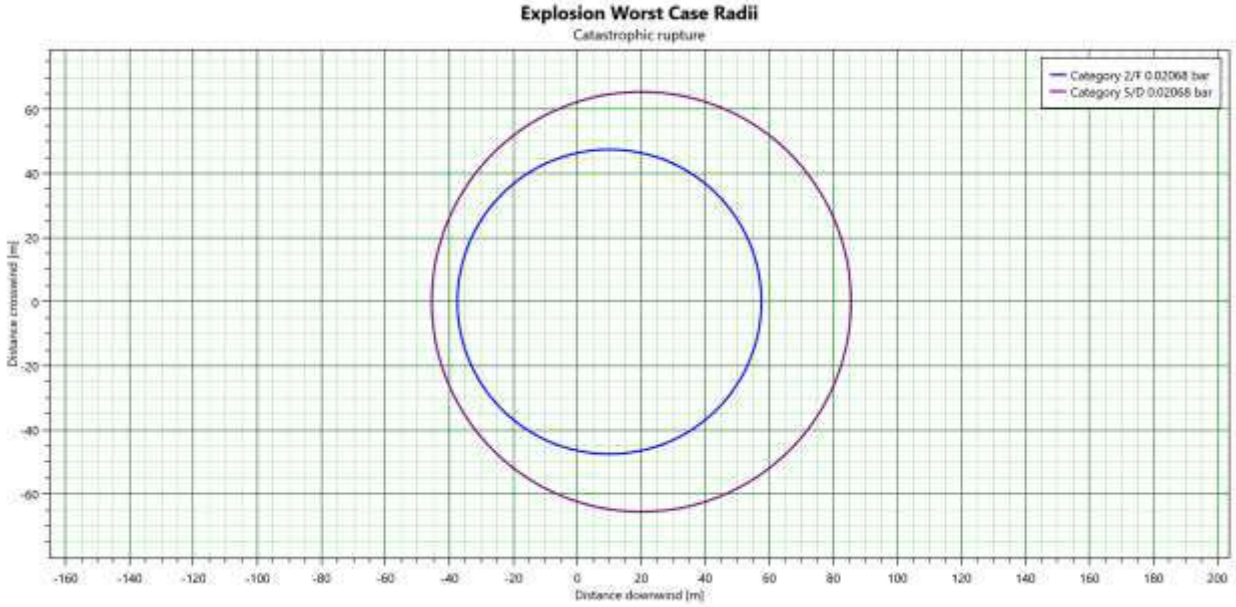

Cloud Footprint
Catastrophic rupture
Category 2/F @ 70000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 2/F Pool
Category 5/D @ 70000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

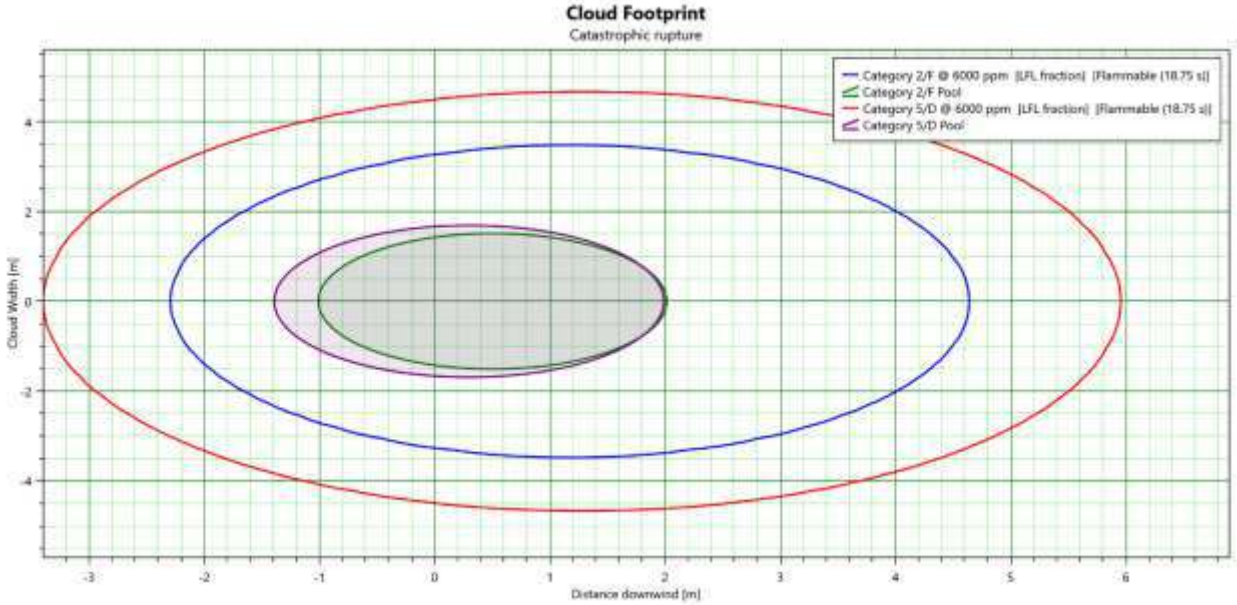
12.7 n hexane


Radiation Ellipse for Late Pool Fire
Catastrophic rupture
Category 2/F 4 kW/m2
Category 5/D 4 kW/m2
Y [m]
X [m]

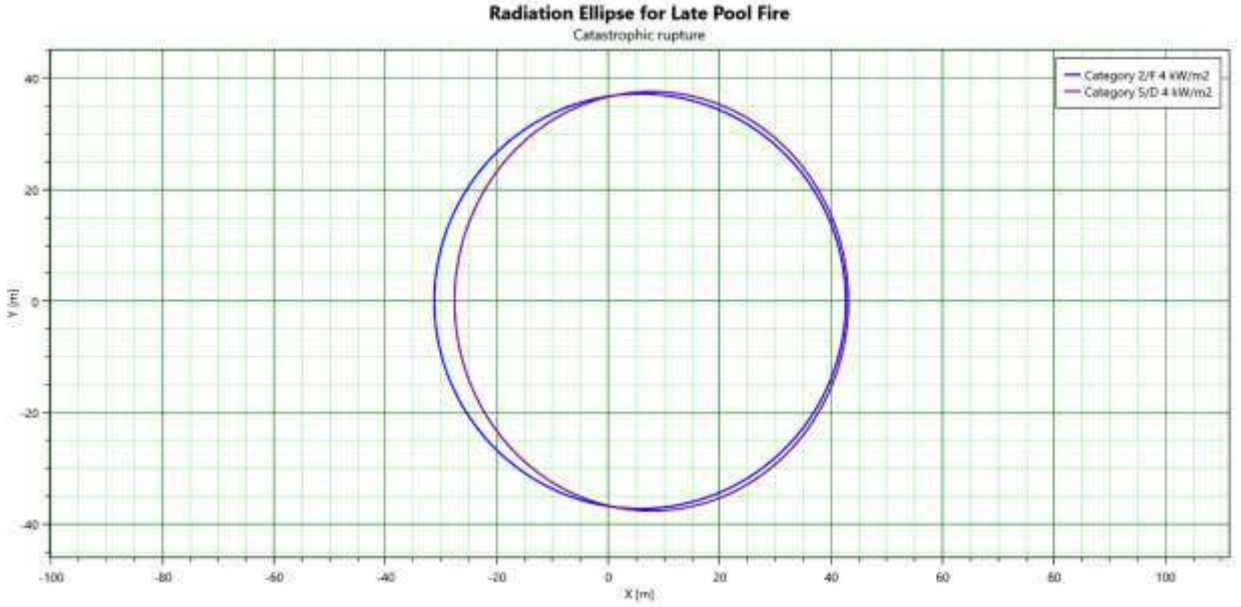

Radiation Ellipse for Immediate Pool Fire
Catastrophic rupture
Category 2/F 4 kW/m2
Category 5/D 4 kW/m2
Y [m]
X [m]

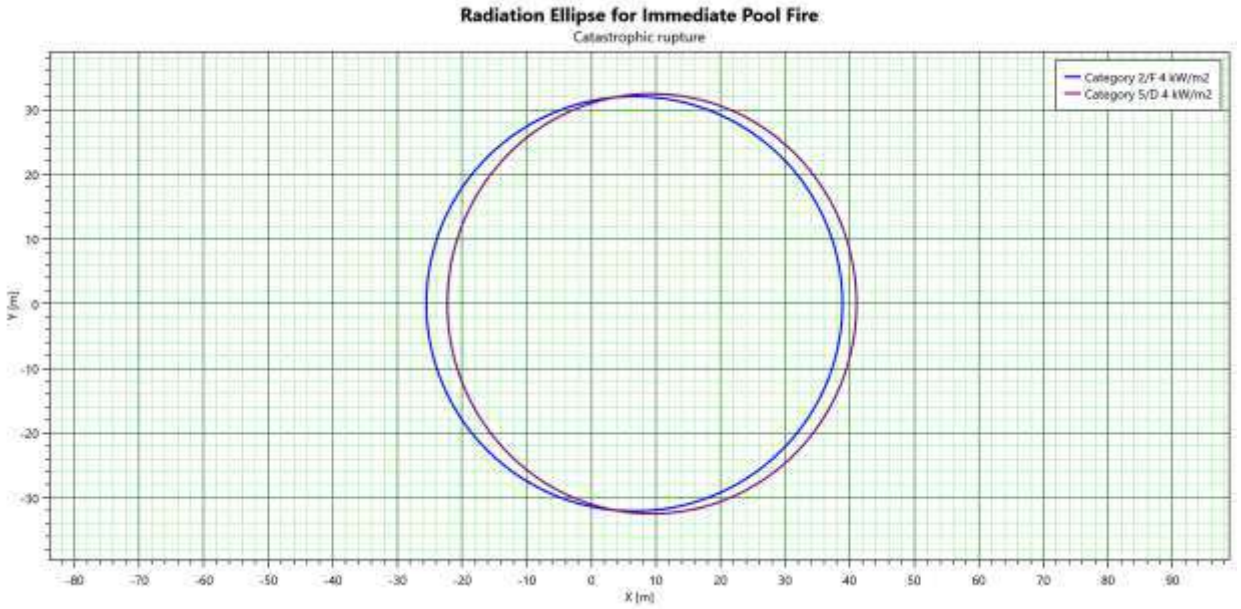

Flash Fire Envelope
Catastrophic rupture
Category 2/F (6000 ppm)
Category 5/D (6000 ppm)
Distance crosswind [m]
Distance downwind [m]

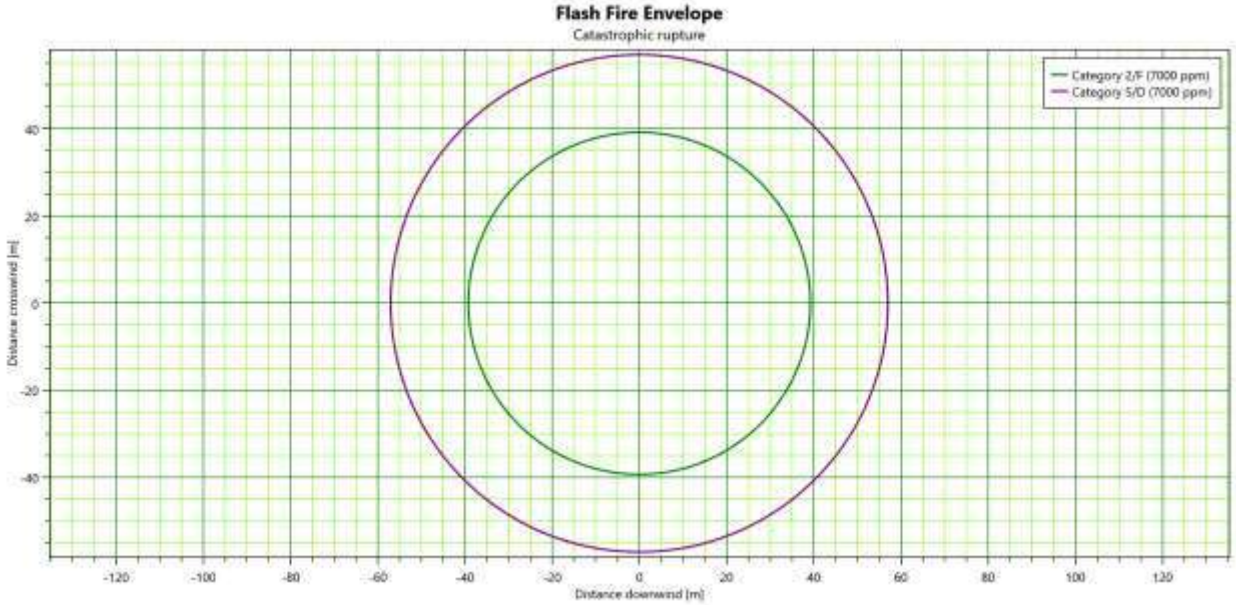

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F 0.02068 bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

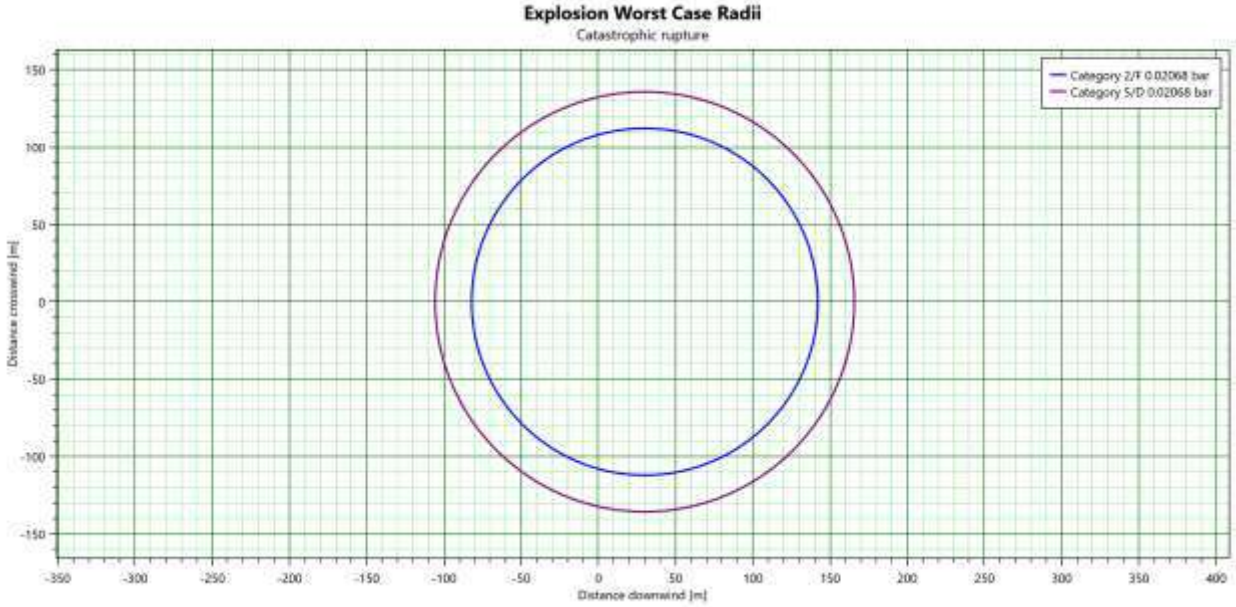

Cloud Footprint
Catastrophic rupture
Category 2/F @ 6000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 2/F Pool
Category 5/D @ 6000 ppm [LFL fraction] [Flammable (18.75 s)]
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

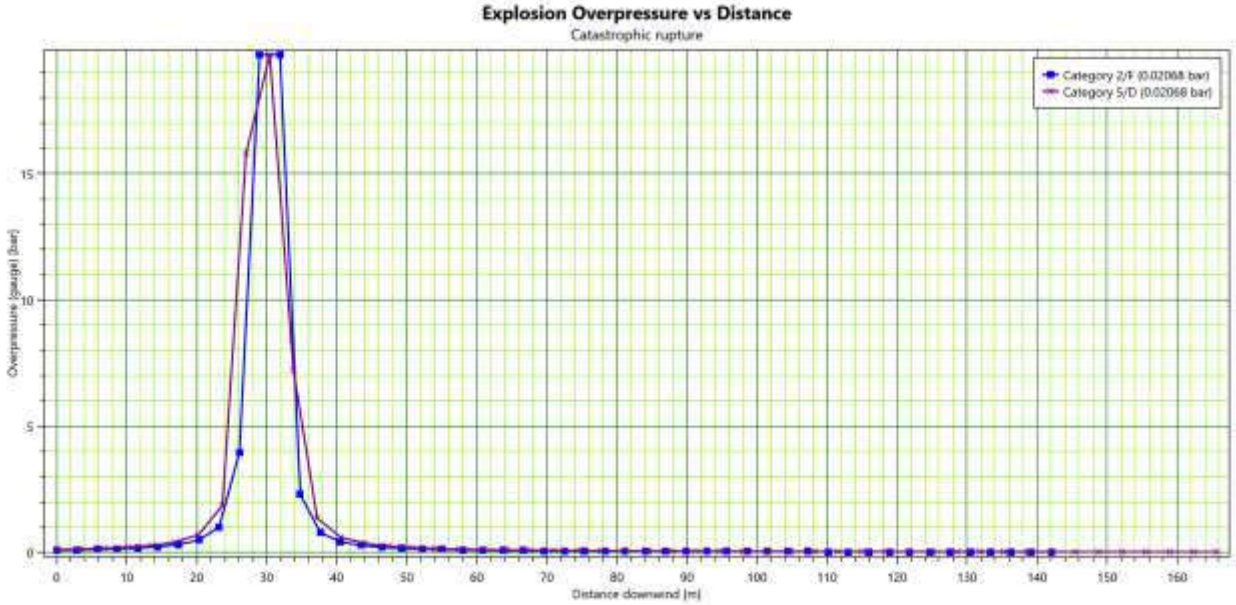
12.8 pet ether

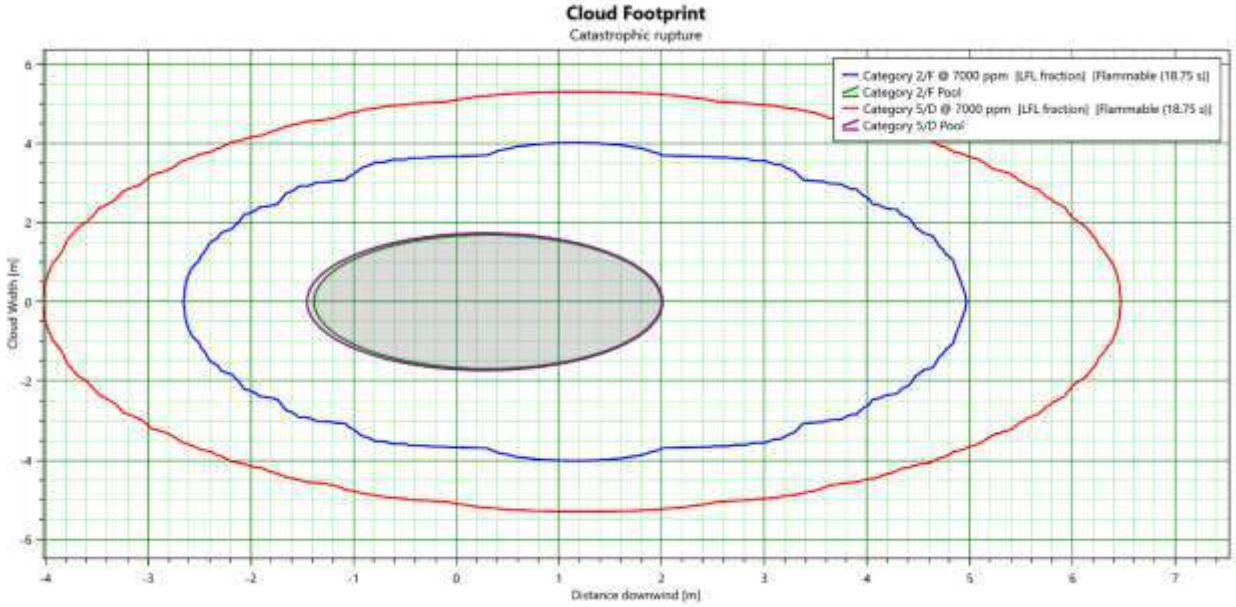




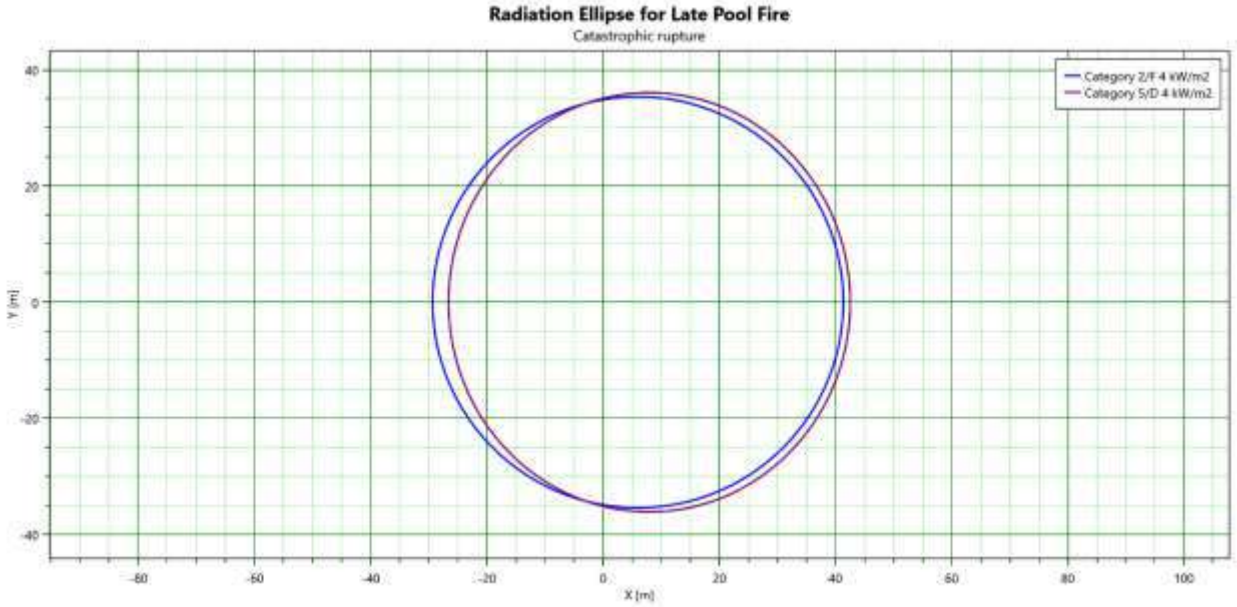

Flash Fire Envelope
Catastrophic rupture
Category 2/F (7000 ppm)
Category 5/D (7000 ppm)
Distance crosswind [m]
Distance downwind [m]

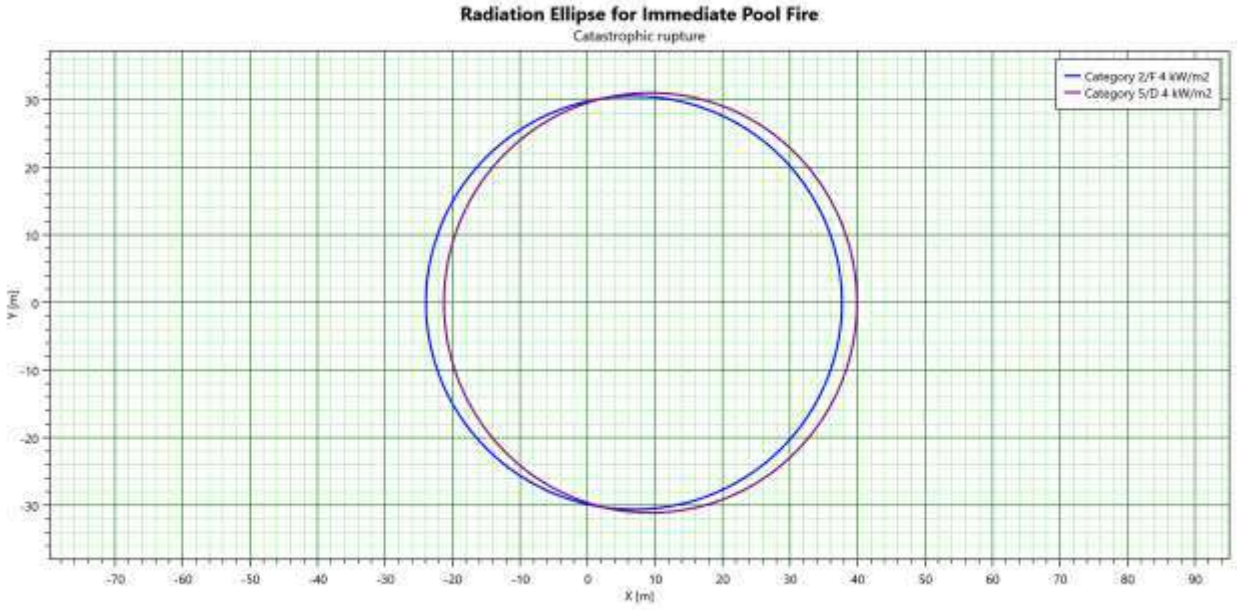

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F 0.02068 bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

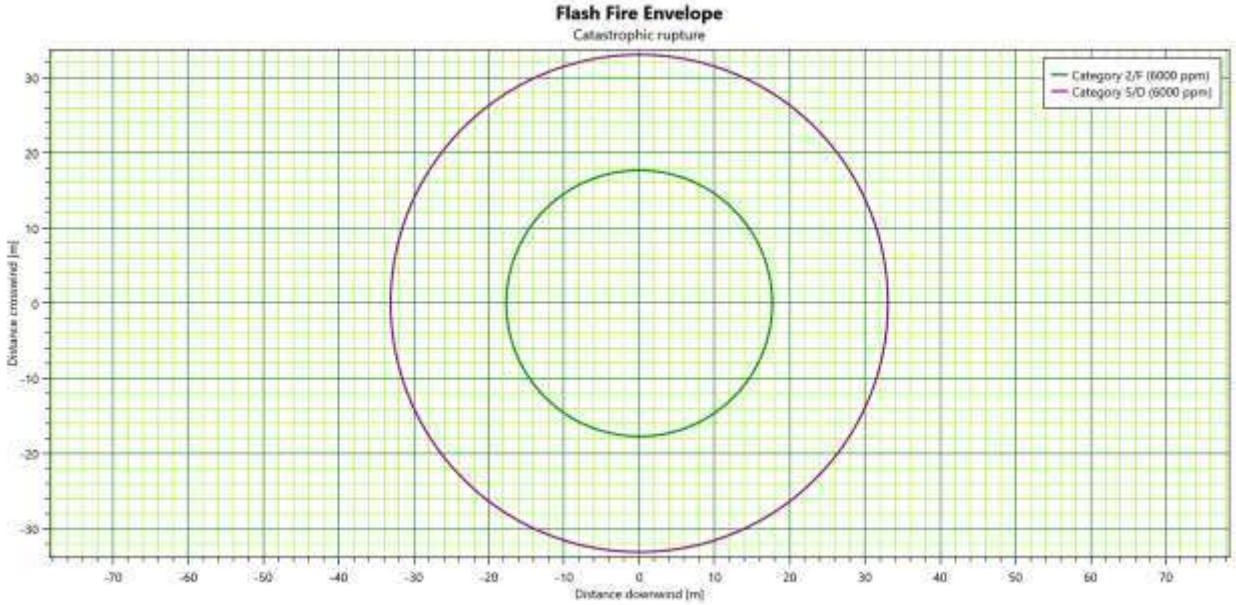

Explosion Overpressure vs Distance
Catastrophic rupture
Category 2/F (0.02068 bar)
Category 5/D (0.02068 bar)
Overpressure (gauge) [bar]
Distance downwind [m]

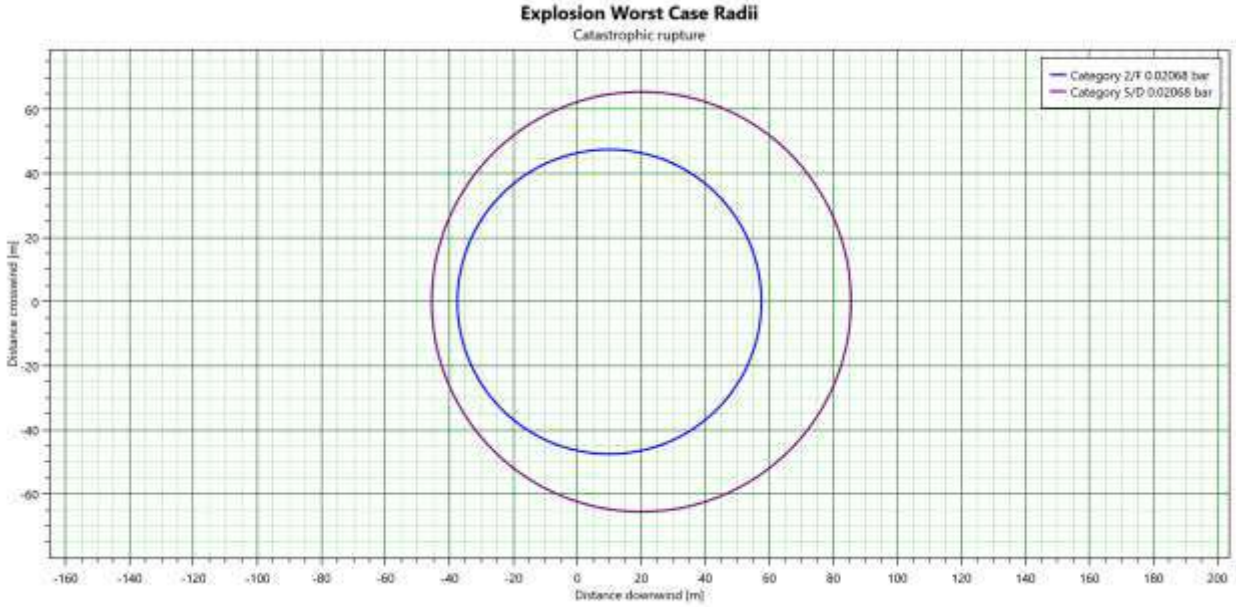

Cloud Footprint
Catastrophic rupture
Category 2/F @ 7000 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 7000 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width [m]
Distance downwind [m]

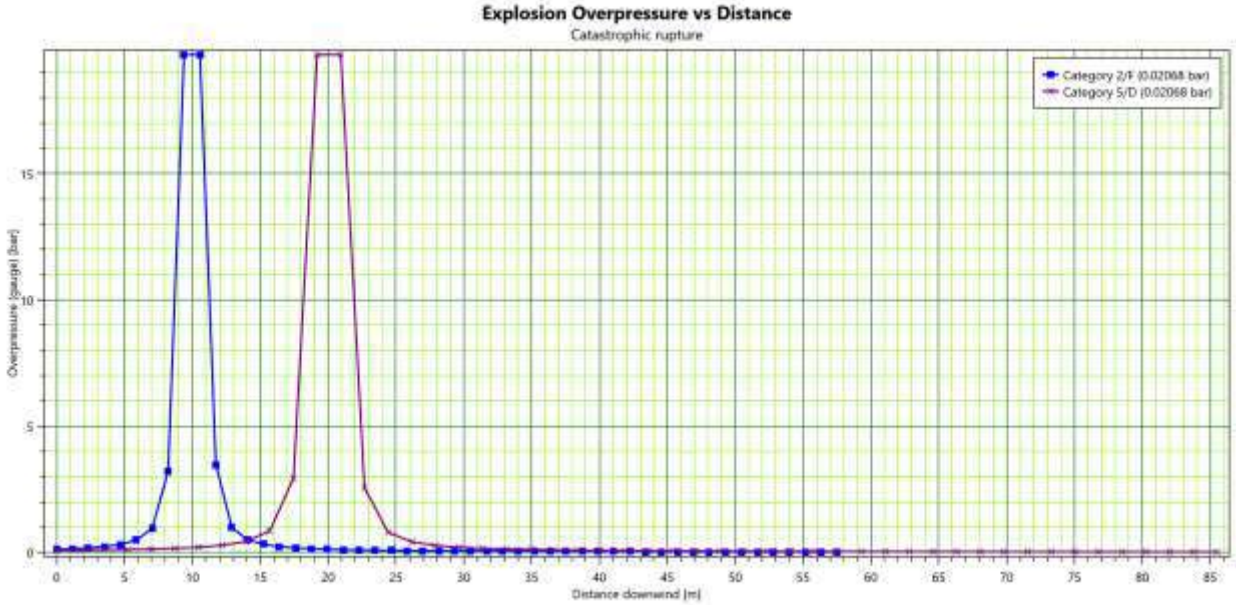
12.9 Tetrahydrofuran

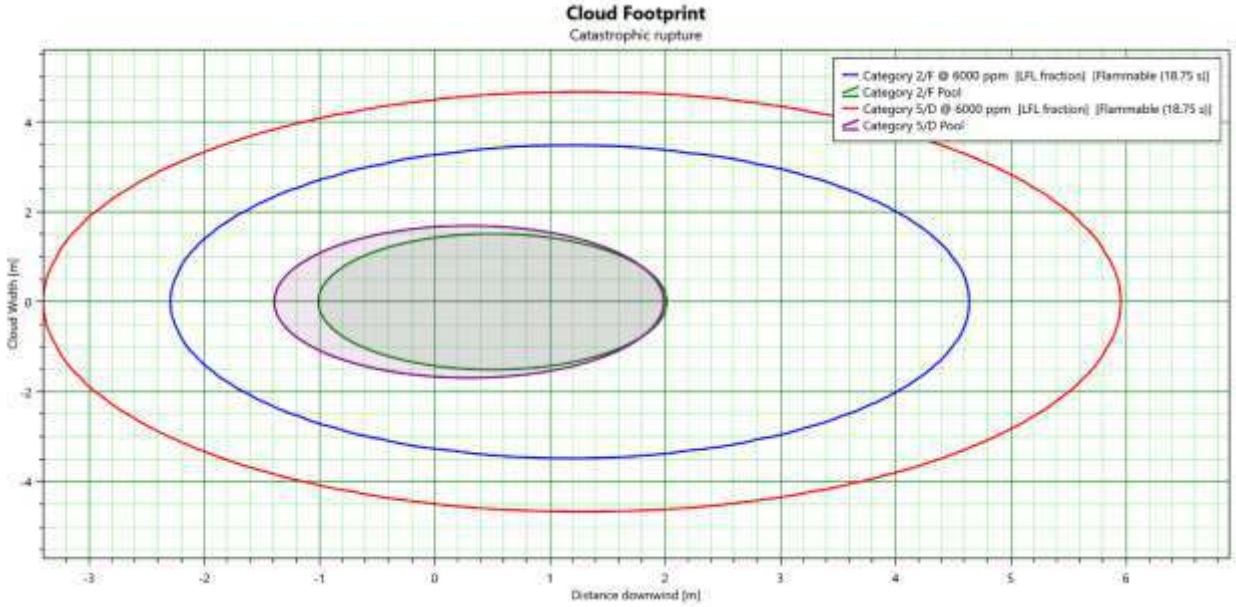




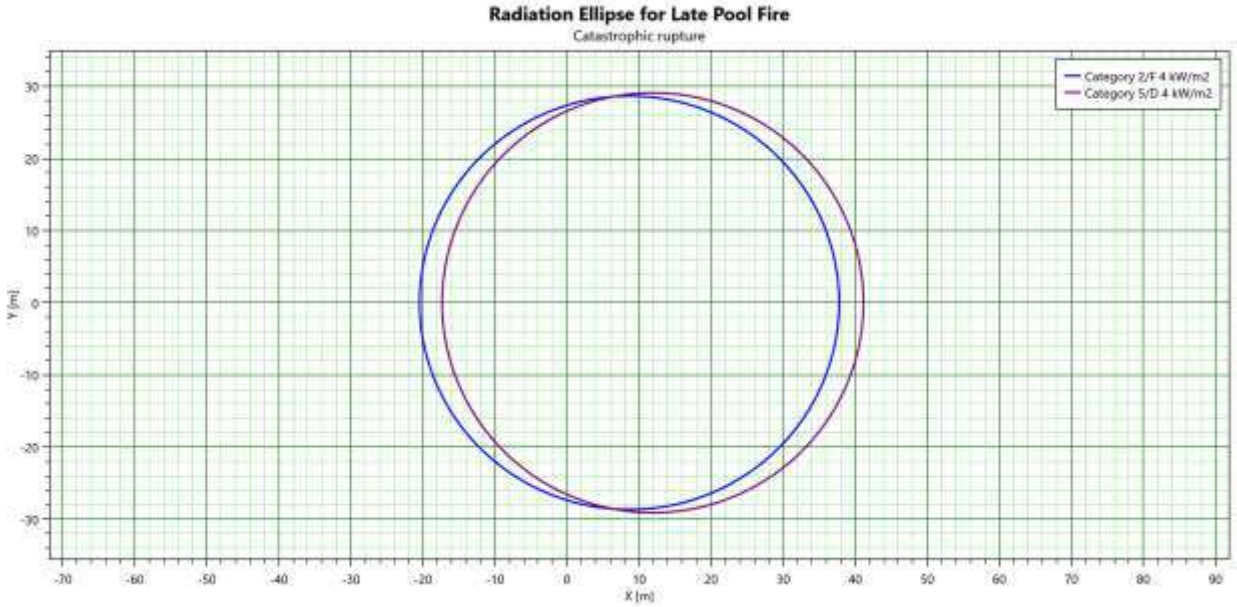

Flash Fire Envelope
Catastrophic rupture
Category 2/F (6000 ppm)
Category 5/D (6000 ppm)
Distance crosswind [m]
Distance downwind [m]

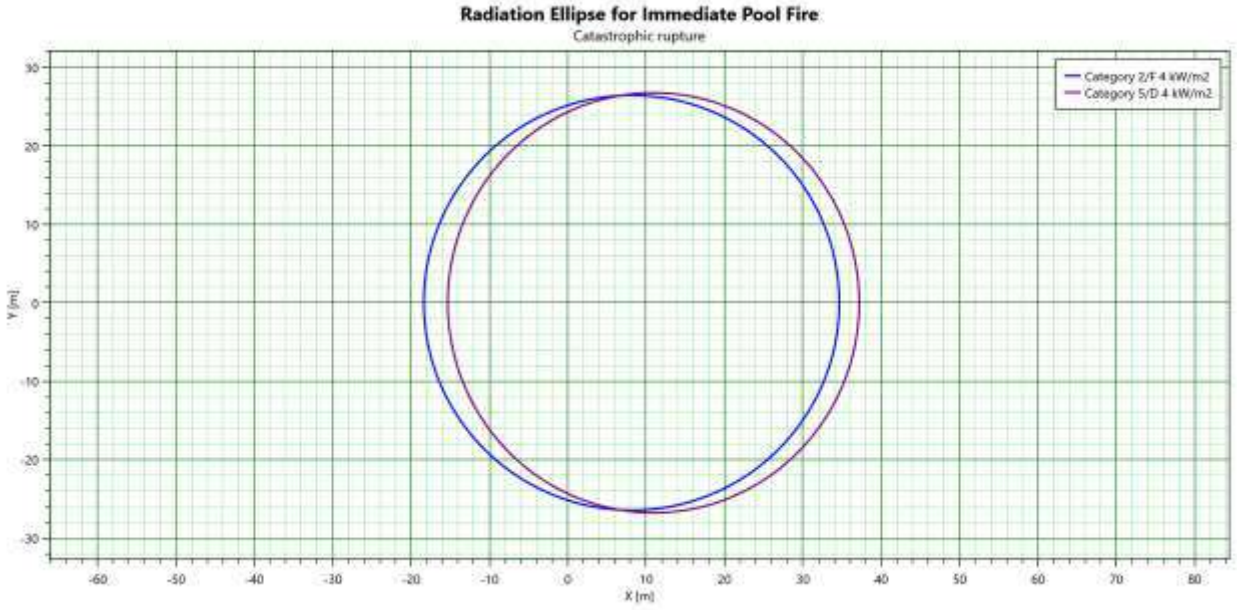

Explosion Worst Case Radii
Catastrophic rupture
Category 2/F 0.02068 bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]

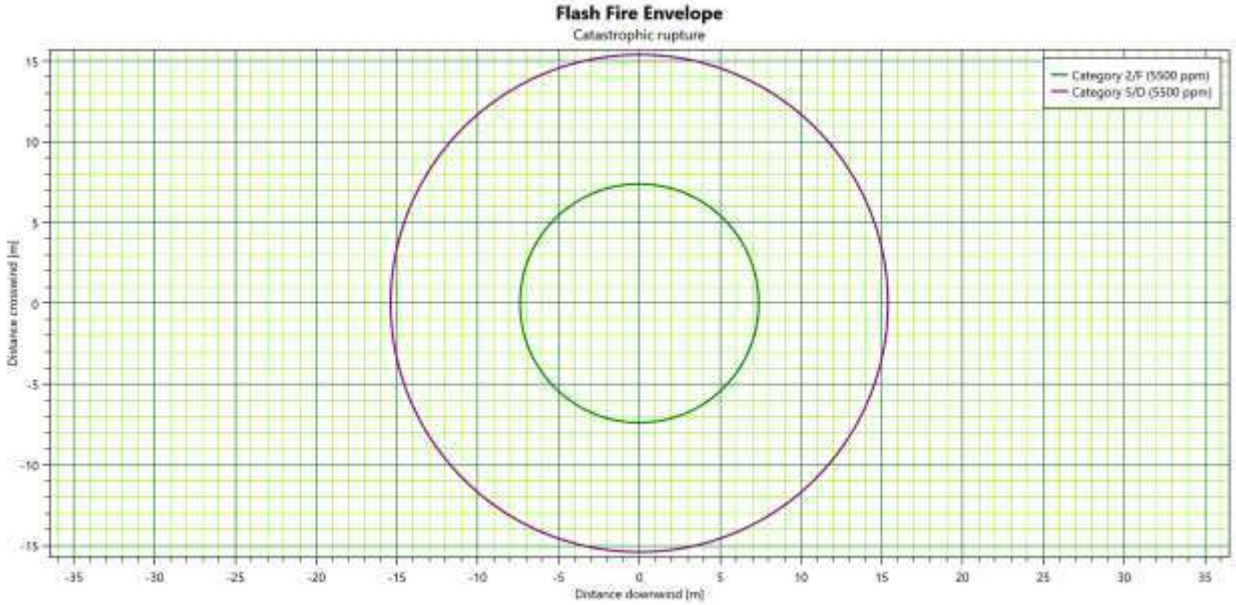

Explosion Overpressure vs Distance
Catastrophic rupture
Category 2/F (0.02068 bar)
Category 5/D (0.02068 bar)
Overpressure (gauge) (bar)
Distance downwind (m)

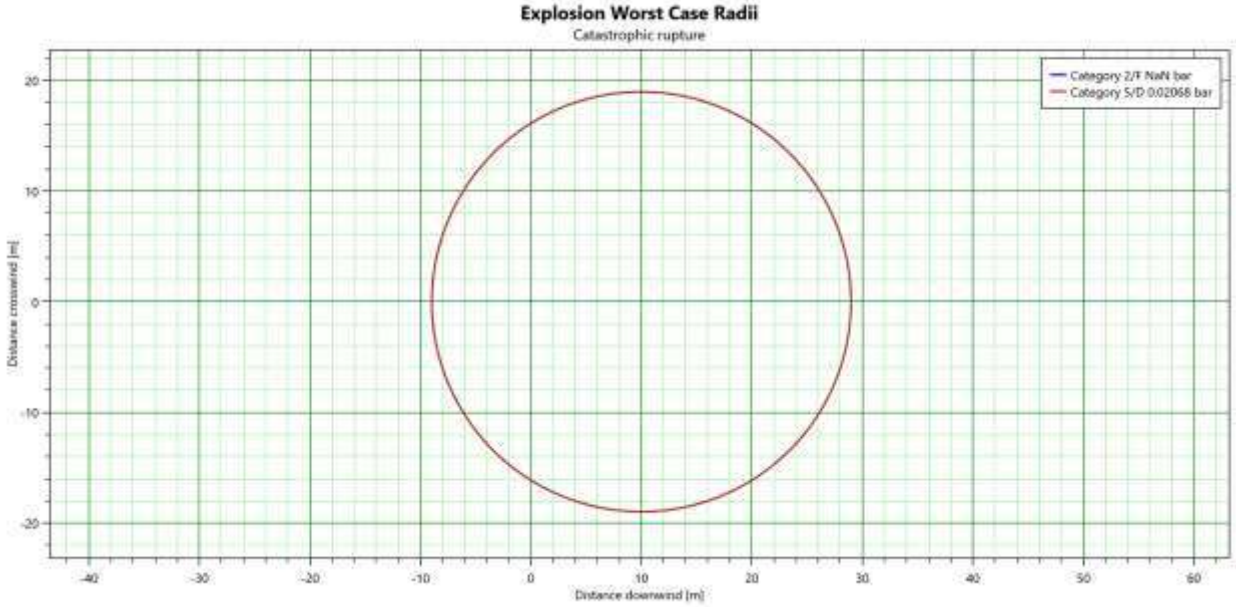

Cloud Footprint
Catastrophic rupture
Category 2/F @ 6000 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 6000 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width (m)
Distance downwind (m)

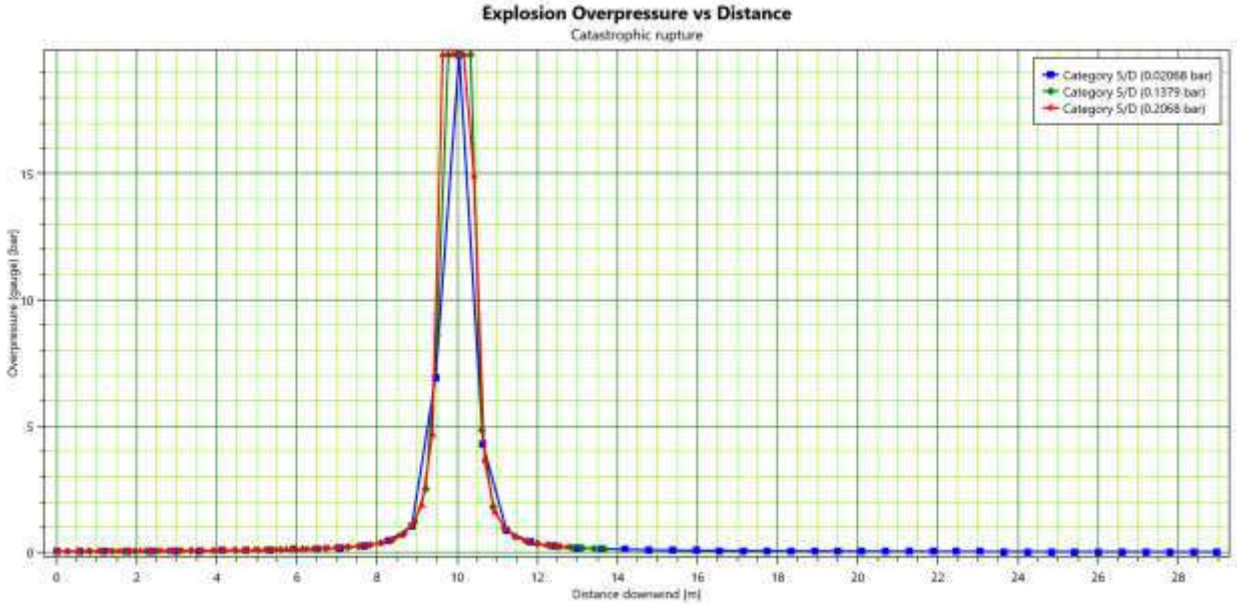
12.10 Toluene

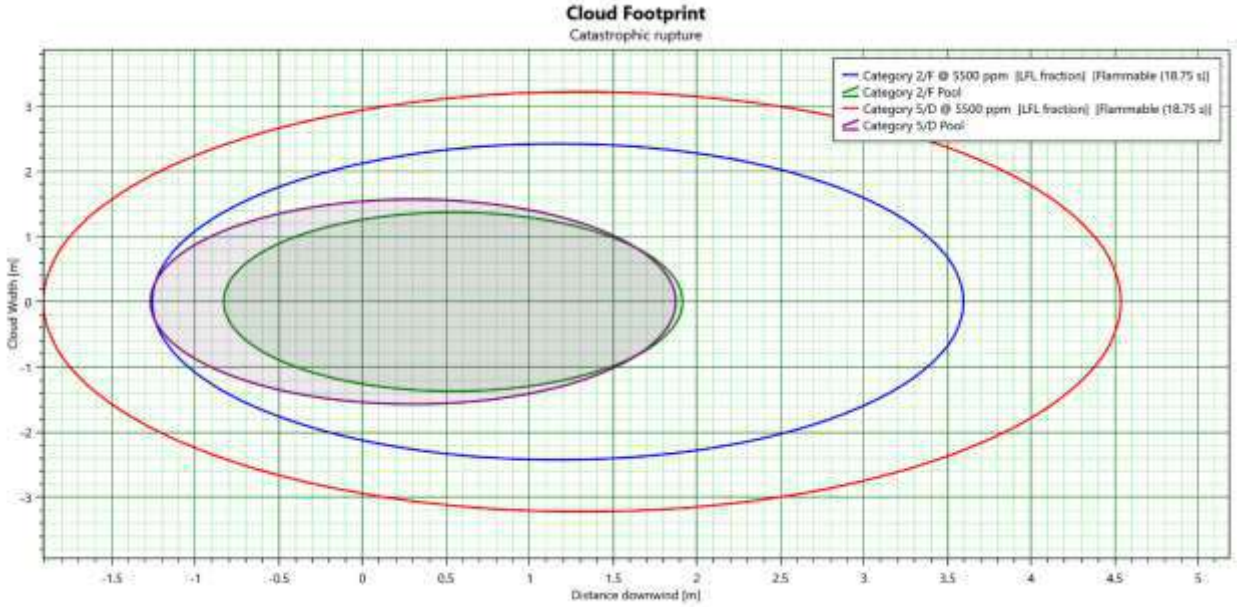





Flash Fire Envelope
Catastrophic rupture
Category 2/F (5500 ppm)
Category 5/D (5500 ppm)
Distance crosswind [m]
Distance downwind [m]


Explosion Worst Case Radii
Catastrophic rupture
Category 2/F NaN bar
Category 5/D 0.02068 bar
Distance crosswind [m]
Distance downwind [m]


Explosion Overpressure vs Distance
Catastrophic rupture
Category 5/D (0.02068 bar)
Category 5/D (0.1379 bar)
Category 5/D (0.2068 bar)
Overpressure (gauge) (bar)
Distance downwind (m)


Cloud Footprint
Catastrophic rupture
Category 2/F @ 5500 ppm (LFL fraction) (Flammable (18.75 s))
Category 2/F Pool
Category 5/D @ 5500 ppm (LFL fraction) (Flammable (18.75 s))
Category 5/D Pool
Cloud Width (m)
Distance downwind (m)

13 REFERENCES

- Guide to Manufacture, Storage and Import of Hazardous Chemicals Rules (MSIHC), 1989 issued by the ministry of environment and forests, (MoEF) Govt. of India as amended up to date.
- Health Safety and Executive "Failure Rate and Event Data for use within Land Use Planning Risk Assessments"
- IS 15656:2006: Hazard identification and risk analysis - Code of Practice
- Guidelines for Quantitative Risk Assessment CPR 18E (Purple book), Committee for the Prevention of Disasters, Netherlands (Edition: PGS 3, 2005)
- Guidelines for Hazard Evaluation Procedures - Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 1992.
- F.P. Lees, "Explosion – Overpressure Damage Data," Loss Prevention in the Process Industries – Hazard Identification, Assessment and Control, Second Edition, 1996, p.17/200-204.
- Effects of Thermal Radiation Centre for Chemical Process Safety, (CCPS) 1994.
- Ignition Probability Review; Model Development and Look-up Correlations, IP Research Report, Energy Institute, London, January 2006
- Spouge J., "A Guide to Quantitative Risk Assessment for Offshore Installations," DNV Technica, CMPT 1999, Publication 99/100a, ISBN I 870553 365
- Overall Plot Plan

14 APPENDIX A – LEGAL DISCLAIMER

a. Limitation of Liability. The consulting services conducted by Vigilant Ally LLP (the "Company") were performed using generally accepted guidelines, standards, and/or practices, which the Company considers reliable. Although the Company performed its consulting services pursuant to reliable and generally accepted practices in the industry, the Company does not guarantee or provide any representations or warranties with respect to Client's use, interpretation or application of the findings, conclusions, and/or suggestions of the consulting services provided by the Company. Moreover, the findings, conclusions, and the suggestions resulting from the consulting service are based upon certain assumptions, information, documents, and procedures provided by the Customer. AS SUCH, IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, PUNITIVE OR CONSEQUENTIAL DAMGES OF ANY NATURE WHATSOEVER, INCLUDING WITHOUT LIMITATION, ANY LOST REVENUE OR PROFITS OF THE CUSTOMER OR ITS CUSTOMERS, AGENTS AND DISTRIBUTORS, RESULTING FROM, ARISING OUT OF OR IN CONNECTION WITH, THE SERVICES PROVIDED BY THE COMPANY. The Customer agrees that the Company shall have no liability for damages, which may result from Client's use, interpretation or application of the consulting services provided by the Company.

b. The Company's pricing of the consulting services provided does not contemplate that the Company shall have any liability resulting from its performance of the consulting services, except as otherwise set forth in the Quotation from the Company. Accordingly, the Customer shall indemnify and hold harmless the Company, its shareholders, directors, officers, employees and agents (the "Indemnified Parties") from and against any and all loss, cost, liability and expense, including reasonable attorney's fees and costs, which any of the Indemnified Parties may incur, sustain or be subject to, as a result of any claim, demand, action, investigation or proceeding arising out of or relating to either: (a) the consulting services provided by the Company; or (b) any material, equipment, specifications or safety information (or lack thereof) supplied to the Company (or which should have been supplied to the Company) by Customer and/or any failure of such materials, equipment, specifications and safety information to comply with any federal, state or local law or safety standard.

END OF REPORT

ANNEXURE – XIV

FIRE NOC

TAMIL NADU FIRE AND RESCUE SERVICES

(Under section 13 of the Tamil Nadu Fire Service Act 1985 and

Tamil Nadu Fire Service Rule 1990 - Appendix-III)

District Office,

Fire and Rescue Service,

Villupuram District.

PP NOC No: 4405/NOC/NMSB/2025

Dated: 20/08/2025

NO OBJECTION CERTIFICATE

Sub: Tamilnadu Fire and Rescue Services Villupuram District - Issue of No Objection Certificate for Construction of Institutions Building in S.F.No.16 & 17, Plot No.38, Tindivanam Sidco Industrial Estate, Pelakuppam Village, Tindivanam Taluk, Villupuram District - Reg.

Ref: Token ID: 315120 Dated: 02/08/2025

****

With reference to the letter cited above, BASKARAN N, District Officer, Fire and Rescue Services, Villupuram District has inspected the Institutions building site located at S.F.No. 16 & 17, Plot No.38, Tindivanam Sidco Industrial Estate, Pelakuppam Village, Tindivanam Taluk, Villupuram District on 05/08/2025. This planning proposal proposed to construct Institutions consisting of **INDUSTRIAL BUILDING** with height of 4.5 meters. The plot area is 5527.68 Sq.mts and total buildup area is 1718.09 Sq.mts. The proposed building occupancy is classified as group G and subdivision G-4 as per the National Building code of India Part-IV Fire and Life Safety-2016.

No objection Certificate is issued on Fire and Rescue Services point of view to accord planning permission to the proposed building subject to fulfilment of the below conditions.

Conditions

The following fire safety measures should be provided in the proposed building before the actual occupation as listed below.

VII. Group G - Industrial Buildings Conditions

9. Moderate Hazard Covered area more than 1000 m2

1. The First aid firefighting equipment's should be provided at all floors in accordance with the IS 2190:2010 requirements.
2. There should be a wet-riser along with hose reel assembly per thousand square meters area covering all floor areas with landing valves along with delivery hoses.
3. To feed the wet-riser and sprinkler system an underground static water tank of minimum capacity 150,000 litters should be provided with refilling facilities.
4. A terrace level tank of capacity 20,000 litres also should be provided.
5. Set of pumps each consisting of two electrical pump and one diesel pump of capacity 2280 LPM and two electrical pump of capacity of 180 litres per minute should be provided.
6. Yard hydrant should be provided at all around the building every 30 meters.
7. Fire service inlets fitted with NRV at ground level should be provided.
8. Public Address System should be provided connecting all the floors.
9. An automatic sprinkler system should be provided at all floors.
10. Automatic detector system should be provided at all floors above and below the fall ceiling.
11. Manually operated Fire Alarm call points (MCP) should be provided on all floors.
12. Alternative & Independent power systems should be provided to Fire pumps, Emergency Lighting system and fire lift.

District Officer

Villupuram District

To:

JUVENUSDRUGS,

Pelakuppam Village,

Tindivanam Taluk,

Villupuram District

ANNEXURE – XV

RAW DATA OF AAQ

PROJECT NAME: **M/s. Juvenus Drugs**

Sample Analysis Started on: 21.03.2025 **Sample Analysis Completed on: 14.05.2025**

LOCATION CODE & NAME:	AAQ1 - Project Site				AAQ2 -Venmathiyathur				AAQ3 - Ural				AAQ4 - Pattanam			
	Results in µg/m3				Results in µg/m3				Results in µg/m3				Results in µg/m3			
Sampling Date	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx
20.03.2025 to 21.03.2025	65	26	3.8	15	57	21	3.4	17	53	18	3.1	13	59	23	5.2	16
27.03.2025 to 28.03.2025	60	21	4.0	14	53	18	3.1	10	58	23	3.6	17	52	18	4.6	18
03.04.2025 to 04.04.2025	66	24	4.1	17	50	24	3.4	15.4	51	14	4.0	20	61	26	4.2	19
10.04.2025 to 11.04.2025	63	27	4.0	21	54	21	3.8	18	48	16	3.4	16	70	28	5.4	16
17.04.2025 to 18.04.2025	69	25	5.3	17	63	26	3.4	14	60	25	5.2	24	60	25	5.9	19
24.04.2025 to 25.04.2025	65	29	5.1	19	56	21	3.0	19	63	18	4.8	16	58	21	5.1	16
01.05.2025 to 02.05.2025	67	26	4.3	15	53	19	3.3	17	55	20	4.6	17	61	24	6.4	18
08.05.2025 to 09.05.2025	64	23	4.7	16	61	24	3.4	19	61	25	4.1	15	66	28	6.0	16
MIN	**60**	**21**	**3.8**	**14**	**50**	**18**	**3.0**	**10**	**48**	**14**	**3.1**	**13**	**52**	**18**	**4.2**	**16**
MAX	**69**	**29**	**5.3**	**21**	**63**	**26**	**3.8**	**19**	**63**	**25**	**5.2**	**24**	**70**	**28**	**6.4**	**19**
AVG	**64.9**	**25.1**	**4.4**	**16.7**	**55.9**	**21.8**	**3.4**	**16.2**	**56.1**	**19.9**	**4.1**	**17.3**	**60.9**	**24.1**	**5.4**	**17.3**
98%	**68.7**	**28.7**	**5.3**	**20.7**	**62.7**	**25.7**	**3.7**	**19.0**	**62.7**	**25.0**	**5.1**	**23.4**	**69.4**	**28.0**	**6.3**	**19.0**

LOCATION CODE & NAME:	AAQ5 - Tindivanam				AAQ6 - Vempundi				AAQ7 - Kollar				AAQ8 - Kudisipalayam			
	Results in µg/m3				Results in µg/m3				Results in µg/m3				Results in µg/m3			
Sampling Date	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx	PM10	PM2.5	SO2	NOx
20.03.2025 to 21.03.2025	74	28	5.6	17	57	19	3.2	16	35	18	3.5	14	36	12	3.3	14
27.03.2025 to 28.03.2025	71	26	5.4	22	54	16	3.6	15	40	21	3.2	12	33	15	3.0	12
03.04.2025 to 04.04.2025	76	29	6.1	20	50	23	4.2	20	38	16	3.1	14	40	18	3.6	15
10.04.2025 to 11.04.2025	86	34	6.7	22	55	20	3.9	16	42	23	3.8	15	37	15	3.4	16
17.04.2025 to 18.04.2025	71	25	6.4	18	58	25	3.5	20	54	28	4.1	19	34	12	3.1	14
24.04.2025 to 25.04.2025	78	28	5.7	24	51	19	4.0	17	50	26	4.1	14	36	15	3.3	13
01.05.2025 to 02.05.2025	73	32	6.4	20	58	16	3.4	19	44	24	3.5	15	42	16	3.0	14
08.05.2025 to 09.05.2025	76	27.4	5.9	17	52	21	4.1	15	41	22	3.8	13	39	14	3.5	16
MIN	**71**	**25**	**5.4**	**17**	**50**	**16**	**3.2**	**15**	**35**	**16**	**3.1**	**12**	**33**	**12**	**3.0**	**12**
MAX	**86**	**34**	**6.7**	**24**	**58**	**25**	**4.2**	**20**	**54**	**28**	**4.1**	**19**	**42**	**18**	**3.6**	**16**
AVG	**75.6**	**28.7**	**6.0**	**20.0**	**54.4**	**19.9**	**3.7**	**17.3**	**43.0**	**22.3**	**3.6**	**14.5**	**37.1**	**14.6**	**3.3**	**14.3**
98%	**84.9**	**33.7**	**6.7**	**23.7**	**58.0**	**24.7**	**4.2**	**20.0**	**53.4**	**27.7**	**4.1**	**18.4**	**41.7**	**17.7**	**3.6**	**16.0**

ANNEXURE – XVI

PROJECT COST CERTIFICATE

Project Cost Estimate Certificate

To whomsoever it may concern

This is to certify that the estimate cost (Gross Fixed Asset Value) of the proposed Bulk Drug & Intermediates Manufacturing Unit at Survey Nos. 16 (Part) & 17 (Part) , Plot no. 38, TANSIDCO Pharma Industrial Park at **TINDIVANAM MEGA PHARMA CLUSTER**, Pellakuppam, Kollar & Venmaniyathur Village, Tindivanam Taluk, Villupuram District, Tamil Nadu – 604 001 by M/s. Juvenus Drugs:

S. No	Gross Fixture Assets	Estimated Value INR (in Crores)
1.	Land Cost	1.52
2.	Building Cost	1.0
3.	Plant & Machinery Cost	1.0
4.	Utilities/Other Infrastructure Cost	1.0
Total		4.52

Place: Villupuram

Date: 24/02/2025

ANNEXURE – XVII

BOARD RESOLUTION FOR AUTHORIZED SIGNATORY

JUVENUS
DRUGS

CERTIFIED TRUE COPY OF THE RESOLUTION PASSED AT THE MEETING OF THE PARTNERS OF THE FIRM HELD ON 17th DAY OF JANUARY, 2025 AT NO.55, RAJ FLATS, NEAR RING ROAD, DEVAKI NAGAR, PONNIAMANMEDU, CHENNAI, TAMIL NADU, 600110 STARTED AT 11.00 AM AND CONCLUDED AT 11.30 AM

The Partners of the firm appointed Mr. P. Kannan as the Chairperson to conduct the meeting of the firm.

"Resolved That" the partner of the firm Mrs. A. Lakshmi, hereby authorized Mr. P. Kannan (Aadhaar No: 890066225799) Managing Director of Juvenus Drugs authorized to apply all kinds of approvals required for the property located at Plot No. 38, Survey Nos. 16 & 17, TANSIDCO Industrial Estate at Tindivanam Mega Pharma Cluster, Pelakuppam Village, Tindivanam Taluk, Villupuram District, Tamil Nadu.

"Resolved That" the partner of the firm Mrs. A. Lakshmi, authorizing Mr. P. Kannan – Managing Director to apply revenue records, NOC from PWD, Local Body, NHAI, Tamil Nadu Pollution Control Board (TNPCB), State Level Environmental Impact Assessment Authority – Tamil Nadu (SEIAA-TN) and also submit application to BDO, DTCP for the purposed of planning permission / building permit and apply to TNEB connection or any other licenses from local authorities like Panchayat, Village Officer, Tahsildar or any other statutory Government bodies, offices, etc.,

"Resolved Further That" Mr. P. Kannan be and is hereby authorized to issue certified true copy of this resolution to any authority or person, as and when required and to sign the documents, Letters, etc.,

for Juvenus Drugs

For JUVENUS DRUGS

Partner

For JUVENUS DRUGS

Partner

Partners:

1. Mr. P. Kannan

2. Mrs. A. Lakshmi

ANNEXURE – XVIII

DISCLOSURE OF EIA CONSULTANT

Details of EIA Consultant Organization

Name of the Organization	:	Eco Services India Private Limited.
Contact Person:		
Name	:	Dr. P. Kalaiselvan
Designation	:	Director
Address/Location	:	No. 1/134, Dhanakotiraja Street, Sundar Nagar, Ekkatuthangal, Guindy, Chennai – 600032. Tel: +91-44-3068 3067 Fax: +91-44-3068 0006 Mobile: +91-9383999109 E-mail: kalaiselvan@ecoservices.in

Status of Accreditation:

M/s. Eco Service India Private Limited is accredited by NABET/QCI for handling projects in the Sector Nos. 4, 8, 21, 29, 31, 38 & 39 (i.e., Item Nos. 1(d), 3(a), 5(f), 7(a), 7(c), 8(a) & 8(b) of the Schedule to EIA Notification, 2006). Please refer to the List of Accredited Consultant Organization with their Certificate / Extension Letter no. as updated by NABET every month. We herewith enclose our NABET Accreditation certificate for your reference.

भारतीय गुणवत्ता परिषद्
QUALITY COUNCIL® OF INDIA
QCI Creating an Ecosystem for Quality

NABET

National Accreditation Board for Education and Training

Certificate of Accreditation

Eco Services India Private Limited, Chennai

1/134, Dhanakotiraja Street, Sundar Nagar, Ekkaduthangal, Guindy, Chennai – 600032

*The organization is accredited as **Category-A** under the QCI-NABET **Scheme for Accreditation of EIA Consultant Organization, Version 3**: for preparing EIA/EMP reports in the following Sectors-*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Thermal power plants	4	1 (d)	A
2.	Metallurgical industries (ferrous only)	8	3 (a)	B
3.	Synthetic organic chemicals industry	21	5 (f)	A
4.	Airports	29	7 (a)	A
5.	Industrial estates/ parks/ complexes/areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	A
6.	Building and construction projects	38	8 (a)	B
7.	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated May 03, 2024, posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/24/3251 dated May 24, 2024. The accreditation needs to be renewed before the expiry date Eco Services India Private Limited, Chennai following due process of assessment.

Issue Date
May 24, 2024

Valid up to
April 03, 2027

Mr. Ajay Kumar Jha
(Sr. Director, NABET)

Certificate No.
NABET/EIA/24-27/RA 0332

Prof (Dr) Varinder S Kanwar
(CEO-NABET)

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.