

**ACTION PLAN FOR INDUSTRIAL CLUSTER IN
CRITICALLY POLLUTED AREA**

**Monitoring, Sampling, Analysis of
Stack, Ambient Air Quality, Surface
Water, Ground Water, Waste Water**

तारापुर Tarapur



Maharashtra Pollution Control Board

Kalpataru Point, Sion East, Mumbai - 400022

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By undertaking this project and completing in schedule time, we consider ourselves very lucky since we have helped the mankind by giving the data on pollution load and further action by the Board, to bring down the pollution level.

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Abbreviations:

APHA	American Public Health Association
BDL	Below Detection Limit
BOD	Biochemical Oxygen Demand
CEPI	Comprehensive Environmental Pollution Index
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CPA	Critically Polluted Areas
SPA	Severely Polluted Areas
DO	Dissolved Oxygen
ETP	Effluent Treatment Plant
MIBK	Methyl Isobutyl Ketone
MPCB	Maharashtra Pollution Control Board
NAAQS	National Ambient Air Quality Standards
NO_x	Oxides of Nitrogen
ND	Not Detected
PAH	Poly Aromatic Hydrocarbons
PCB	Poly Chlorinated Biphenyls
PCT	Poly Chlorinated Terphenyls
PM₁₀	Particulate Matter (size less than 10 µm)
PM_{2.5}	Particulate Matter (size less than 2.5 µm)
SO₂	Sulphur Dioxide
STAP	Short Term Action Plan
WHO	World Health Organization

1. Introduction:

India has experienced rapid industrial growth in last few years. Maharashtra is one of the most industrialised states in the country. The state has identified industrial sectors like auto, engineering, chemical, electronics and textile as focus sectors. Industrial processes and activities consume materials and resources for manufacturing products generating emissions, effluents and solid wastes. Rise in growth in industrial activities is leading to manifold impacts to the environment. This environmental pollution is a wide reaching problem and if not controlled to certain tolerable levels, it is likely to influence the human health too. Long term exposure to the polluted air and water causes chronic health problems. Hence, scientists are exploring the quantum of pollution load as well as to device certain strategies and technologies so that our sustainable development would not be jeopardized otherwise our long cherished dream of establishing eco-socialism on this watery planet could not come true.

The extent of pollution varies with the size of the industry, the nature of the industry, the type of products used and produced etc. In view of this, Central Pollution Control Board (CPCB) has evolved the concept of Comprehensive Environmental Pollution Index (CEPI) during 2009-10 as a tool for comprehensive environmental assessment of prominent industrial clusters and formulation of remedial Action Plans for the identified critically polluted areas. The index captures the various dimensions of environment including air, water and land. Comprehensive Environmental Pollution Index (CEPI), which is a rational number to characterize the environmental quality at a given location following the algorithm of source, pathway and receptor have been developed. Later-on proposals were received from the SPCBs, State Governments, and Industrial Associations and concerned Stake-holders for revisiting the criteria of assessment under CEPI concept. After careful examination and consideration of the suggestions of concerned stake-holders, it was decided to prepare the revised concept of CEPI by eliminating the subjective factors but retaining the factors which can be measured precisely. Hence, revised concept came into existence, which is termed as Revised CEPI Version 2016.

The present report is also based on the revised CEPI version 2016. The results of the application of the Comprehensive Environmental Pollution Index (CEPI) to selected industrial clusters or areas are presented in this report. The main objective of the study is to identify polluted industrial clusters or areas in order to take concerted action and to centrally monitor them at the national level to improve the current status of their environmental components such as air and water quality data, ecological damage, and visual environmental conditions. For the study, Central Pollution Control Board (CPCB) has selected a total of 88 industrial areas or clusters in consultation with the Ministry of Environment & Forests Government of India. Out of these, 5 critically polluted industrial clusters namely Tarapur, Dombivali, Navi Mumbai, Aurangabad and Chandrapur, are identified and 3 severely polluted industrial clusters namely Pimpri-chinchwad, Nashik and Chembur from Maharashtra are added into this list.

In this report, CEPI study includes Tarapur industrial area of Maharashtra state. It is one of the best industrial area situated near Mumbai, Thane and adjacent to Gujarat state on Mumbai - Ahmedabad Express Highway. The industrial part of this place has a number of factories manufacturing dyes, paints and industrial / agricultural chemicals. Heavy metal factories manufacturing a wide variety of equipment are also based in this region. A few nationally prominent industrial establishments have their manufacturing plants in Tarapur. This city accommodates bulk drug manufacturing units, speciality chemical manufacturing units, steel plants and some textile plants. Government of Maharashtra has established Industrial Estate at Boisar, Tarapur in the year 1972. This estate is known as MIDC Tarapur. This is one of the largest chemical industrial estates in the State of Maharashtra.

2. Scope of Work

The Scope of Work consisted of the following:

Monitoring, Sampling, Analysis for Stack, Ambient Air Quality, Surface Water, Waste Water, and Ground Water Quality for identified five Critically Polluted areas (CPAs) in Maharashtra i.e. **Chandrapur, Dombivli, Aurangabad, Navi Mumbai** and **Tarapur** and 3 Severely Polluted areas (SPAs) in Maharashtra i.e. **Chembur, Pimpri-Chinchwad and Nashik** as per standard methods.

- At each of the 5 CPAs and 3 SPAs, 24 hourly ambient air quality monitoring to be carried out.
- Representative samples for surface water quality, waste water quality and Ground Water quality to be collected from prominent surface and Ground Water bodies located in and around the clusters/areas.
- Submission of complete monitoring, sampling and analysis reports including the summary of the parameters exceeding the prescribed standards/norms for all the 5 CPAs and 3 SPAs.
- Submission of 3 copies of final report with photographs at prominent locations and the CD (soft copy) on completion of the project for every critically polluted and severely polluted area separately.

Monitoring, Sampling, Analysis for Stack, Ambient Air Quality, Surface Water, Waste Water and Ground Water Quality for Tarapur:

- The sampling was carried out in 3 days at various locations i.e. from 27th June to 29th June, 2018.
- In Tarapur, a total of 7 Stack Monitoring Samples, 4 Ambient Air Quality Monitoring Samples, 17 Waste Water Samples and 6 Ground Water Samples were collected and analyzed.

2.1 Stack Emission Parameters

The Stack Emissions were analyzed with the following parameters:

1. Acid Mist
2. Ammonia
3. Carbon Monoxide
4. Chlorine
5. Fluoride(gaseous)
6. Fluoride (particulate)
7. Hydrogen Chloride
8. Hydrogen Sulphide
9. Oxides of Nitrogen
10. Oxygen

11. Polyaromatic Hydrocarbons (Particulate)
12. Suspended Particulate Matter
13. Sulphur Dioxide
14. Benzene
15. Toluene
16. Xylene
17. Volatile Organic Compounds (VOCs)

2.2 Ambient Air Quality Parameters

The Ambient Air Quality was analyzed with the following parameters:

1. Sulphur Dioxide (SO₂)
2. Nitrogen Dioxide (NO₂)
3. Particulate Matter (PM₁₀)
4. Particulate Matter (PM_{2.5})
5. Ozone (O₃)
6. Lead (Pb)
7. Carbon Monoxide (CO)
8. Ammonia (NH₃)
9. Benzene (C₆H₆)
10. Benzo (a) Pyrene (BaP) (Particulate Phase Only)
11. Arsenic (As)
12. Nickel (Ni)

2.3 Water/Waste Water Parameters

The Water/Waste Water was analyzed with the following parameters:

- a. Prominent Surface Water bodies such as outfalls of CETPs, ETPs, treated effluent drainage, river, canal, ponds, lakes and other such water supply resources flowing through the area or flowing adjoining the CPA.
- b. Ground Water Quality data of prominent ground water resources such as observation wells of Central Ground Water Board, drinking water wells, hand pumps, bore wells, hand pumps, bore wells and other such water supply resources located in the industrial cluster/area under consideration or in the peripheral areas.

Basic water quality parameters for surface water and ground water both are as follows:

i. Simple Parameters:

1. Sanitary Survey
2. General Appearance
3. Colour
4. Smell
5. Transparency
6. Ecological(Presence of animals like fish, insects) (Applicable to only surface water)

ii. Regular Monitoring Parameters:

7. pH
8. Oil & Grease
9. Suspended Solids
10. Dissolved Oxygen (% saturation) (Not applicable for ground waters)
11. Chemical Oxygen Demand
12. Biochemical Oxygen Demand
13. Electrical Conductivity
14. Nitrite-Nitrogen
15. Nitrate-Nitrogen
16. (NO₂ + NO₃)-Nitrogen
17. Free Ammonia
18. Total Residual Chlorine
19. Cyanide
20. Fluoride
21. Sulphide

22. Dissolved Phosphate
23. Sodium Absorption Ratio (SAR)
24. Total Coliforms (MPN/100 ml)
25. Faecal Coliforms (MPN/100 ml)

iii. Special Parameters:

26. Total Phosphorous
27. Total Kjeldahl Nitrogen(TKN)
28. Total Ammonia ($\text{NH}_4 + \text{NH}_3$)-Nitrogen
29. Phenols
30. Surface Active Agents
31. Organo Chlorine Pesticides
32. Polynuclear aromatic hydrocarbons (PAH)
33. Polychlorinated Biphenyls (PCB)and Polychlorinated Terphenyls (PCT)
34. Zinc
35. Nickel
36. Copper
37. Hexavalent Chromium
38. Chromium (Total)
39. Arsenic (Total)
40. Lead
41. Cadmium
42. Mercury
43. Manganese
44. Iron

45. Vanadium

46. Selenium

47. Boron

iv. Bioassay (Zebra Fish) Test: For specified samples only.

2.4 Methodology followed in Sampling and Analysis

Industries, places and locations that have been chosen for the sampling are representative of the city/area. Sampling has been done at the potential polluted areas so as to arrive at the CEPI. This will further help the authorities to monitor the areas in order to improve the current status of their environmental components such as air and water quality data, ecological damage and visual environmental conditions. Methodology for sampling, preservation and analysis have been done according to the references incorporated. Methodology of various types of parameters is presented under following annexure:

1. Stack Emission Sampling and Analysis Methodology – **Annexure II**
2. Ambient Air Sampling and Analysis Methodology - **Annexure III**
3. Water/Wastewater Sampling and Analysis Methodology - **Annexure IV**

3. Results of Analysis

Results of Analysis are tabulated below for Stack Emission Monitoring, Ambient Air Quality Monitoring, Waste Water Analysis and Water Analysis. These are followed by their respective graphical representation.

Kindly note:

- NA specifies the sample is not analysed for the specific parameter.
- ND specifies that even though the sample was analysed for the parameter, it was not detected.
- BDL specifies that the result obtained is below detection limit.

Please Note: Industrial clusters observed with below detection limit parameters are NOT included into the graphs

3.1 Stack Emission Monitoring:

Stack Emission Monitoring Results are compared against The Environment (Protection) Rules, 1986 General Emission Standard - Part D. The limits are represented on the graphical representation. Graph of Volatile Organic Carbon (VOCs) could not be prepared as their concentration was found either very less or not detected.

Sr.	Name of Industry	Included in
1.	Mandhana Industrial Ltd. (Dyeing Unit- II)	Table No. I
2.	Mandhana Industrial Ltd. (Shirting Unit)	Table No. I
3.	Angadpal industries Pvt. Ltd.	Table No. I
4.	Gini Silk Mills Ltd	Table No. I
5.	Siyaram Silk Mills Ltd.	Table No. II
6.	Calyx Chemical Ltd.	Table No. II
7.	UPL, Plot No. E-51	Table No. II

Table No. I:

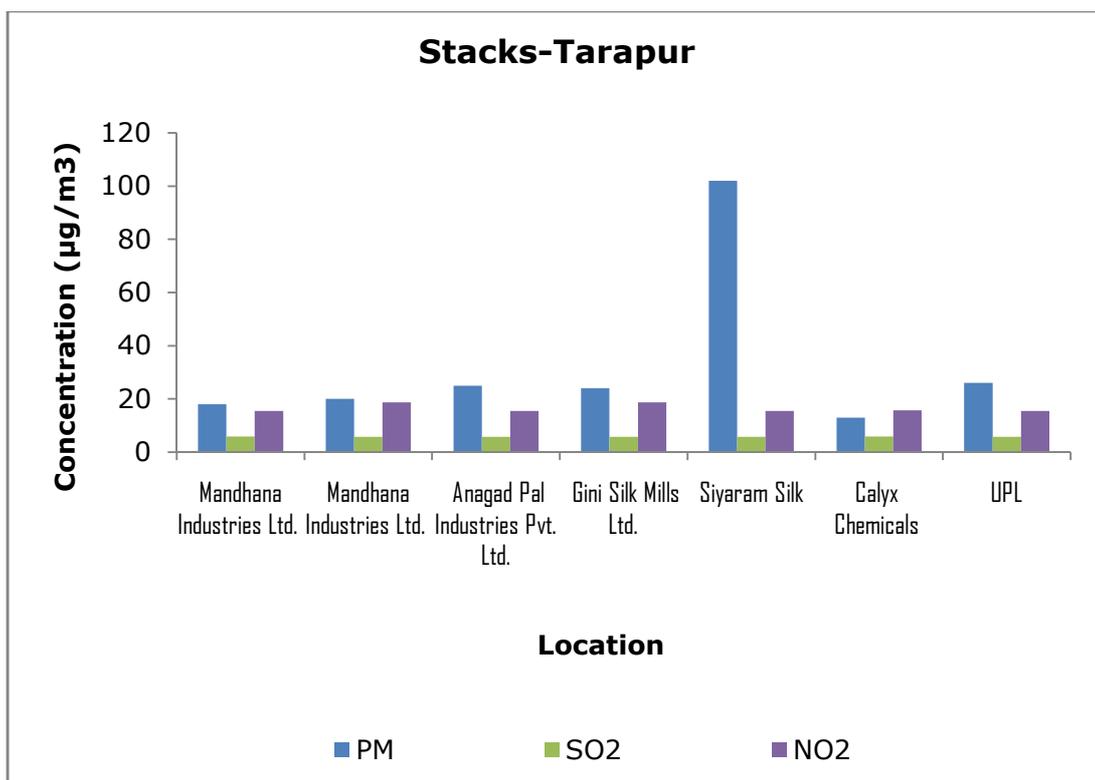
Name of Industry			Mandhana Industrial Ltd. (Dyeing Unit- II)	Mandhana Industrial Ltd. (Shirting Unit)	Angadpal industries Pvt. Ltd.	Gini Silk Mills Ltd
Date of Sampling			27.06.18	27.06.18	27.06.18	28.06.18
Stack ID			Boiler	Boiler	Boiler	Boiler
Sr.	Parameters	Unit	Result			
1	Particulate Matter	mg/Nm ³	18	20	25	24
	Std. Limit	mg/Nm³	150	150	150	150
2	Sulphur Dioxide (SO ₂)	mg/Nm ³	5.92	5.71	5.71	5.71
		kg/d	6.7	6.55	3.05	8.18

Name of Industry			Mandhana Industrial Ltd. (Dyeing Unit- II)	Mandhana Industrial Ltd. (Shirting Unit)	Angadpal industries Pvt. Ltd.	Gini Silk Mills Ltd
Date of Sampling			27.06.18	27.06.18	27.06.18	28.06.18
Stack ID			Boiler	Boiler	Boiler	Boiler
	Std. Limit	mg/Nm³	-	-	-	-
3	Nitrogen Dioxide (NO ₂)	mg/Nm ³	15.5	18.7	15.5	18.7

Table No. II:

Name of Industry			Siyaram Silk Mills Ltd.	Calyx Chemical Ltd.	UPL
Date of Sampling			28.06.18	28.06.18	28.06.18
Stack ID			Boiler	Boiler	Boiler
Sr.	Parameters	Unit	Result		
1	Particulate Matter	mg/Nm ³	102	13	26
	Std. Limit	mg/Nm³	150	150	150
2	Sulphur Dioxide (SO ₂)	mg/Nm ³	5.71	5.92	5.71
		kg/d	3.05	2.47	2.93
	Std. Limit	mg/Nm³	-	-	-
3	Nitrogen Dioxide (NO ₂)	mg/Nm ³	15.5	15.7	15.5

Graphs: Stack Monitoring Results:



3.2 Ambient Air Quality:

In order to arrive at conclusions, the Ambient Air Quality Monitoring Results are compared against National Ambient Air Quality Standards, 2009 (**Annexure V**).

Please Note: In Tarapur, all the parameters observed below detection limit in their concentrations are not shown in the graphs.

Sr.	Locations	Location details	Table No.
1.	Mandhana Industrial Ltd. (Dyeing Unit- II)	Near Main Gate	Table No. I
2.	Mandhana Industrial Ltd. (Shirting Unit)	Near ETP	Table No. I
3.	Siyaram Silk Mills Ltd.	Near ETP	Table No. II
4.	Sumitomo Chemical India Pvt. Ltd.	Near Main Gate	Table No. II

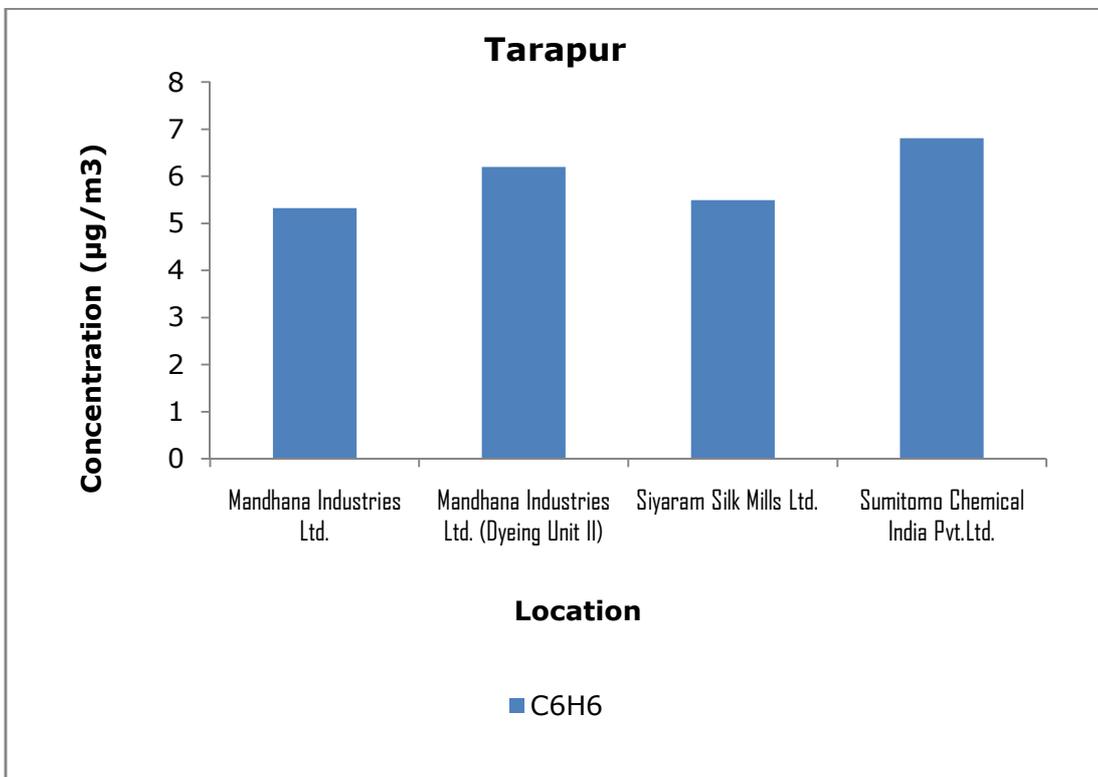
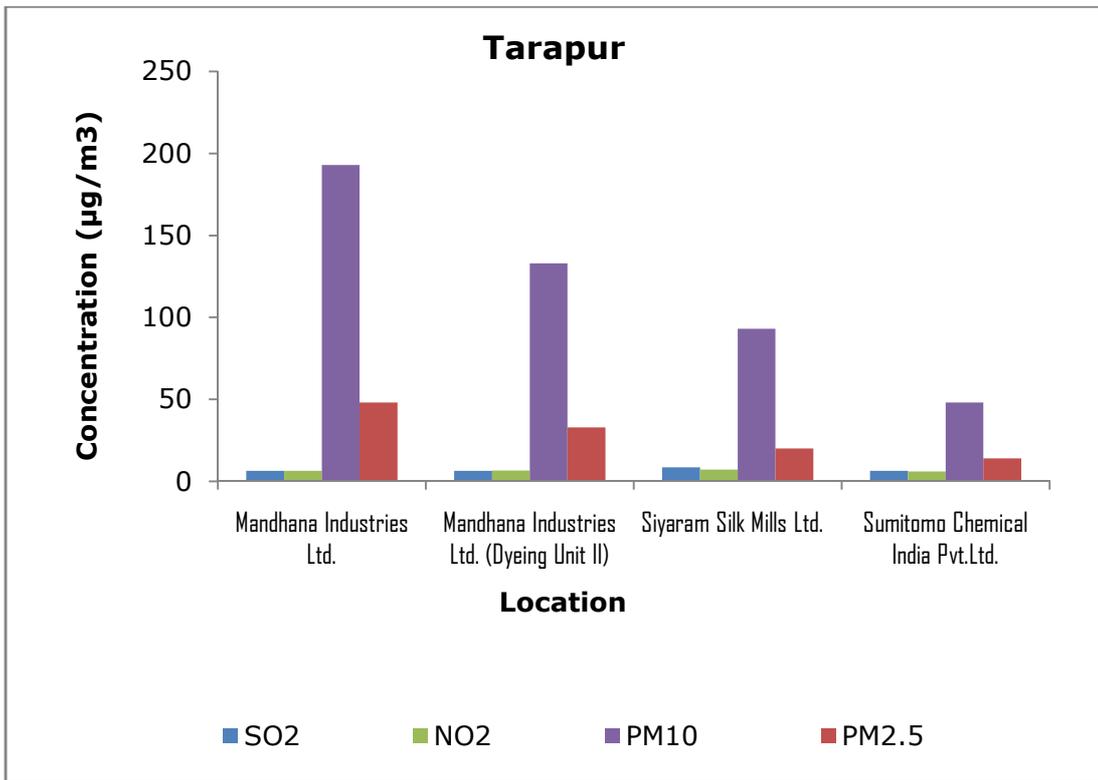
Table No. I:

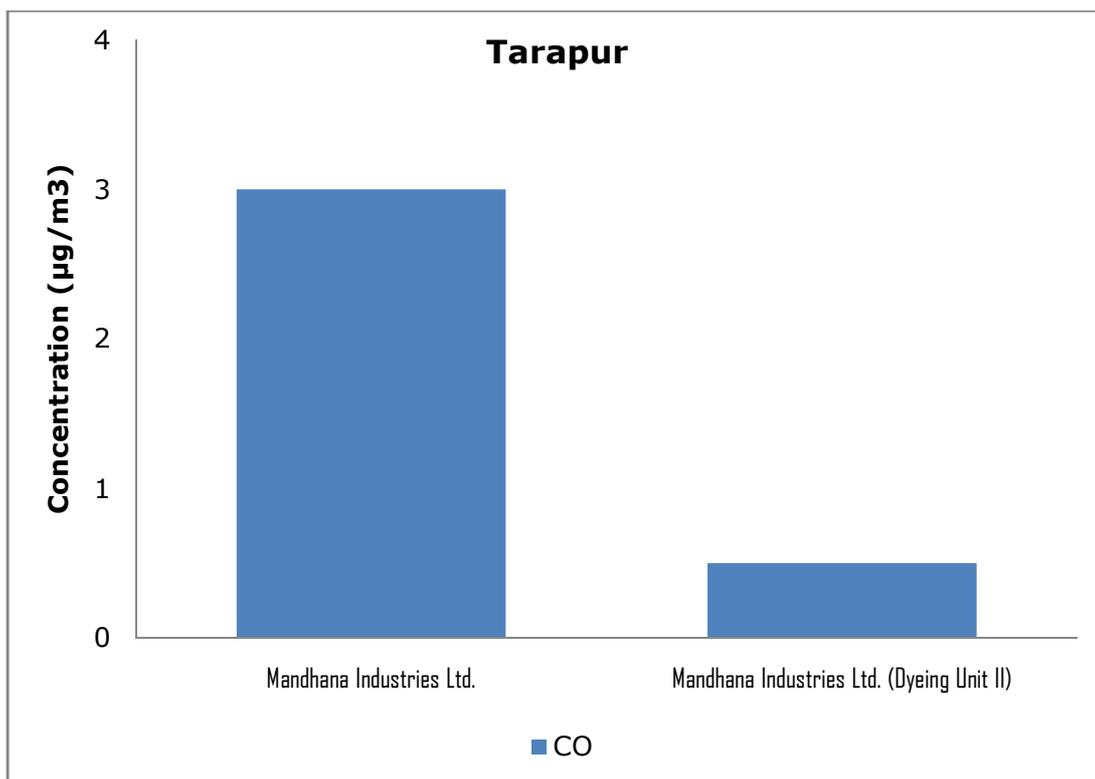
Location				Mandhana Industrial Ltd. (Dyeing Unit- II)	Mandhana Industrial Ltd. (Shirting Unit)
Date of Sampling				27.06.18	27.06.18
Sr.	Parameters	Unit	Std. Limit (NAAQS, 2009)	Results	
1.	Sulphur Dioxide (SO ₂)	µg/m ³	80	6.5	6.39
2.	Nitrogen Dioxide (NO ₂)	µg/m ³	80	6.36	6.65
3.	Particulate Matter (size <10 µm) or PM ₁₀	µg/m ³	100	193	133
4.	Particulate Matter (size <2.5µm) or PM _{2.5}	µg/m ³	60	48	33
5.	Ozone (O ₃)	µg/m ³	180	BDL	BDL
6.	Lead (Pb)	µg/m ³	1	BDL	BDL
7.	Carbon Monoxide (CO)	mg/m ³	04	3	0.5
8.	Ammonia (NH ₃)	µg/m ³	400	BDL	BDL
9.	Benzene (C ₆ H ₆)	µg/m ³	5	5.32	6.2
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m ³	1	BDL	BDL
11.	Arsenic (as As)	ng/m ³	6	BDL	BDL
12.	Nickel (as Ni)	ng/m ³	20	BDL	BDL

Table No. II:

Location				Siyaram Silk Mills Ltd.	Sumitomo Chemical India Pvt. Ltd.
Date of Sampling				28.06.18	28.06.18
Sr.	Parameters	Unit	Std. Limit (NAAQS, 2009)	Results	
1.	Sulphur Dioxide (SO ₂)	µg/m ³	80	8.53	6.39
2.	Nitrogen Dioxide (NO ₂)	µg/m ³	80	7.18	6
3.	Particulate Matter (size <10 µm) or PM ₁₀	µg/m ³	100	93	48
4.	Particulate Matter (size <2.5µm) or PM _{2.5}	µg/m ³	60	20	14
5.	Ozone (O ₃)	µg/m ³	180	BDL	BDL
6.	Lead (Pb)	µg/m ³	1	BDL	BDL
7.	Carbon Monoxide (CO)	mg/m ³	04	BDL	BDL
8.	Ammonia (NH ₃)	µg/m ³	400	BDL	BDL
9.	Benzene (C ₆ H ₆)	µg/m ³	5	5.49	6.81
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m ³	1	BDL	BDL
11.	Arsenic (as As)	ng/m ³	6	BDL	BDL
12.	Nickel (as Ni)	ng/m ³	20	BDL	BDL

Graphs: Ambient Air Monitoring Results:





3.3 Water/Waste Water:

Water Analysis Results are compared against CPCB document on criteria for Comprehensive Environmental Assessment of Industrial Clusters-Water Quality Parameters Requirement and Classification (Annexure IX), CPCB Water Quality Criteria (Annexure VIII) and Drinking Water Specification, IS 10500:2012 (Annexure VII), Wastewater Analysis Results are compared with General Standards for Discharge of Environmental Pollutants Part A: Effluents, The Environment (Protection) Rules, 1986, Schedule VI.

Sr.	Locations	Location detail	Included in
1.	Sarex Overseas	ETP Outlet	Table I
2.	Mandhana Industries Ltd.	ETP Outlet	Table I
3.	CETP inlet	ETP Inlet	Table I
4.	CETP outlet	ETP Outlet	Table II
5.	Calyx Chemical Ltd.	ETP Outlet	Table II
6.	Siyaram Silk Mills Ltd.	ETP Outlet	Table II
7.	Tata Steel	ETP Outlet	Table II

Sr.	Locations	Location detail	Included in
8.	Lupin Ltd., outlet	ETP Outlet	Table III
9.	Lupin Ltd., RO rejected	ETP Outlet	Table III
10.	JSW Steel RO Permit I	ETP Outlet	Table III
11.	JSW Steel RO Permit II	ETP Outlet	Table IV
12.	D-Decore	ETP Outlet	Table IV
13.	Resonance Specialties Ltd.	ETP Outlet	Table IV
14.	Aarti Drugs	ETP Outlet	Table V
15.	Galaxy Pvt. Ltd.	ETP Outlet	Table V
16.	Aarti Industries	ETP Outlet	Table V
17.	D-Decor	ETP Outlet	Table VI

Table I:

Location				Sarex Overseas	Mandhana Industries Ltd.	CETP Inlet
Date of Sampling				27.06.18	27.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
1.	Colour	Hazen		3	5	5
2.	Smell	-		Disagreeable	Disagreeable	Disagreeable
3.	Transparency	m		0.5	0.5	0.3
4.	pH	-	5.5 -9.0	7.59	8.19	7.1
5.	Oil & Grease	mg/L	10.0	BDL	BDL	BDL
6.	Suspended Solids	mg/L	100.0	28	28	52

Location				Sarex Overseas	Mandhana Industries Ltd.	CETP Inlet
Date of Sampling				27.06.18	27.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
7.	Dissolved Oxygen (%Saturation)	%		67	0	0
8.	Chemical Oxygen Demand	mg/L	250.0	200	380	3200
9.	Biochemical Oxygen Demand (3 days,27° C)	mg/L	30.0	70	138	1128
10.	Electrical Conductivity (at 25° C)	µmhos/cm		497	7560	6060
11.	Nitrite Nitrogen (as N)	mg/L		0.55	0.9	BDL
12.	Nitrate Nitrogen (as N)	mg/L	100	6.76	85.5	287
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	7.31	86.4	287
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL	BDL
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	0.59	BDL	0.36
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	BDL	0.24
20.	Sodium Absorption Ratio	-		BDL	0.8	0.8

Location				Sarex Overseas	Mandhana Industries Ltd.	CETP Inlet
Date of Sampling				27.06.18	27.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
21.	Total Coliforms	MPN index/100 mL	100.0	920	280	1600
22.	Faecal Coliforms	MPN index/100 mL	1000.0	33	39	130
23.	Total Phosphorous (as P)	mg/L	1.0	BDL	BDL	0.87
24.	Total Kjeldahl Nitrogen	mg/L	100.0	8.06	10.7	138
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	BDL	BDL
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL	BDL
28.	Organo Chlorine Pesticides	µg/L	0.1			
i.	Alachlor	µg/L	2.0	BDL	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.1	BDL	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL	BDL

Location				Sarex Overseas	Mandhana Industries Ltd.	CETP Inlet
Date of Sampling				27.06.18	27.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
vii.	Butachlor	µg/L	3.0	BDL	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL	BDL
ix.	Delta HCH	µg/L	0.2	BDL	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL	BDL
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	BDL	BDL	0.232
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	0.031

Location				Sarex Overseas	Mandhana Industries Ltd.	CETP Inlet
Date of Sampling				27.06.18	27.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
33.	Copper (as Cu)	mg/L		BDL	1.25	0.045
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL	BDL
35.	Total Chromium (as Cr)	mg/L	2.0	BDL	BDL	0.035
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	0.013	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	BDL	BDL	0.797
41.	Iron (as Fe)	mg/L	3.0	0.167	0.334	6.19
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL	BDL
44.	Boron (as B)	mg/L		BDL	BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	50	0	0

Table II:

Location				CETP outlet	Calyx Chemical	Siyaram Silk Mills Ltd.
Date of Sampling				28.06.18	28.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
1.	Colour	Hazen		5	3	5
2.	Smell	-		Disagreeable	Disagreeable	Disagreeable
3.	Transparency	m		0.5	0.5	0.7
4.	pH	-	5.5 -9.0	7.04	6.01	7.9
5.	Oil & Grease	mg/L	10.0	1.2	BDL	BDL
6.	Suspended Solids	mg/L	100.0	48	68	8
7.	Dissolved Oxygen (%Saturation)	%		0	63	48
8.	Chemical Oxygen Demand	mg/L	250.0	2800	220	200
9.	Biochemical Oxygen Demand (3 days,27° C)	mg/L	30.0	987	74	72
10.	Electrical Conductivity (at 25 ° C)	µmhos/cm		2690	2320	3690
11.	Nitrite Nitrogen (as N)	mg/L		BDL	BDL	BDL
12.	Nitrate Nitrogen (as N)	mg/L	100	149	47.2	25.6
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	149	47.2	25.6
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL	BDL

Location				CETP outlet	Calyx Chemical	Siyaram Silk Mills Ltd.
Date of Sampling				28.06.18	28.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	0.52	1.8	0.98
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	1.72	BDL
20.	Sodium Absorption Ratio	-		BDL	0.46	1.8
21.	Total Coliforms	MPN index/100 mL	100.0	540	1600	540
22.	Faecal Coliforms	MPN index/100 mL	1000.0	47	34	17
23.	Total Phosphorous (as P)	mg/L	1.0	0.68	3.53	BDL
24.	Total Kjeldahl Nitrogen	mg/L	100.0	38.7	41.5	11.2
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	BDL	BDL
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL	BDL

Location				CETP outlet	Calyx Chemical	Siyaram Silk Mills Ltd.
Date of Sampling				28.06.18	28.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
28.	Organo Chlorine Pesticides	µg/L	0.1			
i.	Alachlor	µg/L	2.0	BDL	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.1	BDL	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL	BDL
vii.	Butachlor	µg/L	3.0	BDL	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL	BDL
ix.	Delta HCH	µg/L	0.2	BDL	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL	BDL

Location				CETP outlet	Calyx Chemical	Siyaram Silk Mills Ltd.
Date of Sampling				28.06.18	28.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	0.519	0.096	BDL
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	BDL
33.	Copper (as Cu)	mg/L		0.06	0.045	BDL
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL	BDL
35.	Total Chromium (as Cr)	mg/L	2.0	0.03	BDL	BDL
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	BDL	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	0.137	0.042	0.074
41.	Iron (as Fe)	mg/L	3.0	1.93	1.28	0.205
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL	BDL

Location				CETP outlet	Calyx Chemical	Siyaram Silk Mills Ltd.
Date of Sampling				28.06.18	28.06.18	28.06.18
Sr.	Parameters		Std. Limit	Results		
44.	Boron (as B)	mg/L		BDL	BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	0	0	30

Table III

Location				TATA Steels	Lupin Ltd.	Lupin Ltd. RO Rejected
Date of Sampling				28.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
1.	Colour	Hazen		1	1	3
2.	Smell	-		Disagreeable	Disagreeable	Disagreeable
3.	Transparency	m		0.5	1	0.3
4.	pH	-	5.5 -9.0	7.68	7.17	7.35
5.	Oil & Grease	mg/L	10.0	BDL	BDL	BDL
6.	Suspended Solids	mg/L	100.0	8	6	9
7.	Dissolved Oxygen (%Saturation)	%		72	88	1
8.	Chemical Oxygen Demand	mg/L	250.0	20	10	1280

Location				TATA Steels	Lupin Ltd.	Lupin Ltd. RO Rejected
Date of Sampling				28.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
9.	Biochemical Oxygen Demand (3 days, 27° C)	mg/L	30.0	7	4	463
10.	Electrical Conductivity (at 25° C)	µmhos/cm		374	91	8320
11.	Nitrite Nitrogen (as N)	mg/L		BDL	BDL	BDL
12.	Nitrate Nitrogen (as N)	mg/L	100	2.4	1.15	46.2
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	2.4	1.15	46.2
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL	BDL
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	0.5	0.68	1.1
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	BDL	BDL
20.	Sodium Absorption Ratio	-		BDL	BDL	BDL
21.	Total Coliforms	MPN index/100 mL	100.0	240	220	140

Location				TATA Steels	Lupin Ltd.	Lupin Ltd. RO Rejected
Date of Sampling				28.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
22.	Faecal Coliforms	MPN index/100 mL	1000.0	130	33	27
23.	Total Phosphorous (as P)	mg/L	1.0	BDL	BDL	BDL
24.	Total Kjeldahl Nitrogen	mg/L	100.0	4.48	2.01	315
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	BDL	BDL
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL	BDL
28.	Organo Chlorine Pesticides	µg/L	0.1			
i.	Alachlor	µg/L	2.0	BDL	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.1	BDL	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL	BDL
vii.	Butachlor	µg/L	3.0	BDL	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL	BDL

Location				TATA Steels	Lupin Ltd.	Lupin Ltd. RO Rejected
Date of Sampling				28.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
ix.	Delta HCH	µg/L	0.2	BDL	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL	BDL
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	BDL	BDL	BDL
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	BDL
33.	Copper (as Cu)	mg/L		BDL	BDL	BDL
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL	BDL

Location				TATA Steels	Lupin Ltd.	Lupin Ltd. RO Rejected
Date of Sampling				28.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
35.	Total Chromium (as Cr)	mg/L	2.0	BDL	BDL	BDL
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	BDL	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	BDL	BDL	0.05
41.	Iron (as Fe)	mg/L	3.0	BDL	BDL	0.528
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL	BDL
44.	Boron (as B)	mg/L		BDL	BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	100	100	50

Table IV

Location				JSW Steel RO Permit I	JSW Steel RO Permit II	D-Décor
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
1.	Colour	Hazen		3	1	1
2.	Smell	-		Disagreeable	Disagreeable	Disagreeable
3.	Transparency	m		0.3	0.4	0.2
4.	pH	-	5.5 -9.0	7.35	3.97	3.87
5.	Oil & Grease	mg/L	10.0	BDL	BDL	BDL
6.	Suspended Solids	mg/L	100.0	9	6	6
7.	Dissolved Oxygen (%Saturation)	%		1	48	78
8.	Chemical Oxygen Demand	mg/L	250.0	1280	50	40
9.	Biochemical Oxygen Demand (3 days,27° C)	mg/L	30.0	463	17	14
10.	Electrical Conductivity (at 25 ° C)	µmhos/cm		8320	717	1630
11.	Nitrite Nitrogen (as N)	mg/L		BDL	0.02	BDL
12.	Nitrate Nitrogen (as N)	mg/L	100	46.2	BDL	0.35
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	46.2	0.02	0.35
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL	BDL

Location				JSW Steel RO Permit I	JSW Steel RO Permit II	D-Décor
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	1.1	0.96	0.3
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	BDL	1.96
20.	Sodium Absorption Ratio	-		BDL	BDL	BDL
21.	Total Coliforms	MPN index/100 mL	100.0	140	220	280
22.	Faecal Coliforms	MPN index/100 mL	1000.0	27	14	22
23.	Total Phosphorous (as P)	mg/L	1.0	BDL	BDL	5.14
24.	Total Kjeldahl Nitrogen	mg/L	100.0	315	8.06	4.37
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	BDL	BDL
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL	BDL

Location				JSW Steel RO Permit I	JSW Steel RO Permit II	D-Décor
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
28.	Organo Chlorine Pesticides	µg/L	0.1			
i.	Alachlor	µg/L	2.0	BDL	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.1	BDL	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL	BDL
vii.	Butachlor	µg/L	3.0	BDL	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL	BDL
ix.	Delta HCH	µg/L	0.2	BDL	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL	BDL

Location				JSW Steel RO Permit I	JSW Steel RO Permit II	D-Décor
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	BDL	BDL	BDL
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	BDL
33.	Copper (as Cu)	mg/L		BDL	BDL	BDL
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL	BDL
35.	Total Chromium (as Cr)	mg/L	2.0	BDL	BDL	BDL
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	BDL	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	0.05	BDL	BDL
41.	Iron (as Fe)	mg/L	3.0	0.528	0.215	BDL
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL	BDL

Location				JSW Steel RO Permit I	JSW Steel RO Permit II	D-Décor
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
44.	Boron (as B)	mg/L		BDL	BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	50	100	100

Table V

Location				Resosons Specialities Ltd.	Aarti Drugs	Galaxy Pvt Ltd.
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
1.	Colour	Hazen		1	2	1
2.	Smell	-		Disagreeable	Disagreeable	Disagreeable
3.	Transparency	m		0.5	0.5	0.6
4.	pH	-	5.5 -9.0	7.1	4.9	6.95
5.	Oil & Grease	mg/L	10.0	BDL	BDL	BDL
6.	Suspended Solids	mg/L	100.0	7	12	10
7.	Dissolved Oxygen (%Saturation)	%		79	61	63
8.	Chemical Oxygen Demand	mg/L	250.0	10	110	40

Location				Resosons Specialities Ltd.	Aarti Drugs	Galaxy Pvt Ltd.
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
9.	Biochemical Oxygen Demand (3 days, 27° C)	mg/L	30.0	4	39	14
10.	Electrical Conductivity (at 25° C)	µmhos/cm		137	5240	2170
11.	Nitrite Nitrogen (as N)	mg/L		BDL	2.19	0.02
12.	Nitrate Nitrogen (as N)	mg/L	100	2.22	48.1	44.7
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	2.22	50.3	44.72
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL	BDL
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	BDL	1.7	1.8
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	0.4	2.12
20.	Sodium Absorption Ratio	-		BDL	1.7	0.9
21.	Total Coliforms	MPN index/100 mL	100.0	1600	34	140

Location				Resosons Specialities Ltd.	Aarti Drugs	Galaxy Pvt Ltd.
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
22.	Faecal Coliforms	MPN index/100 mL	1000.0	49	14	27
23.	Total Phosphorous (as P)	mg/L	1.0	BDL	1.4	5.65
24.	Total Kjeldahl Nitrogen	mg/L	100.0	1.01	30	13.4
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	0.11	BDL
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL	BDL
28.	Organo Chlorine Pesticides	µg/L	0.1			
i.	Alachlor	µg/L	2.0	BDL	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.1	BDL	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL	BDL
vii.	Butachlor	µg/L	3.0	BDL	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL	BDL

Location				Resosons Specialities Ltd.	Aarti Drugs	Galaxy Pvt Ltd.
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
ix.	Delta HCH	µg/L	0.2	BDL	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL	BDL
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	BDL	0.632	BDL
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	BDL
33.	Copper (as Cu)	mg/L		BDL	BDL	BDL
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL	BDL

Location				Resosons Specialities Ltd.	Aarti Drugs	Galaxy Pvt Ltd.
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results		
35.	Total Chromium (as Cr)	mg/L	2.0	BDL	BDL	BDL
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	BDL	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	BDL	0.36	BDL
41.	Iron (as Fe)	mg/L	3.0	BDL	0.545	BDL
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL	BDL
44.	Boron (as B)	mg/L		BDL	BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	50	100	100

Table VI

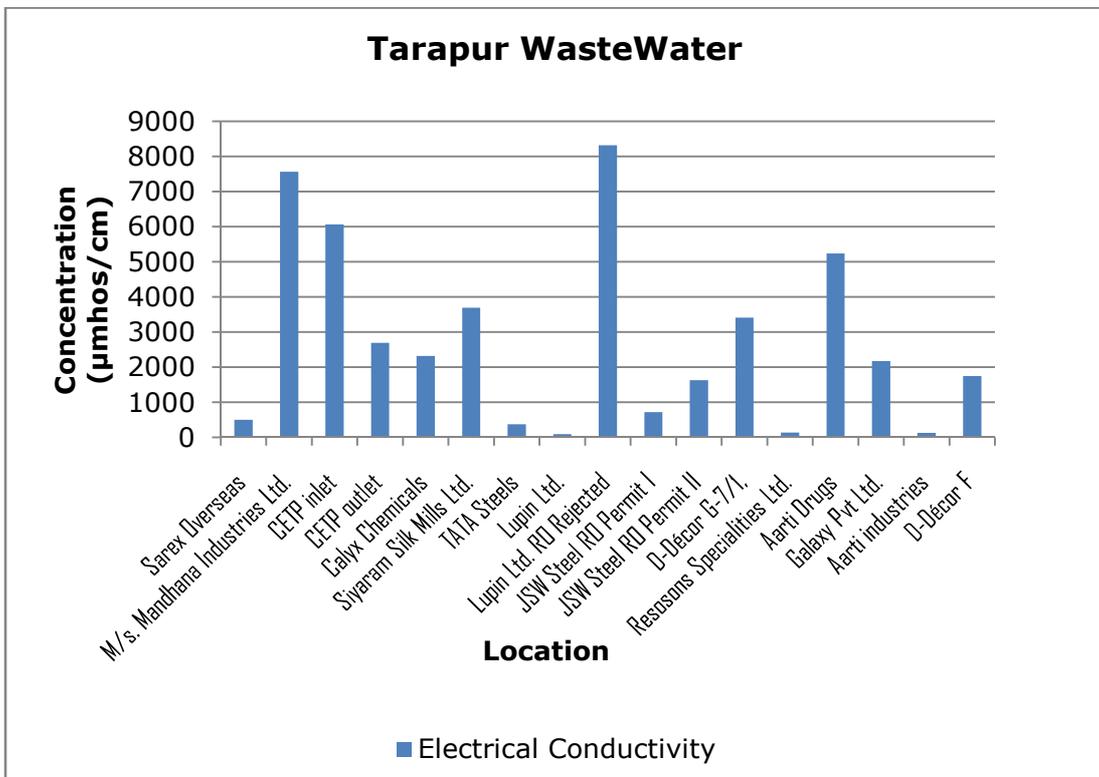
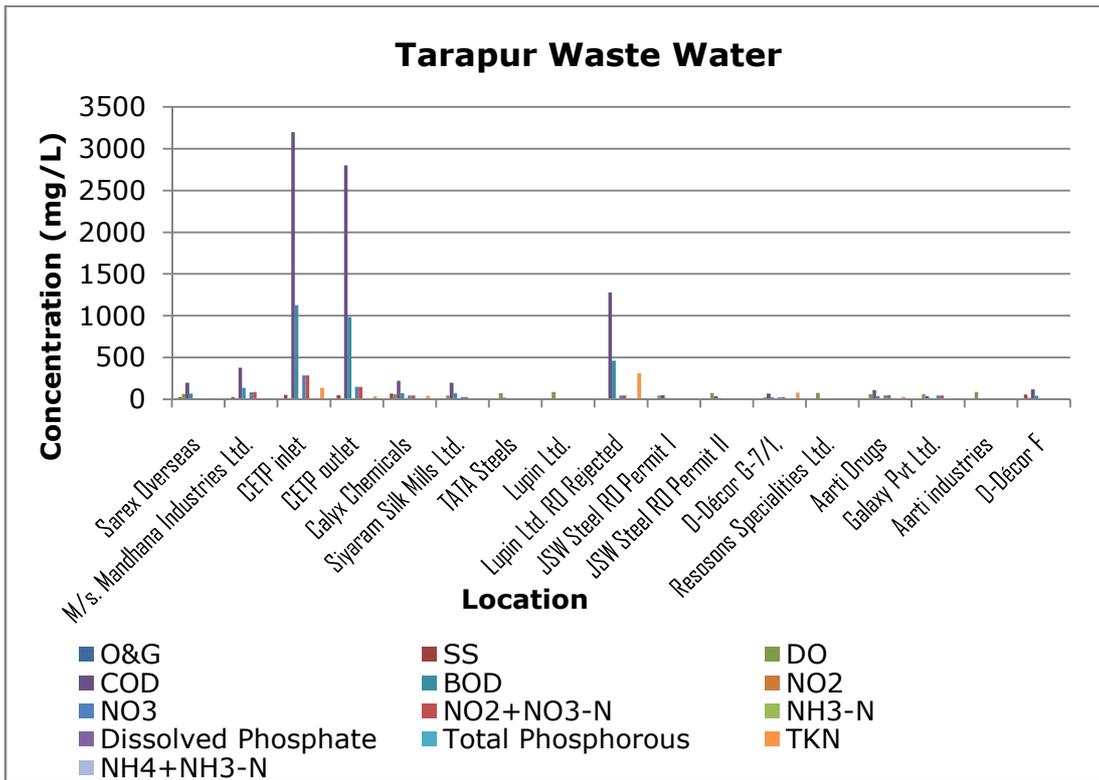
Location				Aarti Industries	D-Decor
Date of Sampling				29.06.18	29.06.18
Sr.	Parameters		Std. Limit	Results	
1.	Colour	Hazen		1	1
2.	Smell	-		Disagreeable	Disagreeable
3.	Transparency	m		0.5	0.3
4.	pH	-	5.5 -9.0	7.21	7.53
5.	Oil & Grease	mg/L	10.0	BDL	BDL
6.	Suspended Solids	mg/L	100.0	8	56
7.	Dissolved Oxygen (%Saturation)	%		87	19
8.	Chemical Oxygen Demand	mg/L	250.0	10	120
9.	Biochemical Oxygen Demand (3 days,27° C)	mg/L	30.0	4	43
10.	Electrical Conductivity (at 25° C)	µmhos/cm		124	1748
11.	Nitrite Nitrogen (as N)	mg/L		BDL	0.29
12.	Nitrate Nitrogen (as N)	mg/L	100	<0.2	2.44
13.	(NO ₂ + NO ₃)-Nitrogen	mg/L	5.0	ND	2.73
14.	Free Ammonia (as NH ₃ -N)	mg/L	5.0	BDL	BDL

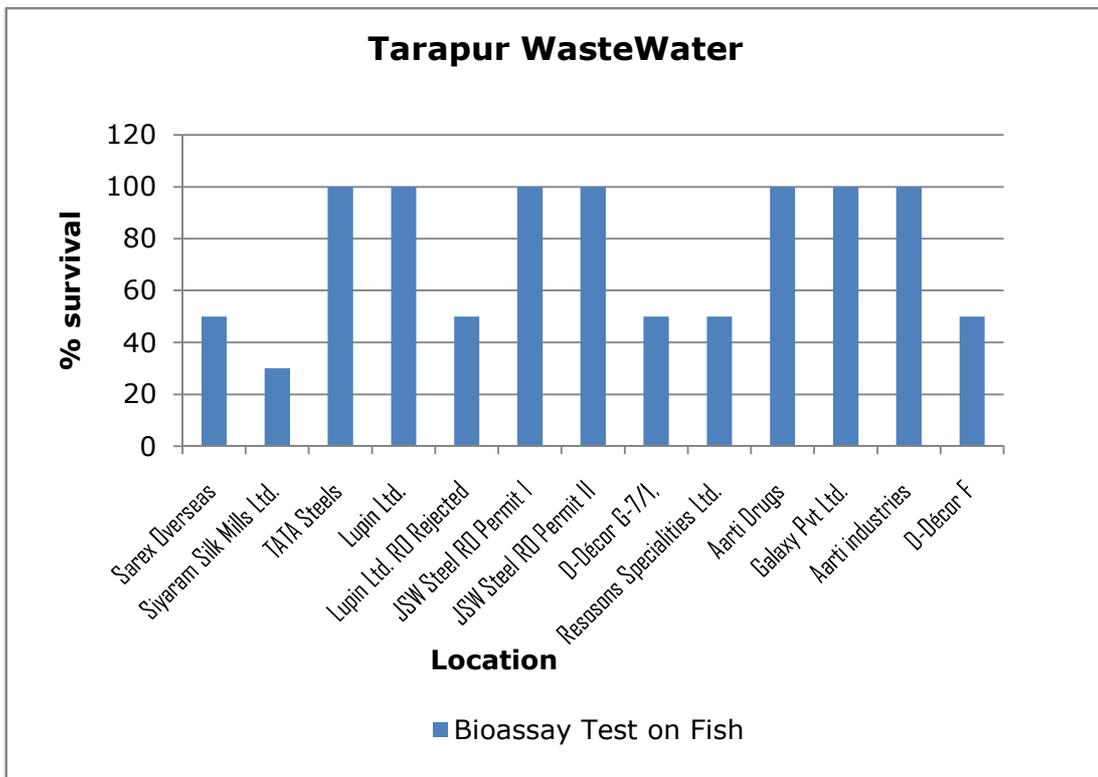
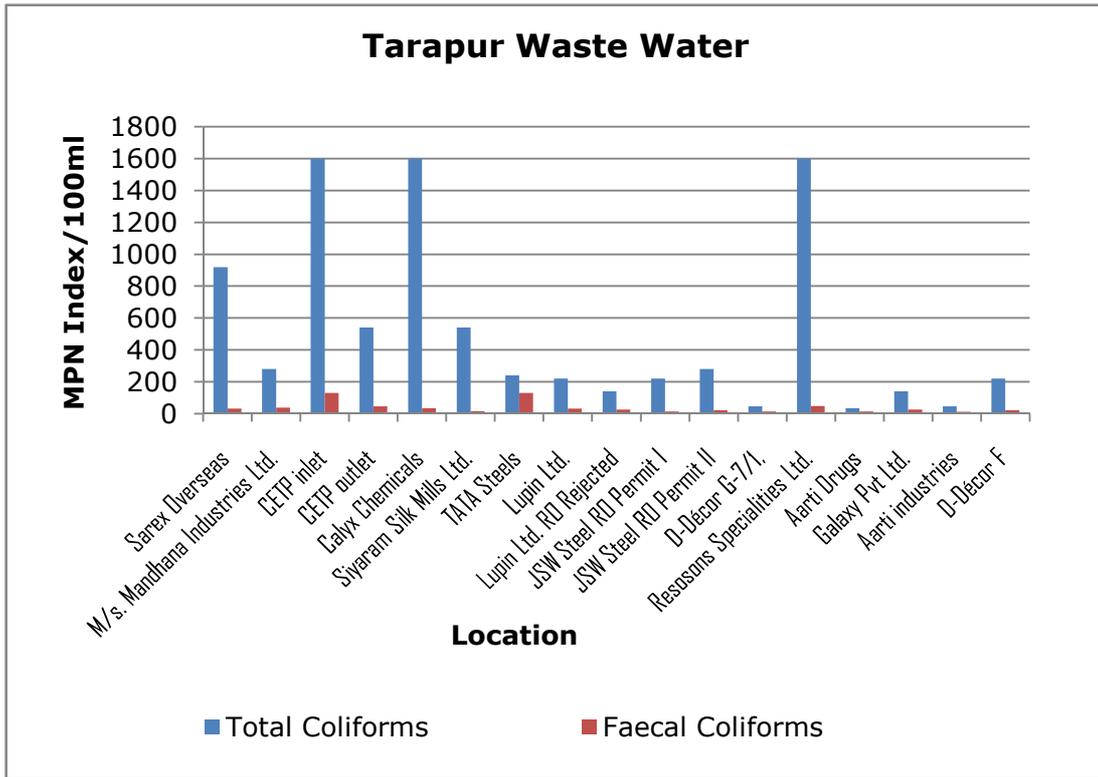
Location				Aarti Industries	D-Decor
Date of Sampling				29.06.18	29.06.18
15.	Total Residual Chlorine	mg/L	1.0	BDL	BDL
16.	Cyanide (as CN)	mg/L	0.2	BDL	BDL
17.	Fluoride (as F)	mg/L	2.0	0.4	1.64
18.	Sulphide (as S ²⁻)	mg/L	2.0	BDL	BDL
19.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	0.7
20.	Sodium Absorption Ratio	-		BDL	0.53
21.	Total Coliforms	MPN index/100 mL	100.0	47	220
22.	Faecal Coliforms	MPN index/100 mL	1000.0	13	22
23.	Total Phosphorous (as P)	mg/L	1.0	BDL	1.12
24.	Total Kjeldahl Nitrogen	mg/L	100.0	0.78	1.23
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	5.0	BDL	0.1
26.	Phenols (as C ₆ H ₅ OH)	mg/L	3.0	BDL	BDL
27.	Surface Active Agents (as MBAS)	mg/L	3.0	BDL	BDL
28.	Organo Chlorine Pesticides	µg/L	0.1		
i.	Alachlor	µg/L	2.0	BDL	BDL
ii.	Atrazine	µg/L	0.2	BDL	BDL

Location				Aarti Industries	D-Decor
Date of Sampling				29.06.18	29.06.18
iii.	Aldrin	µg/L	0.1	BDL	BDL
iv.	Dieldrin	µg/L	2.0	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL
vi.	Beta HCH	µg/L	2.0	BDL	BDL
vii.	Butachlor	µg/L	3.0	BDL	BDL
viii.	Chlorpyrifos			BDL	BDL
ix.	Delta HCH	µg/L	0.2	BDL	BDL
x.	p,p DDT	µg/L	0.05	BDL	BDL
xi.	o,p DDT	µg/L	100.0	BDL	BDL
xii.	p,p DDE	µg/L	250.0	BDL	BDL
xiii.	o,p DDE	µg/L	30.0	BDL	BDL
xiv.	p,p DDD	µg/L		BDL	BDL
xv.	o,p DDD	µg/L		BDL	BDL
xvi.	Alpha Endosulfan	µg/L	10.0	BDL	BDL
xvii.	Beta Endosulfan	µg/L		BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	5.0	BDL	BDL
xix.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL
29.	Poly Aromatic hydrocarbons (as PAH)	µg/L	0.2	BDL	BDL
30.	Polychlorinated Biphenyls (PCB)	µg/L	2.0	BDL	BDL
31.	Zinc (as Zn)	mg/L	5.0	0.316	0.131

Location				Aarti Industries	D-Decor
Date of Sampling				29.06.18	29.06.18
32.	Nickel (as Ni)	mg/L	3.0	BDL	BDL
33.	Copper (as Cu)	mg/L		BDL	BDL
34.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	0.1	BDL	BDL
35.	Total Chromium (as Cr)	mg/L	2.0	BDL	BDL
36.	Total Arsenic (as As)	mg/L	0.2	BDL	BDL
37.	Lead (as Pb)	mg/L	0.1	BDL	BDL
38.	Cadmium (as Cd)	mg/L	2.0	BDL	BDL
39.	Mercury (as Hg)	mg/L	0.01	BDL	BDL
40.	Manganese (as Mn)	mg/L	2.0	BDL	BDL
41.	Iron (as Fe)	mg/L	3.0	BDL	0.139
42.	Vanadium (as V)	mg/L	0.2	BDL	BDL
43.	Selenium (as Se)	mg/L	0.05	BDL	BDL
44.	Boron (as B)	mg/L		BDL	BDL
45.	Bioassay Test on fish	% survival	90% survival after 96h in 100% effluent	100	50

Graphs: Waste Water Monitoring





3.4 Ground Water Analysis Results:

Sr. No.	Locations	Denotation	Included in
1.	Ankush Gharatwadi	A	Table I
2.	Dhodi Pooja Area	B	Table I
3.	Lala Vajpayee Area	C	Table I
4.	Chiku Wadi	D	Table II
5.	Kumbhavali Village	E	Table II
6.	Salvad Village	F	Table II

Table I

Location				Ankush Gharatwadi	Dhodi Pooja Area	Lala Vajpayee Area
Type				Borewell	Bore Well	Well Water
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
1.	Colour	Hazen	5	1	1	1
2.	Odour		Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	-	6.5-8.5	7.79	7.5	7.92
4.	Oil & Grease	mg/L	100	BDL	BDL	BDL
5.	Suspended Solids	mg/L	500	BDL	BDL	BDL
6.	Chemical Oxygen Demand	mg/L	10 (WHO, 1993)	7.79	7.5	7.92
7.	Biochemical Oxygen Demand (3 days, 27° C)	mg/L	6 (WHO, 1993)	BDL	BDL	BDL

Location				Ankush Gharatwadi	Dhodi Pooja Area	Lala Vajpayee Area
Type				Borewell	Bore Well	Well Water
Date of Sampling				29.06.18	29.06.18	29.06.18
8.	Electrical Conductivity (at 25° C)	µmhos/cm	750	BDL	BDL	BDL
9.	Nitrite Nitrogen (as N)	mg/L		BDL	1.14	0.07
10.	Nitrate Nitrogen (as N)	mg/L	45	9.34	28.1	18.6
11.	(NO ₂ + NO ₃)- Nitrogen	mg/L	1.0	9.34	29.24	18.67
12.	Free Ammonia (as NH ₃ -N)	mg/L	0.5	BDL	BDL	BDL
13.	Total Residual Chlorine	mg/L	0.2	BDL	BDL	BDL
14.	Cyanide (as CN)	mg/L		BDL	BDL	BDL
15.	Fluoride (as F)	mg/L	1	1.3	1.05	1.12
16.	Sulphide (as S ²⁻)	mg/L	0.05	BDL	BDL	BDL
17.	Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
18.	Sodium Absorption Ratio			BDL	BDL	BDL
19.	Total Coliforms	MPN index/100 mL	ND	32	220	33
20.	Faecal Coliforms	MPN index/100 mL	ND	14	22	14
21.	Total Phosphorous (as P)	mg/L	0.5	BDL	BDL	BDL

Location				Ankush Gharatwadi	Dhodi Pooja Area	Lala Vajpayee Area
Type				Borewell	Bore Well	Well Water
Date of Sampling				29.06.18	29.06.18	29.06.18
22.	Total Kjeldahl Nitrogen	mg/L	0.001	2.35	1.12	0.89
23.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	0.5	BDL	BDL	BDL
24.	Phenols (as C ₆ H ₅ OH)	mg/L	0.001	BDL	BDL	BDL
25.	Surface Active Agents (as MBAS)	mg/L	0.05	BDL	BDL	BDL
26.	Organo Chlorine Pesticides	µg/L				
i.	Alachlor	µg/L		BDL	BDL	BDL
ii.	Atrazine	µg/L	2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.03	BDL	BDL	BDL
iv.	Dieldrin	µg/L	0.03	BDL	BDL	BDL
v.	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	0.04	BDL	BDL	BDL
vii.	Chlorpyrifos	µg/L		BDL	BDL	BDL
viii.	Butachlor	µg/L	125	BDL	BDL	BDL
ix.	Delta HCH	µg/L	0.04	BDL	BDL	BDL
x.	p,p DDT	µg/L	1	BDL	BDL	BDL
xi.	o,p DDT	µg/L	1	BDL	BDL	BDL
xii.	p,p DDE	µg/L	1	BDL	BDL	BDL

Location				Ankush Gharatwadi	Dhodi Pooja Area	Lala Vajpayee Area
Type				Borewell	Bore Well	Well Water
Date of Sampling				29.06.18	29.06.18	29.06.18
xiii.	o,p DDE	µg/L	1	BDL	BDL	BDL
xiv.	p,p DDD	µg/L	1	BDL	BDL	BDL
xv.	o,p DDD	µg/L	1	BDL	BDL	BDL
xvi.	Alpha Endosulfan	µg/L	0.4	BDL	BDL	BDL
xvii.	Beta Endosulfan	µg/L	0.4	BDL	BDL	BDL
xviii.	Endosulfan Sulphate	µg/L	0.4	BDL	BDL	BDL
xix.	γ HCH (Lindane)	µg/L	2.0	BDL	BDL	BDL
27.	Polynuclear aromatic hydrocarbons (as PAH)	µg/L	0.0001	0.000 39	BDL	BDL
28.	Polychlorinated Biphenyls (PCB)	µg/L	0.0005	BDL	BDL	BDL
29.	Zinc (as Zn)	mg/L	5.0	BDL	BDL	BDL
30.	Nickel (as Ni)	mg/L	0.02	BDL	BDL	BDL
31.	Copper (as Cu)	mg/L	0.05	BDL	BDL	BDL
32.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	1	BDL	BDL	BDL
33.	Total Chromium (as Cr)	mg/L	0.05	BDL	BDL	BDL
34.	Total Arsenic (as As)	mg/L	0.01	BDL	BDL	BDL
35.	Lead (as Pb)	mg/L	0.01	BDL	BDL	BDL

Location				Ankush Gharatwadi	Dhodi Pooja Area	Lala Vajpayee Area
Type				Borewell	Bore Well	Well Water
Date of Sampling				29.06.18	29.06.18	29.06.18
36.	Cadmium (as Cd)	mg/L	0.003	BDL	BDL	BDL
37.	Mercury (as Hg)	mg/L	0.001	BDL	BDL	BDL
38.	Manganese (as Mn)	mg/L	0.1	BDL	BDL	BDL
39.	Iron (as Fe)	mg/L	0.3	BDL	BDL	BDL
40.	Vanadium (as V)	mg/L		BDL	BDL	BDL
41.	Selenium (as Se)	mg/L	0.01	BDL	BDL	BDL
42.	Boron (as B)	mg/L		BDL	BDL	BDL
43.	Bioassay Test on fish	% survival		100	100	100

Table II

Location				Chiku Wadi	Kumbhavali Village	Salvad Village
Type				Ground water	Bore Well	Bore Well
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameter		Std. Limit	Results		
1.	Colour	Hazen	5	1	1	1
2.	Odour		Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	-	6.5-8.5	6.99	7.49	7.23
4.	Oil & Grease	mg/L	100	BDL	BDL	BDL
5.	Suspended Solids	mg/L	500	BDL	12	6

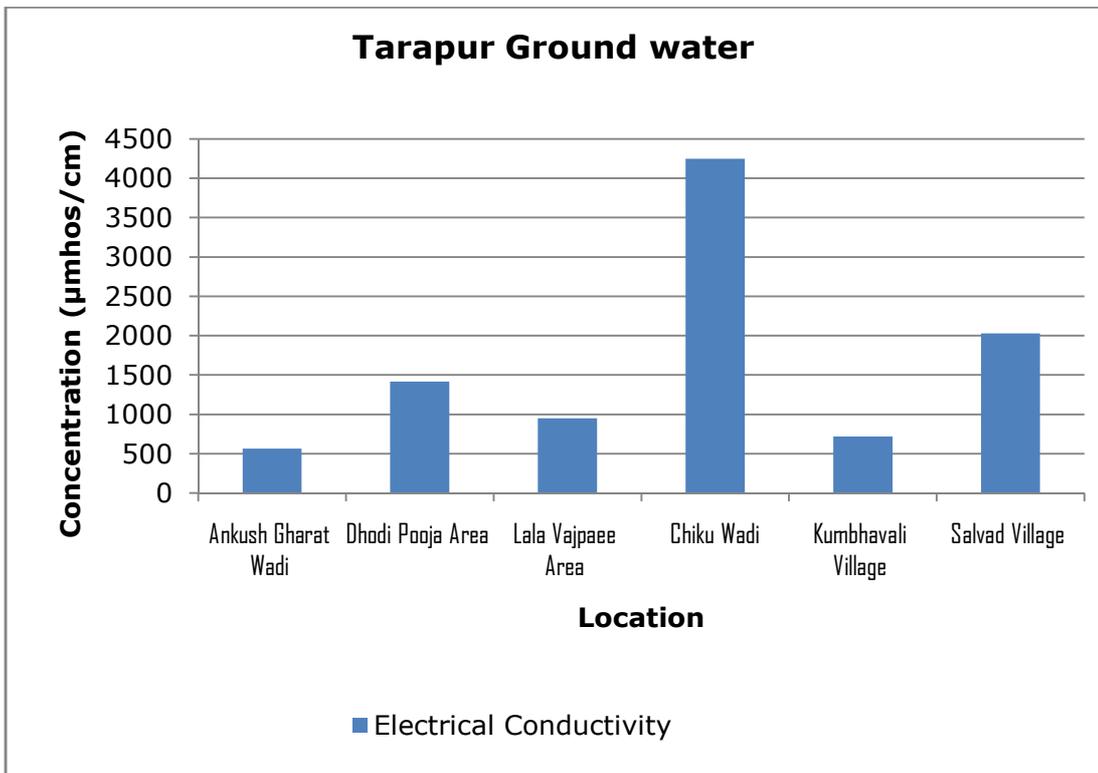
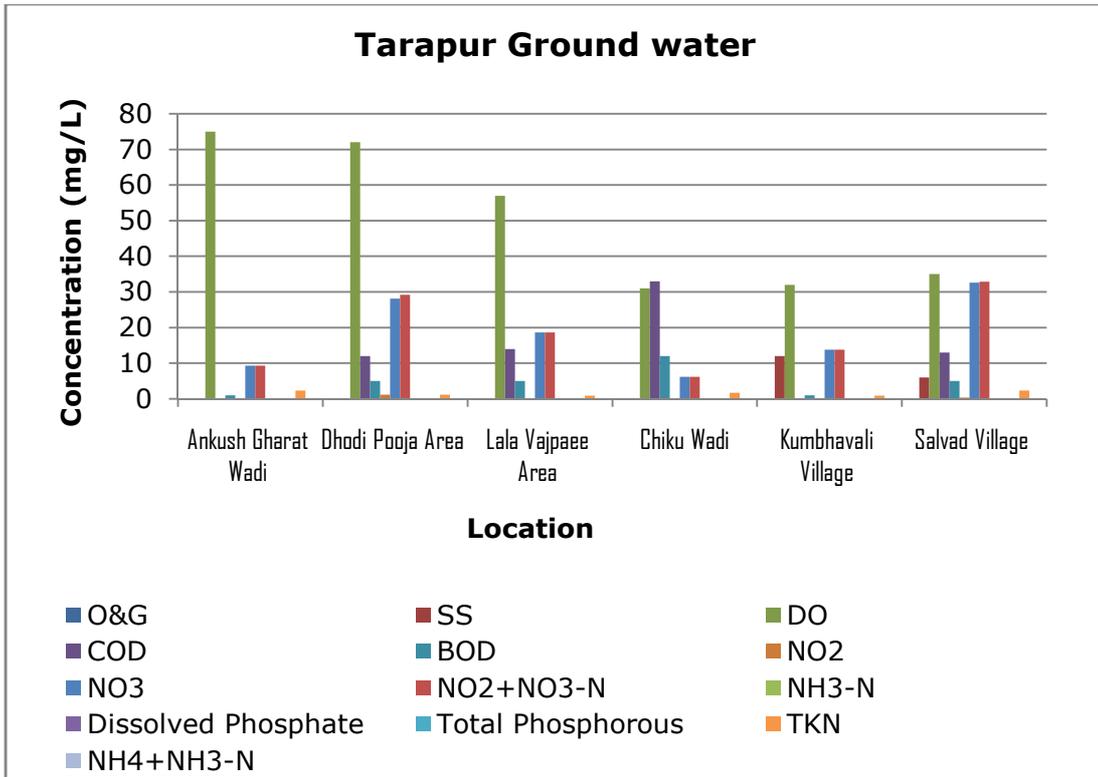
Location			Chiku Wadi	Kumbhavali Village	Salvad Village	
Type			Ground water	Bore Well	Bore Well	
Date of Sampling			29.06.18	29.06.18	29.06.18	
Sr.	Parameter	Std. Limit	Results			
6.	Chemical Oxygen Demand	mg/L	10 (WHO, 1993)	33	BDL	13
7.	Biochemical Oxygen Demand (3 days, 27° C)	mg/L	6 (WHO, 1993)	12	1	5
8.	Electrical Conductivity (at 25° C)	µmhos/cm	1000	4250	717	2030
9.	Nitrite Nitrogen (as N)	mg/L		BDL	0.02	0.26
10.	Nitrate Nitrogen (as N)	mg/L	45	6.2	13.8	32.6
11.	(NO ₂ + NO ₃)-Nitrogen	mg/L	1.0	6.2	13.82	32.86
12.	Free Ammonia (as NH ₃ -N)	mg/L	0.5	BDL	BDL	BDL
13.	Total Residual Chlorine	mg/L	0.2	BDL	BDL	BDL
14.	Cyanide (as CN)	mg/L		BDL	BDL	BDL
15.	Fluoride (as F)	mg/L	1	0.63	1.14	1.19
16.	Sulphide (as S ²⁻)	mg/L	0.05	BDL	BDL	BDL
17.	Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
18.	Sodium Absorption Ratio			BDL	BDL	BDL

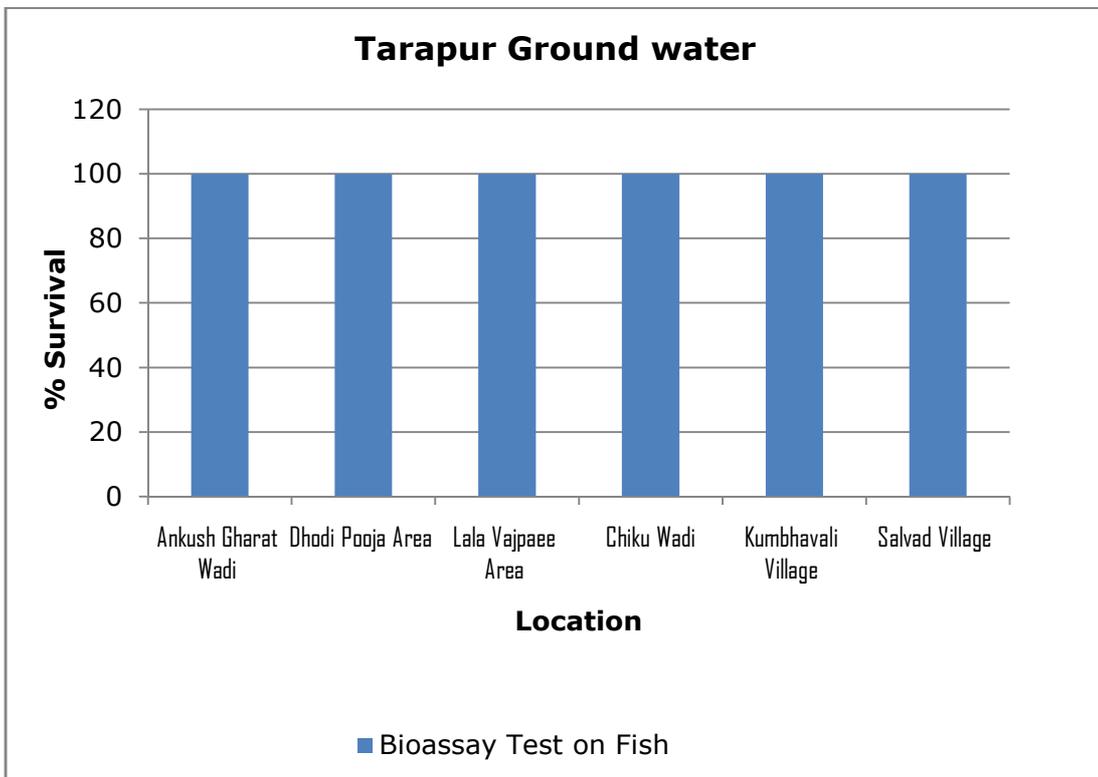
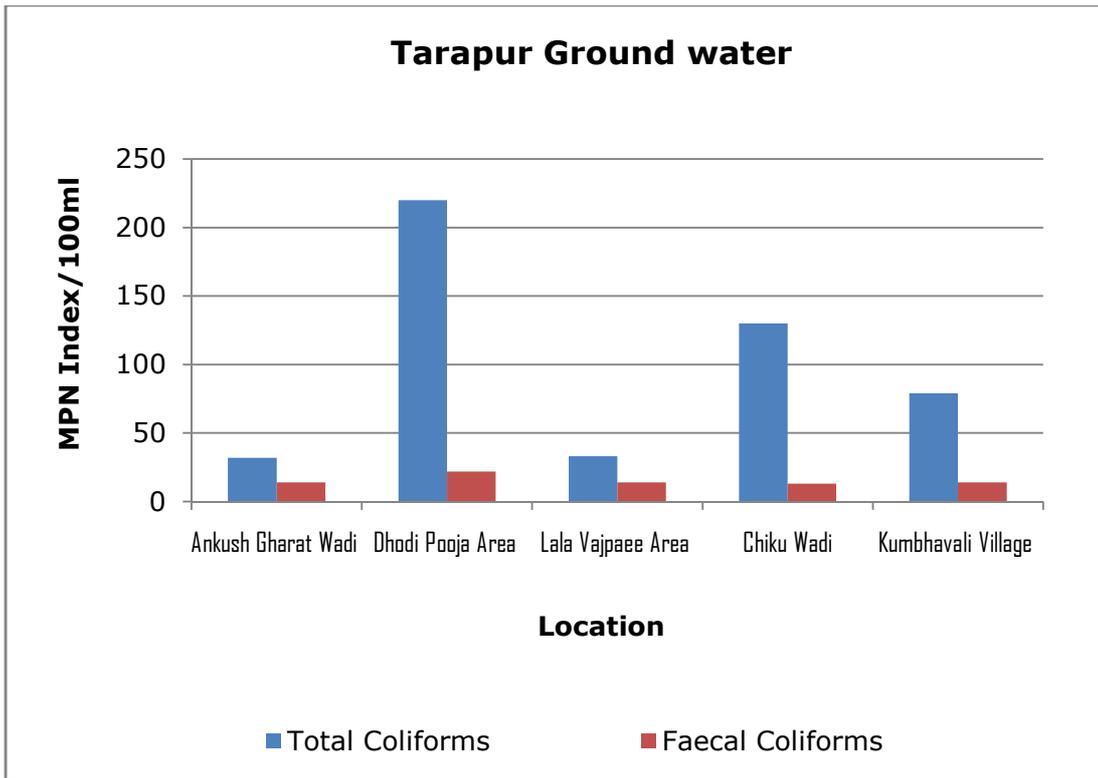
Location			Chiku Wadi	Kumbhavali Village	Salvad Village	
Type			Ground water	Bore Well	Bore Well	
Date of Sampling			29.06.18	29.06.18	29.06.18	
Sr.	Parameter	Std. Limit	Results			
19.	Total Coliforms	MPN index/100 mL	ND	130	79	27
20.	Faecal Coliforms	MPN index/100 mL	ND	13	14	9.3
21.	Total Phosphorous (as P)	mg/L	0.5	BDL	BDL	BDL
22.	Total Kjeldahl Nitrogen	mg/L	0.001	1.68	0.89	2.35
23.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	mg/L	0.5	BDL	BDL	BDL
24.	Phenols (as C ₆ H ₅ OH)	mg/L	0.001	BDL	BDL	BDL
25.	Surface Active Agents (as MBAS)	mg/L	0.05	BDL	BDL	BDL
26.	Organo Chlorine Pesticides	µg/L				
i.	Alachlor	µg/L		BDL	BDL	BDL
ii.	Atrazine	µg/L	2	BDL	BDL	BDL
iii.	Aldrin	µg/L	0.03	BDL	BDL	BDL
iv.	Dieldrin	µg/L	0.03	BDL	BDL	BDL
v	Alpha HCH	µg/L	0.01	BDL	BDL	BDL
vi.	Beta HCH	µg/L	0.04	BDL	BDL	BDL

Location				Chiku Wadi	Kumbhavali Village	Salvad Village
Type				Ground water	Bore Well	Bore Well
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameter		Std. Limit	Results		
vii.	Chlorpyrifos	µg/L	0.04	BDL	BDL	BDL
viii.	Butachlor	µg/L		BDL	BDL	BDL
viii.	Delta HCH	µg/L	125	BDL	BDL	BDL
ix.	p,p DDT	µg/L	1	BDL	BDL	BDL
x.	o,p DDT	µg/L	1	BDL	BDL	BDL
xi.	p,p DDE	µg/L	1	BDL	BDL	BDL
xii.	o,p DDE	µg/L	1	BDL	BDL	BDL
xiii.	p,p DDD	µg/L	1	BDL	BDL	BDL
xiv.	o,p DDD	µg/L	1	BDL	BDL	BDL
xv.	Alpha Endosulfan	µg/L	0.4	BDL	BDL	BDL
xvi.	Beta Endosulfan	µg/L	0.4	BDL	BDL	BDL
xvii.	Endosulfan Sulphate	µg/L	0.4	BDL	BDL	BDL
xviii.	γ HCH (Lindane)	µg/L	2.0	BDL	BDL	BDL
31.	Polynuclear aromatic hydrocarbons (as PAH)	µg/L	0.0001	BDL	BDL	BDL
32.	Polychlorinated Biphenyls (PCB)	µg/L	0.0005	BDL	BDL	BDL
33.	Zinc (as Zn)	mg/L	5.0	BDL	BDL	BDL
34.	Nickel (as Ni)	mg/L	0.02	BDL	BDL	BDL

Location				Chiku Wadi	Kumbhavali Village	Salvad Village
Type				Ground water	Bore Well	Bore Well
Date of Sampling				29.06.18	29.06.18	29.06.18
Sr.	Parameter		Std. Limit	Results		
35.	Copper (as Cu)	mg/L	0.05	BDL	BDL	BDL
36.	Hexavalent Chromium (as Cr ⁶⁺)	mg/L	1	BDL	BDL	BDL
37.	Total Chromium (as Cr)	mg/L	0.05	BDL	BDL	BDL
38.	Total Arsenic (as As)	mg/L	0.01	BDL	BDL	BDL
39.	Lead (as Pb)	mg/L	0.01	BDL	BDL	BDL
40.	Cadmium (as Cd)	mg/L	0.003	BDL	BDL	BDL
41.	Mercury (as Hg)	mg/L	0.001	BDL	BDL	BDL
42.	Manganese (as Mn)	mg/L	0.1	0.507	BDL	0.55
43.	Iron (as Fe)	mg/L	0.3	BDL	BDL	BDL
44.	Vanadium (as V)	mg/L		BDL	BDL	BDL
45.	Selenium (as Se)	mg/L	0.01	BDL	BDL	BDL
46.	Boron (as B)	mg/L	1.0-5.0	BDL	BDL	BDL
47.	Bioassay Test on fish	% survival		100	100	100

Graphs: Ground Water Monitoring Results:





4 Summary of the Results

Based on the study done, the results are summarised and concluded as follows:

4.1 Stack Emission Monitoring:

In Tarapur, seven different stacks were monitored at UPL, Plot No. E-51, Calyx Chemical Ltd., Siyaram Silk Mills Ltd., M/s Angadpal industries Pvt. Ltd., Gini Silk Mills Ltd., Mandhana Industrial Ltd. (Shirting Unit), and Mandhana Industrial Ltd. (Dyeing Unit- II). Results show that concentration of all the parameters, particulate matter, nitrogen dioxide and sulphur dioxide, are below the standard limits. Particulate matter is observed in the range of 13 to 102 mg/Nm³ and sulphur dioxide in the range of 5.71 to 5.92 mg/Nm³. However, the nitrogen dioxide is observed with the range of 15.5 mg/Nm³ – 18.7mg/Nm³.

4.2 Ambient Air Monitoring:

At Tarapur, ambient air quality was monitored at four locations namely: Sumitomo Chemical India Pvt. Ltd., Siyaram Silk Mills Ltd., Mandhana Industrial Ltd. (Shirting Unit) and Mandhana Industrial Ltd. (Dyeing Unit- II). At all these places 12 parameters of ambient air quality standards were monitored.

1. **Suphur dioxide (SO₂):** All the results for SO₂ are observed lower than the standard limit of 80 µg/m³. It is observed in the range of 6.39 to 8.53 µg/m³.
2. **Nitrogen Dioxide (NO_x):** All the results for SO₂ are observed lower than the standard limit of 80 µg/m³. It is observed in the range of 6.0 to 7.8 µg/m³.
3. **Particulate Matter (PM₁₀):** It is the most critical parameter as its higher concentration in the air affects ecosystem health a lot. However, 50% of all the locations are observed with above the standard limit of 100 µg/m³ of PM₁₀. Minimum of 48µg/m³ is observed at Sumitomo Chemical India Pvt. Ltd. and maximum of 193 µg/m³ at Mandhana Industries Ltd. (Dyeing Unit II).
4. **Particulate Matter (PM_{2.5}):** Concentration of PM_{2.5} is observed below the standard value of 60 µg/m³. It is observed in the range of 14 to 48 µg/m³.
5. **Ozone (O₃):** All values of O₃ recorded below the detection limit i.e.19.8µg/m³.
6. **Lead (Pb):** Lead is categorised as known human carcinogen by CPCB. In our results, concentration of Lead is found below the standard limit.
7. **Carbon Monoxide (CO):** Values of Carbon Monoxide are also observed below standard limit at all the studied locations. It is observed minimum (BDL i.e. <0.5mg/m³) at Sumitomo Chemical India Pvt. Ltd. and maximum (3mg/m³) at Mandhana Industries Ltd (Dyeing Unit).
8. **Ammonia (NH₃):** All values of O₃ recorded below the detection limit.
9. **Benzene:** Benzene falls under group C category, which includes known carcinogens. Study shows that all the locations have little higher concentration of Benzene than its standard limit (5µg/m³). It is observed in the range of 5.32 to 6.81µg/m³.
10. **Benzo (a) Pyrene (BaP):** All values recorded below the detection limit i.e. <0.2ng/m³.
11. **Arsenic:** Arsenic values are also observed well below the detection limit i.e. BDL.

12. **Nickel:** All the values are observed below the standard limit of 20 ng/m³.

4.3 Waste Water Quality:

Seventeen samples of ETP outlet and inlet were collected from different industries in Tarapur region. The quality of waste water was determined by determining various parameters as per standards and corresponding results are discussed below:

1. **pH:** At all the locations, pH of water samples is found well within the range prescribed by CPCB. It is ranged from 3.87 to 8.19.
2. **Oil and Grease:** All values within the acceptable range.
3. **Suspended Solids:** All the samples of different locations are found within the acceptable limits.
4. **Chemical Oxygen Demand:** Chemical Oxygen Demand is found above the standards of 250 mg/L in four water samples namely Mandhana Industries Ltd. (Shirting Unit 380mg/L), CETP inlet (3200 mg/L), CETP Outlet (2800 mg/L) and Lupin Industries, Ro rejected (1280 mg/L).
5. **Biochemical Oxygen Demand:** Biochemical Oxygen demand also exhibits the same picture as COD. This is recorded highest (2200 mg/L) at CETP inlet and minimum at JSW Steel (6.1 mg/L).
6. **Total Kjeldahl Nitrogen:** CETP inlet (543 mg/L), CETP Outlet (229 mg/L), Navapur CETP Discharge (173 mg/L) and Lupin Industries, RO water (555 mg/L), all four exhibit value of TKN beyond standard limit (100 mg/L).
7. **Total Ammonia:** Out of all values of three samples exhibit above standard limit namely CETP Inlet (126 mg/L), CETP Outlet (92 mg/L) and Lupin Industries RO water (92 mg/L). Rest all samples are observed within the permissible limit
8. **Metals:** All metals like Arsenic, Nickel, Copper, Hexavalent Chromium (Cr⁶⁺) are observed either below detection limit or below their standard limits. However water sample of CETP Inlet is observed with above permissible limits of metals also.
9. **Fish Bioassay:** Fish bioassay exhibits 60-90% survival.

Following parameters meet the criteria as prescribed by CPCB.

- 1) **Total Residual Chlorine**
- 2) **Cyanide**
- 3) **Fluoride**
- 4) **Sulphide**
- 5) **Dissolved Phosphate**
- 6) **Total Ammonical Nitrogen**
- 7) **Phenolic compounds**

4.4 Ground Water Quality:

Six Borewell samples were collected from different locations namely: (i) Ankush Gharatwadi (ii) Dhodi Pooja Area (3) Lala Vajpayee (iv) Chiku Wadi (v) Kumbhavali Village (vi) Salvad Village.

1. **Colour** (Hazen Units): Colour units are below the acceptable standard.
2. **Odour** of the sample is agreeable.
3. **pH**: At all the locations, pH of water samples is found well within the range prescribed by CPCB. It is ranged from 6.99 to 7.92.
4. **Chemical Oxygen Demand**: Except chiku wadi and Salvad Village water samples, all other samples were detected below standard limit of 10 mg/L set by WHO. It is ranged from <5 to 33 mg/L.
5. **Biological Oxygen Demand**: Except Chiku Wadi water sample, all other samples were detected below standard limit of 6 mg/L set by WHO. It is ranged from <1 to 12 mg/L.

Following are the parameters which are compared with 10500:2012 Drinking water specifications.

1. **Nitrite**: Values of Nitrite are at below detection level.
2. **Nitrate**: Nitrate value ranged between 6.2mg/L and 32.6mg/L. Nitrate concentrations are below the acceptable standards of IS 10500:2012.
3. **Residual Free Chlorine**: Values are below the acceptable standards.
4. **Total Ammonia**: is within the acceptable range.
5. **Cyanide**: Concentration of cyanide in all the bore well water is very much below the standard.
6. **Fluoride**: Except Chiku wadi water sample, all other samples are observed above standard limit. It is observed in the range of 0.63 to 1.3 mg/L.
7. **Sulphide**: Analytical values are below the detection limits and below the standards.
8. **Sodium Absorption Ratio**: These values fit within range of water quality criteria of CPCB.
9. **Electrical Conductivity**: As per the water quality criteria of CPCB, water samples exceed the limit of electrical conductivity.
10. **Metals**: Metals like Copper, Total Chromium, Lead, Arsenic, Cadmium and Mercury are well within the acceptable limits of drinking water standards.
11. **PAH & PCB** are also below the acceptable limits.
12. **Fish Bioassay**: Fish bioassay exhibits 100% survival

5 CEPI Score:

Comprehensive Environmental Pollution Index (CEPI) is intended to act as early warning tool which helps in categorization of industrial clusters/areas in terms of priority of needing attention.

CPCB had evolved certain methodology to calculate CEPI, in which a score has been fixed for different environmental components based on the level of pollution. The scoring system involves an algorithm that takes into account the basic selection criteria. This approach is based on the basic hazard assessment logic that can be summarized as below.

Hazard = pollutant source, pathways, and receptor

CPCB has calculated CEPI for the identified critically polluted industrial clusters. It is calculated separately for air, water, and land. The basic framework and scoring system of the CEPI – based on three factors namely pollutant, pathway, and receptor – has been described further under this section.

To overcome the subjectivity, revised concept is proposed by eliminating the subjective factors as described in the previous section but retaining the factors which can be measured precisely.

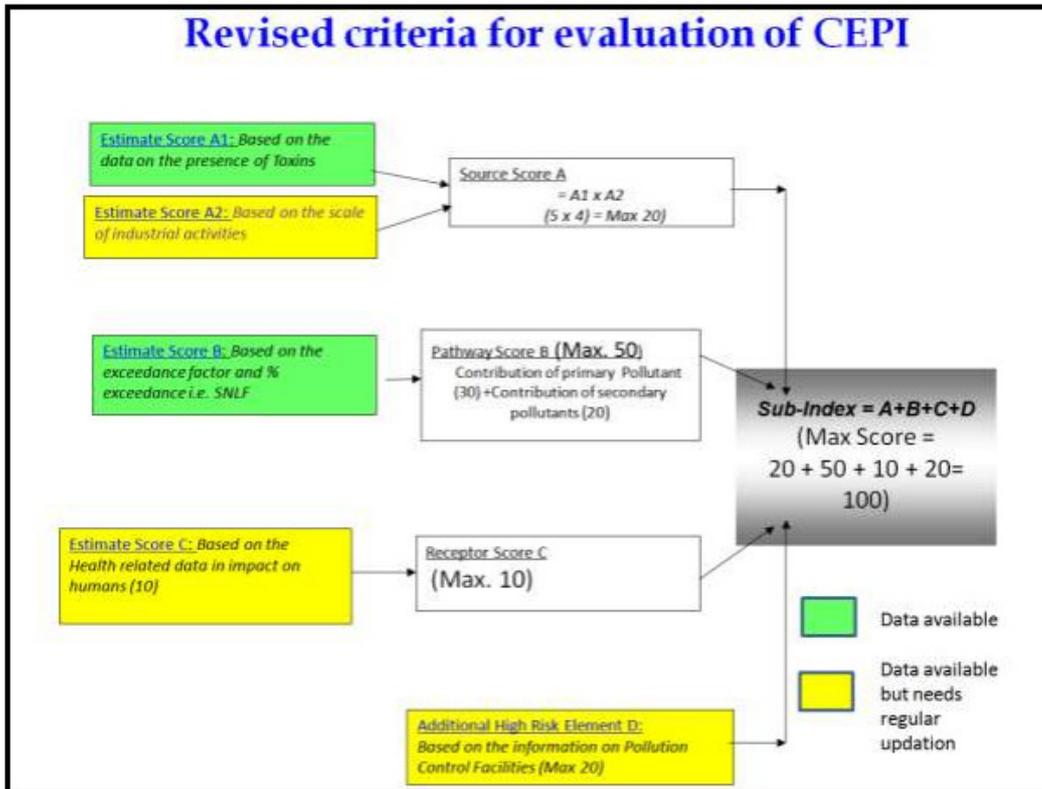
- I. Revised concept is prepared by eliminating the debatable factors but retaining the factors which can be measured precisely.
- II. It is decided to develop the Comprehensive Environmental Pollution Index (CEPI) retaining the existing algorithm of Source, Pathway and Receptor.
- III. Health component was also retained in the revised concept in line with the suggestions of Secretary, MoEFCC during the meeting held in MoEF.

Outlines of revised CEPI 2016 criteria

The outlines of the revised CEPI criteria are as follows:

1. It is proposed to develop the Comprehensive Environmental Pollution Index (CEPI) based on Sources of pollution, real time observed values of the pollutants in the ambient air, surface water and ground water in & around the industrial cluster and health related statistics.
2. For assessment of the environmental quality of the area i.e. CEPI score, the concept of SNLF i.e. a surrogate number which represents the level of exposure (a function of percentage sample Exceedance & Exceedance Factor) shall be used.
3. Health component to be evaluated based on the health data available from major hospitals in the area was also retained in the revised concept.

The evaluation criterion of the revised CEPI version 2016 is described in the flowchart given below:



Here, health data collected for Receptor Score C is included in Annexure I

Based on Sub-Index Score (score of individual environmental component like air, water etc.):

Score more than 63: A Critical Level of Pollution in the respective level of environmental component

Score between 51-63: Severe to critical level of pollution with reference to respective environmental component

Cut-off Score

Score 50: Severely Polluted Industrial Clusters/areas

Score 60: Critically Polluted Industrial Clusters/areas

Based on Aggregated CEPI Score (score includes sub-index score of all individual environmental components together):

Aggregated CEPI score >70: Critically polluted areas

Aggregated CEPI score between 60-70: Severely polluted areas

Since the inception of the programme, MPCB has also formulated Action Plans to mitigate the environmental pollution problems for each of the 8 Critically Polluted Areas (CPAs) in Maharashtra. Based on available information, parameters selected and monitored in continuation with this, CEPI has been calculated and Short-Term Action Plan (STAP) as well as Long Term Action Plan (LTAP) was prepared in 2010.

Subsequently NAAQS 2009 came in force. List of parameters to be considered increased and expanded including more critical and hazardous pollutants like benzene, BaP, Metals, etc. existing in the environment. There was revision of standards (limiting values) as well. In this present report of 2016 prepared by MPCB, CEPI is calculated considering all these revised standards' limiting values, list of parameters and complete scope of monitoring.

5.1 Comparison of CEPI scores:

Below given Table shows aggregated CEPI of present report in comparison with:

1. CEPI score by CPCB in 2009
2. CEPI score 2013
3. CEPI score MPCB 2016
4. CEPI score MPCB February 2017
5. CEPI score MPCB June 2017

Results show that present CEPI score (50.61) of Tarapur city considering all revised standards and parameters has substantially decreased a lot if compared with the CEPI Score of February, 2017 (67.67) report. According to index table, it has come into the severely polluted category. This clearly indicates the successful application of STAP and LTAP of MPCB which resulted in a cleaner environment of Tarapur city in past three years.

Detailed results of Air, Water and Land are given below:

Air:

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
CEPI score June 2018	2	4	8				8				0	10	26
CEPI score February 2018	2.75	4	11				11.5				0	10	32.5
CEPI score June 2017	2.5	4	10	-	-	-	0	-	-	-	0	10	20
CEPI score February 2017	2	5	10	6	3	3	12	3	3	5	14	10	46
CEPI score 2016	4	5	20	6	3	3	12	3	3	5	14	10	56
CEPI score 2013	6	5	30	8	3	3	14	3	5	5	20	10	74

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
CEPI score June 2018	2	4	8				8				0	10	26
CEPI score February 2018	2.75	4	11				11.5				0	10	32.5
CEPI score June 2017	2.5	4	10	-	-	-	0	-	-	-	0	10	20
CPCB Report 2009	5.75	5.0	28.75	2.0	3	3	8	3	3	5	14	10	60.75

Water:

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
CEPI score June 2018	2.5	4.	10				14.25				0	15	39.25
CEPI score February 2018	2.5	4	14				13.5				0	15	38.5
CEPI score June 2017	3.5	4	14	-	-	-	20	-	-	-	0	15	49
CEPI score February 2017	1	5	5	8	3	3	14	5	5	0	25	15	59
CEPI score 2016	1	5	5	8	0	3	11	3	5	0	15	15	46
CEPI score 2013	4	5	20	8	0	3	11	3	3.75	0	11.25	15	57.25
CPCB Report 2009	3	5	15	8	0	3	11	3	5	0	15	15	56

Land:

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
CEPI score June 2018	2.5	4	10				20				0	15	45
CEPI score February 2018	2.5	4	10				20				0	15	45
CEPI score June 2017	3.5	4	14	-	-	-	17.25	-	-	-	0	15	46.25
CEPI score February 2017	1	5	5	8	0	3	11	3	5	0	15	15	46
CEPI score 2016	1	5	5	6	3	3	12	5	3	0	15	15	47
CEPI score 2013	4	5	20	8	3	3	14	5	5	0	25	15	74
CPCB Report 2009	3	5	15	7.75	3	3	13.75	5	1.5	0	7.5	15	51.25

Aggregated CEPI:

	Air Index	Water Index	Land Index	CEPI
CEPI score June 2018	26	39.25	45	50.61
CEPI score February 2018	32.5	38.5	45	51.88
CEPI score June 2017	20	49	46.25	53.72
CEPI score February 2017	46	59	46	67.67
CEPI Score 2016	56	46	47	65.51
CEPI score 2013	74	57.25	74	85.01
CPCB Report 2009	60.75	51.25	56	72.01

6 Conclusions

This is an attempt to check the characteristics and status of environment among the different industrial clusters of Tarapur city. Revised CEPI version 2016 includes 2 major modifications in terms of evaluation of data: (1) It includes Contribution of primary as well as secondary pollutants under Factor B (Max Value 50) and (2) Exhaustive collection of health data of people residing in the vicinity of industrial clusters under study, Factor C (Max Value 10). This has changed the entire criteria of calculating CEPI as compared to the previous CEPI version and hence affected the overall CEPI score also. It shows that the concentration of pollutants in air, ground water and surface water is lowered down as compared to past studies, as most of the results are observed below their standards with an exception of one or two parameters.

Parameters of air sampling are observed within the standard limit all the sampling locations. Among waste water samples, BOD and COD of CETP Inlet, CETP outlet samples are found beyond standard limit. All the ground water samples are found within the limits except BOD and COD of few the water samples, which are observed above standard limits at one location.

Moreover, the lower value (50.61) of Comprehensive Environmental Pollution Index (CEPI) in the present study as compared to past few years study also reveals the fact that the environmental pollution in this city is substantially decreased over the period of times. To achieve this target, improvement in conventional practice and procedures adopted by the industries coupled with initiatives taken by Maharashtra Pollution Control Board played a major role. Although, a decrease in environmental pollution is observed, but still there is lot of scope to improve the environmental quality of the city, for which continuous efforts, strategies, planning and actions are required. Overall CEPI figures are comprised in the table below:

	A1	A2	A	B	C	D	CEPI
Air Index	2	4	8	8	0	10	26.0
Water Index	2.5	4	10	14.25	0	15	39.25
Land Index	2.5	4	10	20	0	15	45.0
Aggregated CEPI							50.61

7 Efforts Taken For the Abatement and Control of Pollution

The regional office of Maharashtra pollution control board has taken various initiatives in reducing the CEPI Score of 67.67 of June to 50.61. Below mentioned are some of the efforts:

- a) Expansion of TEPS-CETP from existing 25 MLD to 37 MLD
- b) Due to various measures taken by the industries solvent recovery improved. And following industries has taken measures
 - M/s. Arti Drugs Ltd, Plot No. N-198, MIDC Tarapur, Tal. Palghar. This industry has developed new technology for the recovery of ammonium sulphate 2000 Mt/month by unit operation like evaporation, crystallization. Earlier the same was treated in their ETP.
 - M/s Camlin Fine Chemicals. Ltd., Plot No. D, MIDC Tarapur has segregated of high COD stream.
 - M/s. Aarti Industries Ltd., Plot No E-50, has installed zero discharge plant such as incineration high COD.
 - M/s Lupin Limited Plt No. T-142 MIDC, Tarapur has provided Anaerobic Digester for segregated effluents.
- c) Board has informed CHWTSDF to increase the frequency of collecting of HW and its transportation.
- d) MIDC is carrying out massive tree plantation program on empty/ reserved plots, and on boundary of MIDC. 4500 nos of trees have been distributed by MIDC to TIMA.
- e) Replacement of RCC drainage by HDPE within MIDC area.
- f) Five nos of industries has started and recycling 50 % of their treated effluent i.e 1604.5 CMD
- g) 7 No. of Textile industries has provided zero discharge system and recycling about 2434 CMD

8 References

1. Criteria for Comprehensive Environmental Assessment of Industrial Clusters, December 2009, CPCB, EIAS/4/2009-10
2. Comprehensive Environmental Assessment of Industrial Clusters, December 2009, CPCB, EIAS/5/2009-10
3. Action Plan for Industrial Cluster: Chandrapur, November 2010, MPCB
4. Action Plan for Industrial Cluster: Dombivli, November 2010, MPCB
5. Action Plan for Industrial Cluster: Aurangabad, November 2010, MPCB
6. Action Plan for Industrial Cluster: Navi Mumbai, November 2010, MPCB
7. Action Plan for Industrial Cluster: Navi Mumbai, November 2010, MPCB
8. Standard Methods for the Examination of Water and Waste Water, American Public Health Association, 22nd Edition, 2012.
9. IS 3025 (various parts)
10. www.mpcb.gov.in
11. www.cpcb.gov.in

9 Annexures

Annexure I Health related data in impact on humans

C: Receptor

Component C (Impact on Human Health) 10	
Main - 10	
% increase in cases	Marks
<5%	0
5-10%	5
>10%	10

- % increase is evaluated based on the total no. of cases recorded during two consecutive years.
- For Air Environment, total no. of cases related to Asthma, Bronchitis, Cancer, Acute respiratory infections etc. are to be considered.
- For surface water/ ground water Environment, cases related to Gastroenteritis, Diarrhoea, renal (kidney) malfunction, cancer etc are to be considered.
- For the above evaluation, the previous 5 years records of 3-5 major hospitals of the area shall be considered.

Attached below health data collected for the region

		Diseases caused by Air pollution					Diseases caused by Water pollution				
Name of Hospital	Year	Asthma	Bronchitis	Pulmonary cancer	Mesothelioma (lung cancer)	Acute respiratory infections	Gastroenteritis	Typhoid	Diarrhea	Liver damage and even cancer (due to presence of chlorinated solvents in the polluted water)	Kidney damage (because of various harmful chemicals present in the polluted water)
Thunga Hospital	2017	53	43	3	6	184	101	154	133	0	0
	2018	21	14	0	0	43	47	36	106	0	0
TAPS HOSPITAL	2017	59	0	0	0	72	73	9	37	0	0
	2018	13	2	0	0	84	33	4	28	0	0

Annexure II: Stack Emission Sampling and Analysis Methodology

Sr.	Parameters	Method References	Techniques	Detection Limit
1.	Acid Mist (as Sulphuric Acid)	US EPA Method no.m-8	Barium thorine titration Method	0.6 mg/Nm ³
2.	Ammonia	IS 11255 (Part 6):1999, Reaffirmed 2003	Titration/Nessler Reagent / Spectrophotometric Method	1 mg/Nm ³
3.	Carbon Monoxide	USEPA Method 10B	GC-FID Method	0.2 mg/Nm ³
4.	Chlorine	US EPA Method 26 for sampling	Titrimetric	0.001 mg/Nm ³
5.	Fluoride (Gaseous)	US EPA Method 13 A	SPADNS Zirconium Lake Spectrophotometric Method	0.025 mg/Nm ³
6.	Fluoride (Particulate)	US EPA Method 13 A	SPADNS Zirconium Lake Spectrophotometric Method	0.005 mg/Nm ³
7.	Hydrogen Chloride	US EPA Method 26 for sampling	Titrimetric	0.25 mg/Nm ³
8.	Hydrogen Sulphide	IS 11255 (Part 4):1985	Titrimetric	1 mg/Nm ³
9.	Oxides of Nitrogen	IS 11255 (Part 7): 2005	PDSA Colorimetric Method	10 mg/Nm ³
10.	Oxygen	IS 13270 : 1992	ORSAT Apparatus	1 %
11.	Poly Aromatic Hydrocarbons (Particulate)	IS 5182 (Part 12) : 2004, Reaffirmed 2009 CPCB Guidelines, May 2011, Page No.39	GC-FID Method	0.25 mg/Nm ³
12.	Suspended Particulate Matter	IS 11255 (Part 1):1985, Reaffirmed 2003	Gravimetric Method	10 mg/Nm ³

Sr.	Parameters	Method References	Techniques	Detection Limit
13.	Sulphur Dioxide	IS 11255 (Part 2): 1985, Reaffirmed 2003	Titrimetric IPA thorine Method	5.0mg/Nm ³
				0.02kg/day
14.	BTX (Benzene, Toluene, Xylene)	NIOSH (NMAM) 1501	Adsorption and Desorption followed by GC-FID analysis	0.001 mg/Nm ³
15.	VOC (Volatile Organic Compounds)	NIOSH (NMAM) 1501 for sampling	Adsorption and Desorption followed by GC-FID or GC/MS analysis	-
i	Methyl Isobutyl Ketone	-	-	0.001 mg/Nm ³
ii	Benzene	-	-	0.001 mg/Nm ³
iii	Toluene	-	-	0.001 mg/Nm ³
iv	Xylene	-	-	0.001 mg/Nm ³
v	Ethyl Benzene	-	-	0.001 mg/Nm ³
vi	Ethyl Acetate	-	-	0.001 mg/Nm ³

Annexure III: Ambient Air Sampling and Analysis Methodology

Sr.	Parameters	Method References	Techniques	Detection Limit
1.	Sulphur Dioxide (SO ₂)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.1	Improved West & Gaeke Method	4 µg/m ³
2.	Nitrogen Dioxide (NO ₂)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.7	Modified Jacob & Hochheiser Method	3 µg/m ³
3.	Particulate Matter (size less than 10 µm) or PM ₁₀	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.11	Gravimetric Method	2 µg/m ³
4.	Particulate Matter (size less than 2.5 µm) or PM _{2.5}	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 15	Gravimetric Method	0.4 µg/m ³
5.	Ozone (O ₃)	APHA, Method No. 820, Page no. 836	Chemical Method	19.6 µg/m ³
6.	Lead (Pb)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	0.02 µg/m ³
7.	Carbon Monoxide (CO)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume II, May 2011, Page No. 16	Non Dispersive Infra Red (BDLIR) spectroscopy	0.05 mg/m ³
8.	Ammonia (NH ₃)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 35	Indophenol Blue Method	4.0µg/m ³
9.	Benzene (C ₆ H ₆)	IS 5182 (Part 11):2006	Adsorption and Desorption followed by GC-FID analysis	1.0 µg/m ³
10.	Benzo (a) Pyrene (BaP) – particulate phase only,	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 39	Solvent extraction followed by GC-FID analysis	0.2 ng/m ³

Sr.	Parameters	Method References	Techniques	Detection Limit
11.	Arsenic (As)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	0.3ng/m ³
12.	Nickel (Ni)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	3.0ng/m ³

Annexure IV: Water/Wastewater Sampling and Analysis Methodology

Sr.	Parameters	Methods References	Techniques	Detection Limit
1.	Sampling Procedure for Chemical Parameters	IS 3025 (Part 1): 1987, Reaffirmed 1998, Amds.1& APHA, 22 ^{BDL} Ed., 2012, 1060 B, 1-39	-	-
2.	Sampling Procedure for Microbiological Parameters	APHA, 22BDL Ed., 2012,1060 B, 1-39, 9040, 9-17, and 9060B, 9-35	-	-
3.	Temperature	APHA, 22 ^{BDL} Ed., 2012, 2550-B, 2-69	By Thermometer	-
4.	Colour	APHA, 22 ^{BDL} Ed., 2012 , 2120-B, 2-26	Visible Comparison Method	1 Hazen Unit
5.	Odour	IS 3025 (Part 5): 1983, Reaffirmed 2006	Qualitative Method	-
6.	pH	APHA, 22 ^{BDL} Ed., 2012, 4500-H ⁺ - B, 4-92	By pH Meter	1
7.	Oil & Grease	APHA, 22 ^{BDL} Ed., 2012, 5520-B, 5-40	Liquid -liquid Partition-Gravimetric Method	1.0 mg/L
8.	Suspended Solids	IS 3025(Part 17): 1984, Reaffirmed 2006,Amds.1	Filtration /Gravimetric Method	5.0 mg/L
9.	Dissolved Oxygen	IS 3025(Part 38): 1989, Reaffirmed 2009	Iodometric Method-Azide modification	0.05 mg/L
10.	Chemical Oxygen Demand	APHA,22 ^{BDL} Ed., 2012 , 5220-B, 5-17	Open Reflux Method	5.0 mg/L
11.	Biochemical Oxygen Demand	IS 3025(Part 44): 1993,Reaffirmed 2009,Amds.1	Iodometric Method	5.0 mg/L
12.	Electrical Conductivity	APHA, 22 ^{BDL} Ed., 2012, 2510- B, 2-54	By Conductivity Meter	0.1 µmho/cm
13.	Nitrite-Nitrogen	APHA, 22 ^{BDL} Ed., 2012, 4500-NO ₂ -B, 4-120	Colorimetric Method	0.006 mg/L

Sr.	Parameters	Methods References	Techniques	Detection Limit
14.	Nitrate-Nitrogen	APHA, 22 ^{BDL} Ed., 2012 ,4500-NO ₃ , B-4-122	UV Spectrophotometer Screening Method	0.2 mg/L
15.	(NO ₂ + NO ₃)-Nitrogen	APHA, 22 ^{BDL} Ed., 2012, 4500-NO ₂ -B, 4-120 APHA, 22 ^{BDL} Ed., 2012, 4500-NO ₃ , B-4-122	Colorimetric Method V Spectrophotometer Screening Method	0.2 mg/L
16.	Free Ammonia	APHA, 22 ^{BDL} Ed., 2012 , 4500 NH ₃ , F, 4 -115	Colorimetric Method	0.006 mg/L
17.	Total Residual Chlorine	IS 3025 (Part 26) :1986 , Reaffirmed 2009, Ed. 2.1(2004-02)	Iodometric Method	0.1 mg/L
18.	Cyanide (CN)	APHA, 22 ^{BDL} Ed., 2012 ,4500-CN, C & E, 4-41 & 4-43	Colorimetric Method	0.001 mg/L
19.	Fluoride (F)	APHA, 22 ^{BDL} Ed., 2012, 4500-F ⁻ , D, 4-87	SPADNS Method	0.05 mg/L
20.	Sulphide (S ²⁻)	APHA, 22 ^{BDL} Ed., 2012, 4500 -S ²⁻ , C-4-175, F-4-178	Iodometric Method	0.08 mg/L
21.	Dissolved Phosphate (P)	APHA, 22 ^{BDL} Ed., 2012 , 4500 P,E, 4-155	Ascorbic Acid Method	0.03 mg/L
22.	Sodium Absorption Ratio	IS11624 :1986, Reaffirmed 2006	By Calculation	0.3
23.	Total Phosphorous (P)	APHA, 22 ^{BDL} Ed., 2012 , 4500 P,E, 4-155	Ascorbic Acid Method	0.03 mg/L
24.	Total Kjeldahl Nitrogen	APHA, 22 ^{BDL} Ed., 2012, 4500 NH ₃ , B & C, 4 -110, 4-112	Titrimetric Method	0.1 mg/L
25.	Total Ammonia (NH ₄ +NH ₃)-Nitrogen	APHA, 22 ^d Ed., 2012 , 4500 NH ₃ , F, 4 -115	Colorimetric Method	0.001 mg/L
26.	Phenols (C ₆ H ₅ OH)	APHA, 22 ^{BDL} Ed., 2012 , 5530- B & C, 5-44 & 5-47	Chloroform Extraction Method	0.001 mg/L

Sr.	Parameters	Methods References	Techniques	Detection Limit
27.	Surface Active Agents	APHA, 22 ^{BDL} Ed., 2012 , 5540-B & C,5-50	Methylene Blue Extraction Method	0.1 mg/L
28.	Organo Chlorine Pesticides	APHA, 22 ^{BDL} Ed., 2012,6410B,6-74	GC MS-MS Method	0.01 µg/L
29.	Polynuclear aromatic hydrocarbons (PAH)	APHA, 22 ^{BDL} Ed., 2012,6410B,6-74	GC MS-MS Method	0.01 µg/L
30.	Polychlorinated Biphenyls (PCB)	APHA, 22 ^{BDL} Ed., 2012,6410B,6-74	GC MS-MS Method	0.01 µg/L
31.	Zinc (Zn)	IS 3025(Part 2): 2004	ICP Method	0.1 mg/L
32.	Nickel (Ni)	IS 3025(Part 2): 2004	ICP Method	0.05 mg/L
33.	Copper (Cu)	IS 3025(Part 2): 2004	ICP Method	0.03 mg/L
34.	Hexavalent Chromium (Cr ⁶⁺)	APHA, 22 ^{BDL} Ed., 2012,3500-Cr,B,3-69	Colorimetric Method	0.02 mg/L
35.	Total Chromium (Cr)	IS 3025(Part 2): 2004	ICP Method	0.02 mg/L
36.	Total Arsenic (As)	IS 3025(Part 2): 2004	ICP Method	0.005 mg/L
37.	Lead (Pb)	IS 3025(Part 2): 2004	ICP Method	0.008 mg/L
38.	Cadmium (Cd)	IS 3025(Part 2): 2004	ICP Method	0.002 mg/L
39.	Mercury (Hg)	IS 3025(Part 2): 2004	ICP Method	0.0008 mg/L
40.	Manganese (Mn)	IS 3025(Part 2): 2004	ICP Method	0.02 mg/L
41.	Iron (Fe)	IS 3025(Part 2): 2004	ICP Method	0.06 mg/L
42.	Vanadium (V)	IS 3025(Part 2): 2004	ICP Method	0.05 mg/L
43.	Selenium (Se)	IS 3025(Part 2): 2004	ICP Method	0.005 mg/L

Sr.	Parameters	Methods References	Techniques	Detection Limit
44.	Boron (B)	IS 3025(Part 2): 2004	ICP Method	0.1 mg/L
45.	Total Coliforms	APHA, 22 ^{BDL} Ed., 2012,9221-B, 9-66	Multiple tube fermentation technique (MPN/100ml)	1.1 MPN/100ml
46.	Faecal Coliforms	APHA, 22 ^{BDL} Ed., 2012,9221-E, 9-74	Multiple tube fermentation technique (MPN/100ml)	1.1 MPN/100ml
47.	Bioassay (Zebra Fish) Test	IS 6582, 1971, Reaffirmed 1987	Static Technique	-

Annexure V: National Ambient Air Quality Standards, 2009



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National Ambient Air Quality Standards: Central Pollution Control Board

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in suppression of the Notification No(s). S.O.384(E), dated 11th April, 1994 and S.O.935(E), dated 14th October, 1998, the **Central Pollution Control Board** hereby notify the National Ambient Air Quality Standards **with immediate effect**, namely:

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Areas (Notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂) $\mu\text{g}/\text{m}^3$	Annual *	50	20	– Improved West and Gaeke – Ultraviolet fluorescence
		24 hours **	80	80	
2	Nitrogen Dioxide (NO ₂) $\mu\text{g}/\text{m}^3$	Annual *	40	30	– Modified Jacob & Hochheiser (Na-Arsenite) – Chemiluminescence
		24 hours **	80	80	
3	Particulate Matter (size less than 10 μm) or PM ₁₀ $\mu\text{g}/\text{m}^3$	Annual *	60	60	– Gravimetric – TOEM – Beta attenuation
		24 hours **	100	100	
4	Particulate Matter (size less than 2.5 μm) or PM _{2.5} $\mu\text{g}/\text{m}^3$	Annual *	40	40	– Gravimetric – TOEM – Beta attenuation
		24 hours **	60	60	
5	Ozone (O ₃) $\mu\text{g}/\text{m}^3$	8 hours **	100	100	– UV photometric – Chemiluminescence – Chemical Method
		1 hour **	180	180	
6	Lead (Pb) $\mu\text{g}/\text{m}^3$	Annual *	0.50	0.50	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper – EDXRF using Teflon filter
		24 hours **	1.0	1.0	
7	Carbon Monoxide (CO) mg/m^3	8 hours **	02	02	– Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour **	04	04	
8	Ammonia (NH ₃) $\mu\text{g}/\text{m}^3$	Annual *	100	100	– Chemiluminescence – Indophenol blue method
		24 hours **	400	400	
9	Benzene (C ₆ H ₆) $\mu\text{g}/\text{m}^3$	Annual *	05	05	– Gas Chromatography based continuous analyzer – Adsorption and Desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP) – particulate phase only, ng/m^3	Annual *	01	01	– Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) ng/m^3	Annual *	06	06	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper.
12	Nickel (Ni) ng/m^3	Annual *	20	20	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper.

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2 % of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman, Central Pollution Control Board [ADVT-III/4/184/09/Exty.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India. Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

$\mu\text{g}/\text{m}^3$: micro-gram/ m^3 i.e. $10^{-6}\text{gm}/\text{m}^3$

ng/m^3 : nano-gram/ m^3 i.e. $10^{-9}\text{gm}/\text{m}^3$

Annexure VI: General Standards for Discharge of Environmental Pollutants, Part A: Effluents (The Environment (Protection) Rules, 1986, Schedule VI)

Sr.	Parameter	Standards			
		Inland surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
1.	Colour and Odour	See Note 1	--	See Note I	See Note 1
2.	Suspended solids, mg/L, Max.	100	600	200	a. For process waste water - 100 b. For cooling water effluent- 10 percent above total Suspended matter of influent cooling water.
3.	Particle size of Suspended solids	Shall pass 850 micron IS Sieve			a. Floatable solids, Max 3 mm b. Settleable solids Max 850 microns
4.	Dissolved solids (Inorganic), mg/L, Max.	2100	2100	2100	--
5.	pH value	5.5 -9.0	5.5 -9.0	5.5 -9.0	5.5-9.0

Sr.	Parameter	Standards			
		Inland surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
6.	Temperature °C, Max	Shall not exceed 40 in any section of the stream within 15 mts. Downstream from the effluent outlet	45 at the point of discharge	--	45 at the point of discharge
7.	Oil and Grease, mg/L, Max	10	20	10	20
8.,	Total Residual chlorine, mg/L, Max	1.0	--	--	1.0
9.	Ammonical Nitrogen (as N), mg/L, Max	50	50	--	50
10.	Total Kjeldahl Nitrogen (as N), mg/L, Max.	100	--	--	100
11.	Free Ammonia (as NH ₃), mg/L, Max	5.0	--	--	5.0
12.	Biochemical oxygen demand (5 days, at 20° c) mg/L, Max	30	350	100	100
13.	Chemical oxygen demand, mg/L, Max	250	--	--	250
14.	Arsenic (as As), mg/l, Max	0.2	0.2	0.2	0.2
15.	Mercury (as Hg). Mg/L, Max	0.01	0.01	--	0.01
16.	Lead (as Pb), mg/L, Max	0.1	1.0	-	1.0

Sr.	Parameter	Standards			
		Inland surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
17.	Cadmium (as Cd), mg/L,	2.0	1.0	--	2.0
18.	Hexavalent Chromium (as Cr ⁺⁶) mg/L, Max	.1	2.0	--	1.0
19.	Total Chromium (as Cr), mg/L, Max	2.0	2.0	--	2.0
20.	Copper (as Cu), mg/L, Max.	3.0	3.0	--	3.0
21.	Zinc (as Zn), mg/L, Max.	5.0	15	0--	15
22.	Selenium (as Se), mg/l, Max.	0.05	0.05	--	0.05
23.	Nickel (as Ni), mg/l, Max.	3.0	3.0	--	5.0
24.	Boron (as B), mg/l, Max.	2.0	2.0	2.0	--
25.	Percent Sodium, Max.	--	60	60	--
26.	Residual Sodium carbonate, mg/l, Max.	--	--	5.0	--
27.	Cyanide (as Cn), mg/L, Max.	0.2	2.0	0.2	0.2
28.	Chloride (as Cl), mg/L, Max.	1000	1000	600	--
29.	Fluoride (as F), mg/IL, Max.	2.0	15	--	15
30.	Dissolved Phosphate (as P), mg/L, Max.	5.0	--	--	--
31.	Sulphate (as SO ₄), mg/L, Max.	1000	1000	1000	--

Sr.	Parameter	Standards			
		Inland surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
32.	Sulphide (as S), mg/L, Max.	2.0	--	--	5.0
33.	Pesticides	Absent	Absent	Absent	Absent
34.	Phenolic Compounds (as C ₆ H ₅ OH), mg/L, Max.	1.0	5.0	--	5.0
35.	Radioactive materials:				
	a. Alpha emitters MC/ml., Max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
	b. Beta emitters µc/ml., Max	10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶

Annexure VII: Drinking Water Specification-IS 10500:2012

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
Table 1	Organoleptic and Physical Parameters			
1.	Colour	Hazen units	Max 5	Max 15
2.	Odour	-	Agreeable	Agreeable
3.	pH value	-	6.5-8.5	No relaxation
4.	Taste	-	Agreeable	Agreeable
5.	Turbidity	NTU	Max 1	Max 5
6.	Total dissolved solids	mg/L	Max 500	Max 2000
Table 2	General parameters concerning substances undesirable in excessive amounts			
7.	Aluminium (as Al)	mg/L	Max 0.03	Max 0.2
8.	Ammonia (as total ammonia-N)	mg/L	Max 0.5	No relaxation
9.	Anionic detergents (as MBAS)	mg/L	Max 0.2	Max 1.0
10.	Barium (as Ba)	mg/L	Max 0.7	No relaxation
11.	Boron (as B)	mg/L	Max 0.5	Max 1.0
12.	Calcium (as Ca)	mg/L	Max 75	Max 200
13.	Chloramines (as Cl ₂)	mg/L	Max 4.0	No relaxation
14.	Chlorides (as Cl)	mg/L	Max 250	Max 1000
15.	Copper (as Cu)	mg/L	Max 0.05	Max 1.5
16.	Fluoride (as F)	mg/L	Max 1.0	Max 1.5
17.	Free residual chlorine	mg/L	Min 0.2	Min 1

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
18.	Iron (as Fe)	mg/L	Max 0.3	No relaxation
19.	Magnesium (as Mg)	mg/L	Max 30	Max100
20.	Manganese (as Mn)	mg/L	Max 0.1	Max 0.3
21.	Mineral Oil	mg/L	Max 0.5	No relaxation
22.	Nitrate (as NO ₃)	mg/L	Max 45	No relaxation
23.	Phenolic Compounds (as C ₆ H ₅ OH)	mg/L	Max 0.001	Max 0.002
24.	Selenium (as Se)	mg/L	Max 0.01	No relaxation
25.	Silver (as Ag)	mg/L	Max 0.1	No relaxation
26.	Sulphate (as SO ₄)	mg/L	Max 200	Max 400
27.	Sulphide (as H ₂ S)	mg/L	Max 0.05	No relaxation
28.	Total Alkalinity as calcium carbonate	mg/L	Max 200	Max600
29.	Total hardness (as CaCO ₃)	mg/L	Max 200	Max 600
30.	Zinc (as Zn)	mg/L	Max 5	Max15
Table 3	Parameters Concerning Toxic Substances			
31.	Cadmium (asCd)	mg/L	Max 0.003	No relaxation
32.	Cyanide (asCN)	mg/L	Max 0.05	No relaxation
33.	Lead (as Pb)	mg/L	Max 0.01	No relaxation
34.	Mercury (asHg)	mg/L	Max 0.001	No relaxation
35.	Molybdenum (as Mo)	mg/L	Max 0.07	No relaxation
36.	Nickel (as Ni)	mg/L	Max 0.02	No relaxation
37.	Pesticides	mg/L	See Table 5	No relaxation
38.	Polychlorinatedbiphenyls	mg/L	Max 0.0005	No relaxation

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
39.	Poly nuclear aromatic Hydrocarbons (as PAH)	mg/L	Max 0.0001	No relaxation
40.	Total Arsenic(as As)	mg/L	Max 0.01	Max0.05
41.	Total Chromium (as Cr)	mg/L	Max 0.05	No relaxation
42.	Trihalomethanes			
a)	Bromoform	mg/L	Max 0.1	No relaxation
b)	DibromochloroMethane	mg/L	Max 0.1	No relaxation
c)	Bromodichloromethane	mg/L	Max 0.06	No relaxation
d)	Chloroform	mg/L	Max 0.2	No relaxation
Table 4	Parameters Concerning Radioactive Substances			
43.	Radioactive Materials			
a)	Alpha emitters	Bq/L	Max 0.1	No relaxation
b)	Beta emitters	Bq/L	Max 1.0	No relaxation
Table 5	Pesticide Residues Limits and Test Method			
i)	Alachor	µg/L	20	No relaxation
ii)	Atrazine	µg/L	2	No relaxation
iii)	Aldrin/ Dieldrin	µg/L	0.03	No relaxation
iv)	Alpha HCH	µg/L	0.01	No relaxation
v)	Beta HCH	µg/L	0.04	No relaxation
vi)	Butachlor	µg/L	125	No relaxation
vii)	Chlorpyriphos	µg/L	30	No relaxation
viii)	Delta HCH	µg/L	0.04	No relaxation
ix)	2,4- Dichlorophenoxyacetic acid	µg/L	30	No relaxation

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
x)	DDT (o,p&p,p – Isomers of DDT, DDE and DDD)	µg/L	1	No relaxation
xi)	EBDLosulfan (α,β & sulphate)	µg/L	0.4	No relaxation
xii)	Ethion	µg/L	3	No relaxation
xiii)	Gamma - HCH (LiBDLane)	µg/L	2	No relaxation
xiv)	Isoproturon	µg/L	9	No relaxation
xv)	Malathion	µg/L	190	No relaxation
xvi)	Methyl parathion	µg/L	0.3	No relaxation
xvii)	Monocrotophos	µg/L	1	No relaxation
xviii)	Phorate	µg/L	2	No relaxation
Table 6	Bacteriological Quality of Drinking Water			
44.	E.coli or thermotolerant coliform bacteria	/100	Not detectable	-
45.	Total coliform bacteria	/100 mL	Not detectable	-
	Virological Requirements			
46.	MS2 phage	/1 L	Absent	-
	Biological Requirements			
47.	Cryptosporidium	/10 L	Absent	-
48.	Giardia	/10 L	Absent	-
49.	Microscopic organisms such as algae, zooplanktons, flagellates, parasites and toxin producing organisms		Free from microscopic organisms	-

Annexure VIII: CPCB Water Quality Criteria:

Designated best use	Quality Class	Primary Water Quality Criteria
Drinking water source without conventional treatment but with chlorination	A	<ul style="list-style-type: none"> ➤ Total coliform organisms (MPN*/100 ml) shall be 50 or less ➤ pH between 6.5 and 8.5 ➤ Dissolved Oxygen 6 mg/L or more, and ➤ Biochemical Oxygen Demand 2 mg/L or less
Outdoor bathing (organized)	B	<ul style="list-style-type: none"> ➤ Total coliform organisms (MPN/100 ml) shall be 500 or less ➤ pH between 6.5 and 8.5 ➤ Dissolved Oxygen 5 mg/L or more, and ➤ Biochemical Oxygen Demand 3 mg/L or less
Drinking water source with conventional treatment	C	<ul style="list-style-type: none"> ➤ Total coliform organisms (MPN/100ml) shall be 5000 or less ➤ pH between 6 and 9 ➤ Dissolved Oxygen 4 mg/L or more, and ➤ Biochemical Oxygen Demand 3 mg/L or less
Propagation of wildlife and fisheries	D	<ul style="list-style-type: none"> ➤ pH between 6.5 and 8.5 ➤ Dissolved Oxygen 4 mg/L or more, and ➤ Free ammonia (as N) 1.2 mg/L or less
Irrigation, industrial cooling, and controlled disposal	E	<ul style="list-style-type: none"> ➤ pH between 6.0 and 8.5 ➤ Electrical Conductivity less than 2250 micro mhos/cm, ➤ Sodium Absorption Ratio less than 26, ➤ and Boron less than 2 mg/l.
	Below E	<ul style="list-style-type: none"> ➤ Not Meeting A, B, C, D & E Criteria

Annexure IX: Water Quality Parameters Requirements and Classification

Water quality parameters are classified into three categories, given in Table (i), (ii) and (iii) (Source: CPCB, 2002, "Water Quality Criteria and Goals", Monitoring of National aquatic Resources Series: MINARS/17/2001-2002).

Table: Basic Water Quality Requirement and Classification (Surface Water + Ground Water)

i) Simple Parameters:

Sr.	Parameters	Requirement for Waters of Class		
		A-Excellent	B-Desirable	C-Acceptable
(i)	Sanitary Survey	Very Clean neighborhood and catchment	Reasonably clean neighborhood	Generally clean neighborhood
(ii)	General Appearance	No floating matter	No floating matter	No floating matter
(iii)	Colour	Absolutely Colourless	Almost colourless, very light shade if any	No colour of anthropogenic origin
(iv)	Smell	Odourless	Almost odourless	No unpleasant odour
(v)	Transparency	>1.0 depth	>0.5 to 0.1m depth	>0.2 to 0.5 m depth
(vi)	Ecological* (Presence of Animals)	Fish & Insects	Fish & Insects	Fish & Insects

* Applicable to only surface water

ii) Regular Monitoring Parameters:

Sr.	Parameters	Requirement for Waters of Class		
		A Excellent	B-Desirable	C-Acceptable
(i)	pH	7.0 to 8.5	6.5 to 9.0	6.5 to 9.0
(ii)	DO (% Saturation)	90-110	80-120	60-140
(iii)	BOD, mg/l	Below 2	Below 5	Below 8
(iv)	EC, μ mhos/cm	BDL000	<2250	<4000
(v)	(NO ₂ +NO ₃)-Nitrogen, mg/l	<5	BDL0	BDL5
(vi)	Suspended solid, mg/l	<25	<50	BDL00

Sr.	Parameters	Requirement for Waters of Class		
		A Excellent	B-Desirable	C-Acceptable
(vii)	Fecal Coliform, MPN/ 100 ml	<20 per 100 ml	<200 per 100 ml	<2000 per 100 ml
(viii)	Bio-assay (Zebra Fish)	No death in 5 days	No death in 3 days	No death in 2 days

Note:

1. Dissolved Oxygen (DO) not applicable for Ground Waters.
2. Dissolved Oxygen in eutrophicated waters should include measurement for diurnal variation.
3. Suspended solid limit is applicable only during non-monsoon period.
4. Faecal Coliform values should meet for 90% times.
5. Static Bio-Assay method may be adopted.

iii) Specific Parameters: (Only in case of need/apprehensions)

Sr.	Parameters	Requirement for Waters of Class		
		A- Excellent	B-Desirable	C-Acceptable
(i)	Total Phosphorous	BDL mg/l	<0.2 mg/l	BDL mg/l
(ii)	T.K.N	BDL.0 mg/l	<2.0 mg/l	<3.0 mg/l
(iii)	Total Ammonia (NH ₄ + NH ₃)-Nitrogen	<0.5 mg/l	BDL.0 mg/l	BDL.5 mg/l
(iv)	Phenols	<2µg/l	<5µg/l	BDL0 µg/l
(v)	Surface Active Agents	<20 µg/l	BDL00µg/l	<200µg/l
(vi)	Organo Chlorine Pesticides	BDLµg/l	BDLµg/l	<0.2µg/l
(vii)	PAH	BDLµg/l	BDL µg/l	<0.2 µg/l
(viii)	PCB and PCT	BDLµg/l	BDLµg/l	BDLµg/l
(ix)	Zinc	BDL00µg/l	<200µg/l	<300 µg/l
(x)	Nickel	<50µg/l	BDL00µg/l	<200µg/l
(xi)	Copper	<20µg/l	<50µg/l	BDL00µg/l

Sr.	Parameters	Requirement for Waters of Class		
		A- Excellent	B-Desirable	C-Acceptable
(xii)	Chromium (Total)	<20µg/l	<50µg/l	BDL00µg/l
(xiii)	Arsenic (Total)	<20µg/l	<50 µg/l	BDL00 µg/l
(xiv)	Lead	<20µg/l	<50µg/l	BDL00µg/l
(xv)	Cadmium	BDL.0µg/l	<2.5 µg/l	<5.0µg/l
(xvi)	Mercury	<0.2µg/l	<0.5µg/l	BDL.0µg/l