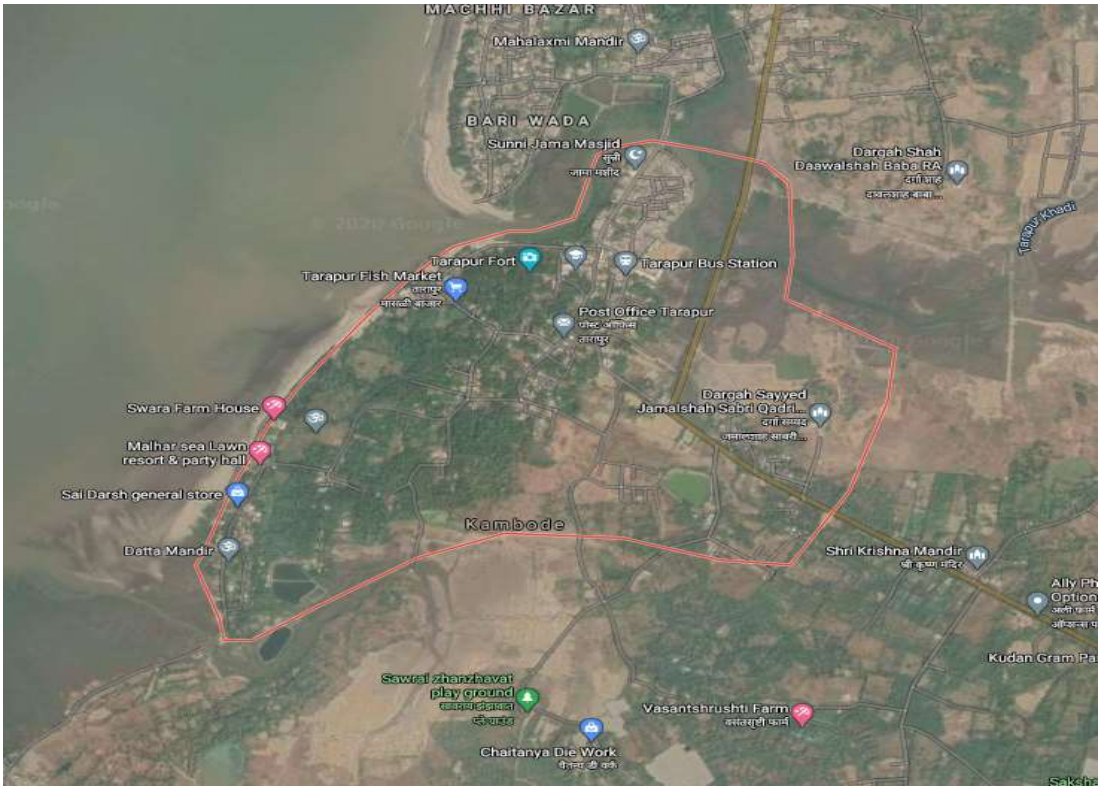
MONITORING, SAMPLING AND ANALYSIS FOR AMBIENT AIR QUALITY, SURFACE WATER QUALITY AND GROUND WATER QUALITY IN 100 POLLUTED INDUSTRIAL AREAS

DURING DECEMBER 2019- FEBRUARY 2020

Environmental Quality Monitoring Report For Tarapur, Maharashtra



Maharashtra Pollution Control Board

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March, 2020

INDEX

Acknowledgement **3**
Abbreviations: **4**
1. Introduction: **5**
2. Scope of Work **6**
2.1 Frequency of Sampling: 7
2.2 Methodology followed in Sampling and Analysis 7
3. Monitoring Locations at Tarapur **8**
3.1 Mapping of the locations monitored **10**
4. Results of Analysis **12**
4.1 Stack Emission Monitoring: 12
4.2 Ambient Air Quality: 15
4.3 Surface Water Quality Analysis: 24
4.4 Ground Water Analysis Results: 49
5. Summary of the Results **70**
5.1 Stack Emission Monitoring: 70
5.2 Ambient Air Monitoring: 70
5.3 Surface Water Quality: 71
5.4 Ground Water Quality: 71
6. CEPI Score: **72**
6.1 Comparison of CEPI scores: 74
7. Conclusions **75**
8. Photographs **76**
9. Annexures **79**
Annexure I Health related data in impact on humans 79
Annexure II: Stack Emission Sampling and Analysis Methodology 80
Annexure III: Ambient Air Sampling and Analysis Methodology 82
Annexure IV: Water/Wastewater Sampling and Analysis Methodology 84
Annexure V: National Ambient Air Quality Standards, 2009 88
Annexure VI: General Standards for Discharge of Environmental Pollutants, Part A: Effluents (The Environment (Protection) Rules, 1986, Schedule VI) 89
Annexure VII: Drinking Water Specification-IS 10500:2012 92
Annexure VIII: CPCB Water Quality Criteria: 95
Annexure IX: Water Quality Parameters Requirements and Classification 96

Acknowledgement

We gratefully acknowledge **Ashok Shingare**, Member Secretary, Maharashtra Pollution Control Board, for entrusting this very important and prestigious project to us.

Our special thanks to Regional and Sub Regional Officer of the concerned areas, for guidance during the sampling. The contribution of **Shri V. M Motghare** (Joint director APC) and **Mr. Sameer Hundlekar** (Field officer) is appreciated.

We would also like to extend our thanks to the concerned staff of Regional Hospitals, who has provided us the health data, which is the most important component of this revised concept of CEPI.

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.

We also thank our associates for working on this project for making the write up, making graphs and feeding the data on computer.

This acknowledgement will be incomplete if we do not thank our laboratory analysts and others who made this project a success by timely analyzing the samples.

We also thank our sampling team members for conducting the sampling in this vast area.

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
PM_{10}	Particulate Matter (size less than 10 µm)
$PM_{2.5}$	Particulate Matter (size less than 2.5 µm)
SO_2	Sulphur Dioxide
STAP	Short Term Action Plan
WHO	World Health Organization

1. Introduction:

Over the years, urbanization and industrialization have led to major pollution-related issues due to increased human activities. Lack of planning and a basic understanding of the ecology affects its balance leading to pollution of water, air, soil, and other natural resources. The pollution load in respect of air quality is of relatively high order in metropolitan cities. It is associated with higher rates of several health disorders too. The development of manufacturing, especially near cities and industrial zones, is changing the environment and the natural composition of water. Pollution of natural environment not only affects people but also have adverse impact on economic growth in the long run. Analysis of pollution load shows that there are few industries in the country which contribute to more than 90percent of the pollution. 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.

Industrial pollution takes on many faces. It contaminates many sources of drinking water, releases unwanted toxins into the air and reduces the quality of soil all over the world. Every liter of waste water discharged by our industries pollutes eight times the quantity of fresh water. 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.

CEPI bridges the perceptive gap between experts, public, and government departments by simplifying the complexity of environmental issues. It aims at categorizing critically polluted industrial areas based on scientific criteria, so as to ascertain various dimensions of pollution. This is a combined framework used to evaluate the impacts caused by industrial clusters on the nearby environment, as a numerical value.

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. A total of 88 industrial areas or clusters have been selected by the Central Pollution Control Board (CPCB) in consultation with the Ministry of Environment & Forests Government of India for the study. 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

2. Scope of Work

The Scope of Work consisted of the following:

Monitoring, Sampling, Analysis for Stack, Ambient Air Quality, Surface Water and Ground Water Quality at identified locations in Tarapur, Maharashtra with a gap of one or two days.

Details regarding the works are provided as below:

Industrial Cluster/ Area	**No. of Stack sites**	**Parameter of Stack**	**No. of AAQM sites**	**Parameter of AAQM**	**Numbers of water quality monitoring site**		**Parameter of Water**
					Surface water	**Ground water**	
Tarapur	**6**	PM, SO_2 and NO_2	**8**	PM_{10}, $PM_{2.5}$, SO_2, NO_2, NH_3, O_3, C_6H_6, CO, BAP, Pb, Ni, As	**6**	**6**	**(i) Simple Parameters** Sanitary Survey, General Appearance, Colour, Smell, Transparency and Ecological **(ii) Regular Monitoring Parameters** pH, O & G, Suspended Solids, DO, COD, BOD, Electrical Conductivity, Total Dissolved Solids, Nitrite–Nitrogen, Nitrate-Nitrogen, (NO_2+NO_3) total nitrogen, Free Ammonia, Total Residual Chlorine, Cyanide, Fluoride, Chloride, Sulphate, Sulphides, Total Hardness, Dissolved Phosphates, SAR, Total Coliforms, Faecal Coliform, **(iii) Special Parameters** Total Phosphorous, TKN, Total Ammonia (NH_4+NH_3)-Nitrogen, Phenols, Surface Active Agents, Anionic detergents, Organo-Chlorine Pesticides, PAH, PCB and PCT, Zinc, Nickel, Copper, Hexa-valent Chromium, Chromium (Total), Arsenic (Total), Lead, Cadmium, Mercury, Manganese, Iron, Vanadium, Selenium, Boron **(iv) Bio-assay (zebra Fish)** Test – For specified samples only.

2.1 Frequency of Sampling:

Parameter	Round of Sampling	Frequency on each Round
Ambient Air Quality Monitoring		
Particulate Matter (size less than 10 µm) or PM_{10}	03	3 Shifts of 8 hrs each
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	03	1 Shifts of 24 hr
Sulphur Dioxide (SO_2)	03	6 Shifts of 4 hrs each
Nitrogen Dioxide (NO_2)	03	6 Shifts of 4 hrs each
Ammonia (NH_3)	03	6 Shifts of 4 hrs each
Ozone (O_3)	03	24 Shifts of 1 hr each
Benzene (C_6H_6)	03	1 Shifts of 24 hr
Carbon Monoxide (CO)	03	24 Shifts of 1 hr each
Benzo (a) Pyrene (BaP) – particulate phase only	03	3 Shifts of 8 hrs each
Lead (Pb)	03	3 Shifts of 8 hrs each
Arsenic (As)	03	3 Shifts of 8 hrs each
Nickel (Ni)	03	3 Shifts of 8 hrs each
Ground Water		
As Mentioned Above	03	01 samples at each round
Surface Water		
As Mentioned Above	03	01 samples at each round

2.2 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 I**
2. Ambient Air Sampling and Analysis Methodology **- Annexure II**
3. Surface Water/ Ground water Sampling and Analysis Methodology - **Annexure III**

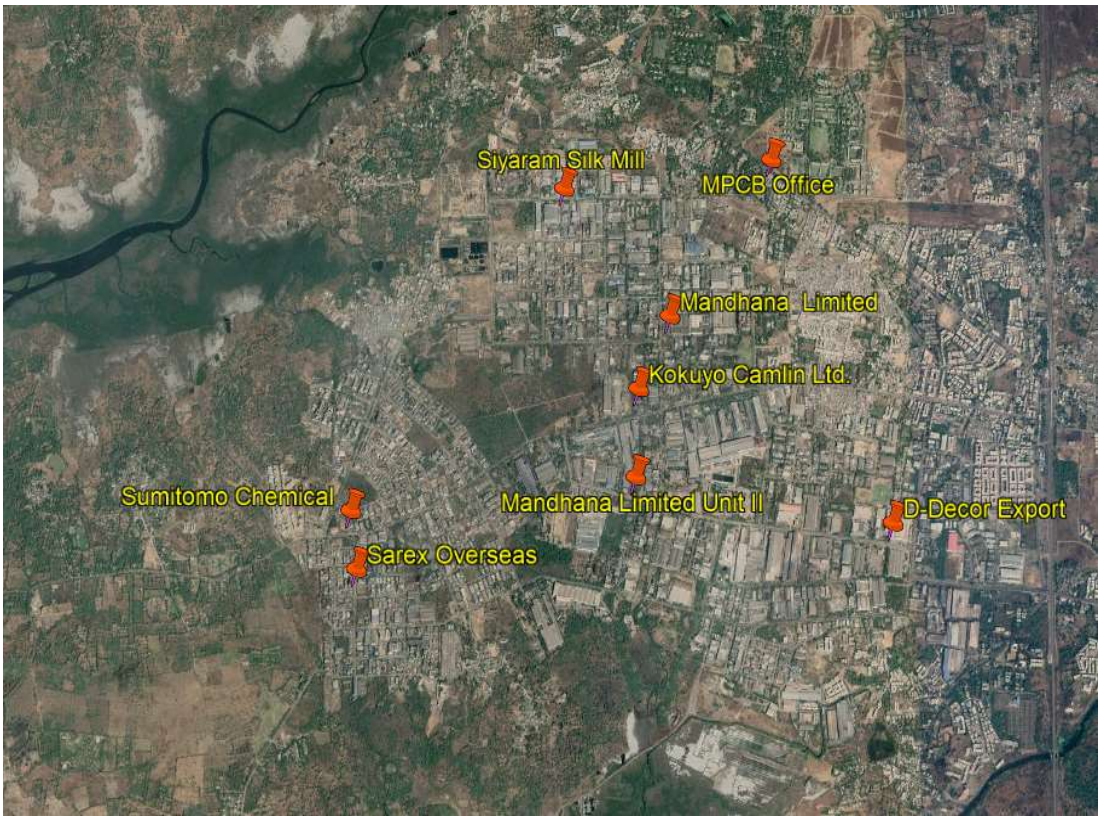
3. Monitoring Locations at Tarapur

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
AAQM Stations at Tarapur						
1.	Siyaram Silk Mill	N19°48'27.92"	E72°43'54.22"	17.02.2020	19.02.2020	21.02.2020
2.	Mandhana Limited Unit II	N19°47'30.85"	E72°44'10.42"	17.02.2020	19.02.2020	21.02.2020
3.	Sumitomo Chemical	N19°47'24.36"	E72°43'8.82"	17.02.2020	19.02.2020	21.02.2020
4.	Mandhana Limited (C-3)	N19°48'2.34"	E72°44'17.83"	18.02.2020	20.02.2020	22.02.2020
5.	MPCB SRO Office	N19°48'33.80"	E72°44'40.47"	18.02.2020	20.02.2020	22.02.2020
6.	Kokuyo Camlin Ltd.	N19°47'48.01"	E72°44'10.99"	18.02.2020	20.02.2020	22.02.2020
7.	D -Decor Export	N19°47'22.04"	E72°45'6.06"	18.02.2020	20.02.2020	22.02.2020
8.	Sarex Overseas	N19°47'13.23"	E72°43'10.42"	23.02.2020	25.04.2020	21.02.2020
Surface Water Sampling Locations at Tarapur						
1.	BPT Navapur out Fall	N19°47'37.21"	E72°44'13.73"	19.02.2020	21.02.2020	23.02.2020
2.	Nallah Carrying Domestic Sewage at Saravali	N19°46'42.95"	E72°45'01.49"	19.02.2020	21.02.2020	23.02.2020
3.	Nallah to Dandi	N19°47'30.28"	E72°46'6.96"	19.02.2020	21.02.2020	23.02.2020
4.	Nallah Near of sump 2 Tarapur CETP	N19°46'47.84"	E72°44'30.31"	19.02.2020	21.02.2020	23.02.2020
5.	Over Flow of Sump No-1	N19°46'29.06"	E72°45'18.89"	19.02.2020	21.02.2020	23.02.2020
6.	Open Drain Near Sump 3 Node	N19°46'26.40"	E72°44'02.83"	19.02.2020	23.02.2020	21.02.2020

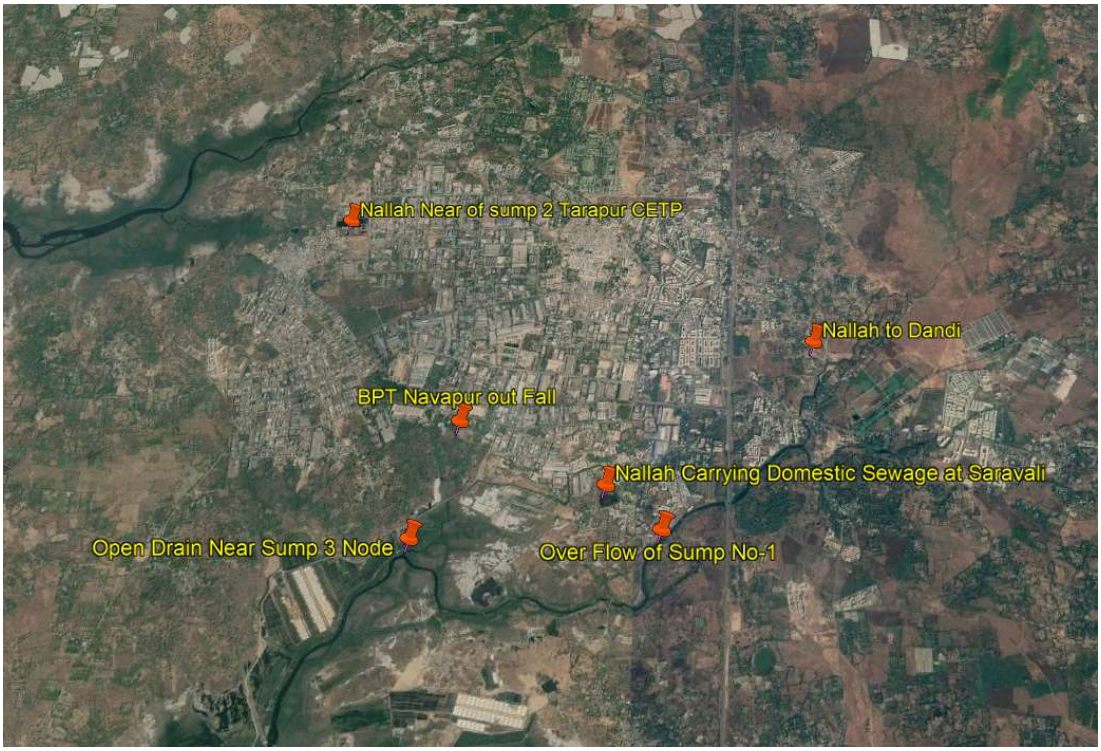
Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
Ground Water Sampling Locations at Tarapur						
1.	Open Well near Nalla Sump 1	N19°46'28.46"	E72°45'15.23"	19.02.2020	21.02.2020	23.02.2020
2.	Hand Pump Water Besides Sai Complex	N19°48'3.42"	E72°44'46.82"	19.02.2020	21.02.2020	23.02.2020
3.	Well Water Chikkuwadi in PID (Police Station)	N19°52'14.17"	E72°41'5.92"	19.02.2020	21.02.2020	23.02.2020
4.	Borewell at Shivaji Nagar Boiser	N19°48'8.17"	E72°43'22.06"	19.02.2020	21.02.2020	23.02.2020
5.	Salvad Village	N19°48'31.49"	E72°43'22.41"	19.02.2020	21.02.2020	23.02.2020
6.	Ankush Gharatwadi	N18^{0}22'13.86"	E74^{0}54'54.11"	19.02.2020	21.02.2020	23.02.2020
Stack Emission monitoring at Tarapur						
1.	Siyaram Silk Mills	N19^{0}06'51.10"	E72^{0}55'27.75"	17.02.2020	19.02.2020	21.02.2020
2.	Ginil Silk Mill Ltd.	N19^{0}05'47.42"	E72^{0}49'55.95"	17.02.2020	19.02.2020	21.02.2020
3.	Mandhana Weaving	N28^{0}47'06.44"	E77^{0}15'38.27"	17.02.2020	19.02.2020	21.02.2020
4.	UPL Limited	N19^{0}04'43.98"	E72^{0}53'08.21"	18.02.2020	20.02.2020	22.02.2020
5.	Calyx Chemical Ltd.	N19^{0}30'03.34"	E72^{0}55'02.74"	18.02.2020	20.02.2020	22.02.2020
6.	Angadpal Industries	N19^{0}26'48.62"	E72^{0}48'28.75"	18.02.2020	20.02.2020	22.02.2020
VOCs Emission monitoring at Tarapur						
1.	Mandhana Weaving	N28^{0}47'06.44"	E77^{0}15'38.27"	17.02.2020	19.02.2020	21.02.2020
2.	Angadpal Industries	N19^{0}26'48.62"	E72^{0}48'28.75"	18.02.2020	20.02.2020	22.02.2020

3.1 Mapping of the locations monitored

AAQM Stations at Tarapur



Surface water sampling locations at Navi Mumbai



Ground water sampling locations at Navi Mumbai

4. Results of Analysis

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

***Kindly note:**

- *NA specifies the sample is not analyzed for the specific parameter.*
- *BDL specifies that the result obtained is below detection limit.*
- *Also, industrial clusters observed with below detection limit parameters are NOT included into the graphs*

4.1 Stack Emission Monitoring:

Stack Emission Monitoring Results are compared against The Environment (Protection) Rules, 1986 General Emission Standard - Part D. As VOCs concentration is not detected in the samples, hence it is not shown in the graphs.

Name of the Industry: Siyaram Silk Mills

Parameters	**Units**	**Results**		
		Round-1 (17.02.2020)	**Round-2 (19.02.2020)**	**Round-3 (21.02.2020)**
Particulate Matter	mg/Nm^3	21	16	19
Sulphur Dioxide (SO_2)	mg/Nm^3	257	8.57	8.57
	kg/day	52.8	1.81	1.73
Nitrogen dioxide (NO_2)	mg/Nm^3	15.8	15.9	15.8

Name of the Industry: Gini SilK Mill Ltd.

Parameters	**Units**	**Results**		
		Round-1 (17.02.2020)	**Round-2 (19.02.2020)**	**Round-3 (21.02.2020)**
Particulate Matter	mg/Nm^3	16	28	15
Sulphur Dioxide (SO_2)	mg/Nm^3	200	11	8
	kg/day	163	9.6	6.74
Nitrogen dioxide (NO_2)	mg/Nm^3	BDL	18.6	15.9

Name of the Industry: Mandhana Weaving

Parameters	Units	Results		
		Round-1 (17.02.2020)	**Round-2 (19.02.2020)**	**Round-3 (21.02.2020)**
Particulate Matter	mg/Nm^3	15	25	13
Sulphur Dioxide (SO_2)	mg/Nm^3	171	11	20
	kg/day	9.19	0.63	1.13
Nitrogen dioxide (NO_2)	mg/Nm^3	13.3	BDL	37.1

Name of the Industry: UPL Limited

Parameters	Units	Results		
		Round-1 (18.02.2020)	**Round-2 (20.02.2020)**	**Round-3 (22.02.2020)**
Particulate Matter	mg/Nm^3	31	26	28
Sulphur Dioxide (SO_2)	mg/Nm^3	314	23	11.4
	kg/day	144	11	5.37
Nitrogen dioxide (NO_2)	mg/Nm^3	BDL	37.1	18.5

Name of the Industry: Calyx Chemical Ltd.

Parameters	Units	Results		
		Round-1 (18.02.2020)	**Round-2 (20.02.2020)**	**Round-3 (22.02.2020)**
Particulate Matter	mg/Nm^3	15	28	15
Sulphur Dioxide (SO_2)	mg/Nm^3	171	13.3	11.4
	kg/day	56.1	4.79	3.89
Nitrogen dioxide (NO_2)	mg/Nm^3	13.3	26.5	23.8

Name of the Industry: Angadpal Industries

Parameters	Units	Results		
		Round-1 (18.02.2020)	**Round-2 (20.02.2020)**	**Round-3 (22.02.2020)**
Particulate Matter	mg/Nm^3	22	21	14
Sulphur Dioxide (SO_2)	mg/Nm^3	57.1	BDL	8.57
	kg/day	46.2	BDL	7.37
Nitrogen dioxide (NO_2)	mg/Nm^3	BDL	15.9	15.9

VOCs Results

Name of the Industry: Mandhana Weaving

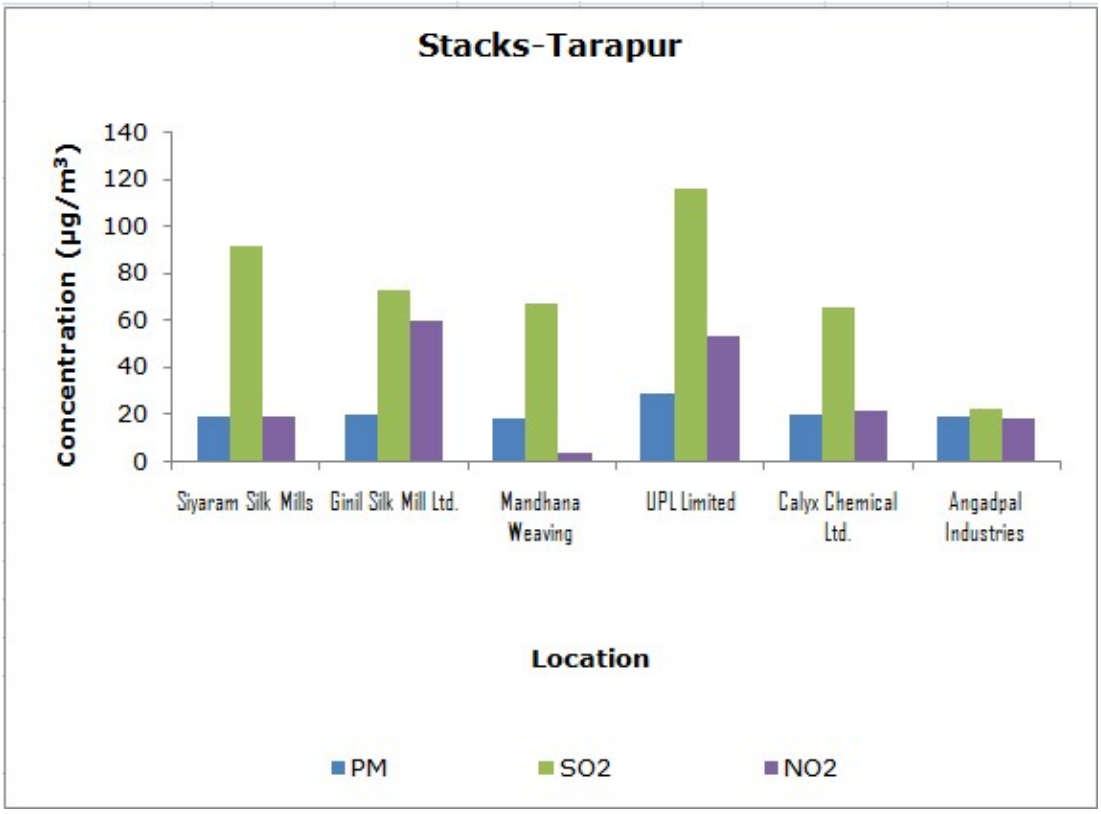
Parameters	Units	Results		
		Round-1 (17.02.2020)	**Round-2 (19.02.2020)**	**Round-3 (21.02.2020)**
Methyl Isobutyl Ketone	mg/Nm^3	BDL	BDL	BDL
Benzene	mg/Nm^3	BDL	BDL	BDL
Toulene	mg/Nm^3	BDL	BDL	BDL
Xylene	mg/Nm^3	BDL	BDL	BDL
Ethyl Benzene	mg/Nm^3	BDL	BDL	BDL
Ethyl Acetate	mg/Nm^3	BDL	BDL	BDL
Isopropyl Alcohol	mg/Nm^3	BDL	BDL	BDL

Name of the Industry: Angadpal Industries

Parameters	Units	Results		
		Round-1 (18.02.2020)	**Round-2 (20.02.2020)**	**Round-3 (22.02.2020)**
Methyl Isobutyl Ketone	mg/Nm^3	BDL	BDL	BDL
Benzene	mg/Nm^3	BDL	BDL	BDL
Toulene	mg/Nm^3	BDL	BDL	BDL
Xylene	mg/Nm^3	BDL	BDL	BDL
Ethyl Benzene	mg/Nm^3	BDL	BDL	BDL
Ethyl Acetate	mg/Nm^3	BDL	BDL	BDL

Parameters	Units	Results		
		Round-1 (18.02.2020)	**Round-2 (20.02.2020)**	**Round-3 (22.02.2020)**
Isopropyl Alcohol	mg/Nm^3	BDL	BDL	BDL

Graph: Stack Monitoring Results:



4.2 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**).

Location: Siyaram Silk Mill

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (17.02.2020)	**Round-2 (19.02.2020)**	**Round-3 (21.02.2020)**
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	6.6	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	175	53	66

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (17.02.2020)	Round-2 (19.02.2020)	Round-3 (21.02.2020)
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	41	15	18
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	BDL
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	BDL
Ammonia (NH_3)	µg/m^3	**400**	110	BDL	45.3
Benzene (C_6H_6)	µg/m^3	**5**	BDL	2.87	BDL
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.717	0.322	0.618
Nickel (Ni)	ng/m^3	**20**	10.8	13	10.7

Location: Mandhana (C-2) Limited

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (17.02.2020)	Round-2 (19.02.2020)	Round-3 (21.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	BDL	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	306	62	59
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	73	14	16
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	BDL
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	3.6
Ammonia (NH_3)	µg/m^3	**400**	19	BDL	19
Benzene (C_6H_6)	µg/m^3	**5**	BDL	2.03	8.62
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (17.02.2020)	Round-2 (19.02.2020)	Round-3 (21.02.2020)
Arsenic (As)	ng/m^3	**6**	0.539	BDL	0.558
Nickel (Ni)	ng/m^3	**20**	21.5	16.7	11.8

Location: Sumitomo Chemicals Ltd.

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (17.02.2020)	Round-2 (19.02.2020)	Round-3 (21.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	11.1	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	262	188	86
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	63	45	24
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	BDL
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	BDL
Ammonia (NH_3)	µg/m^3	**400**	27.8	BDL	76
Benzene (C_6H_6)	µg/m^3	**5**	BDL	5.96	4.66
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.983	BDL	0.469
Nickel (Ni)	ng/m^3	**20**	14.1	17.2	12.7

Location: Mandhana (C-3) Limited

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	BDL	BDL	BDL

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	227	121	62
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	59	25	17
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	25.2
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	0.94	BDL	3
Ammonia (NH_3)	µg/m^3	**400**	62.9	BDL	48
Benzene (C_6H_6)	µg/m^3	**5**	BDL	3.02	13.3
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.448	BDL	0.742
Nickel (Ni)	ng/m^3	**20**	9.82	8.91	14

Location: MPCB SRO Office

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	12.7	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	263	165	77
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	67	40	20
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	BDL
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	BDL
Ammonia (NH_3)	µg/m^3	**400**	102	BDL	29.2
Benzene (C_6H_6)	µg/m^3	**5**	6.06	17.4	7.76

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	1.31	BDL	0.754
Nickel (Ni)	ng/m^3	**20**	51.9	9.02	3.9

Location: Kokuyo Camlin Ltd.

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	BDL	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	133	260	65
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	35	62	19
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	23.8
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	3.45
Ammonia (NH_3)	µg/m^3	**400**	14.6	4.4	35.1
Benzene (C_6H_6)	µg/m^3	**5**	6.78	13.4	4.03
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.784	BDL	0.841
Nickel (Ni)	ng/m^3	**20**	11.1	6.29	4.6

Location: D -Decor Export

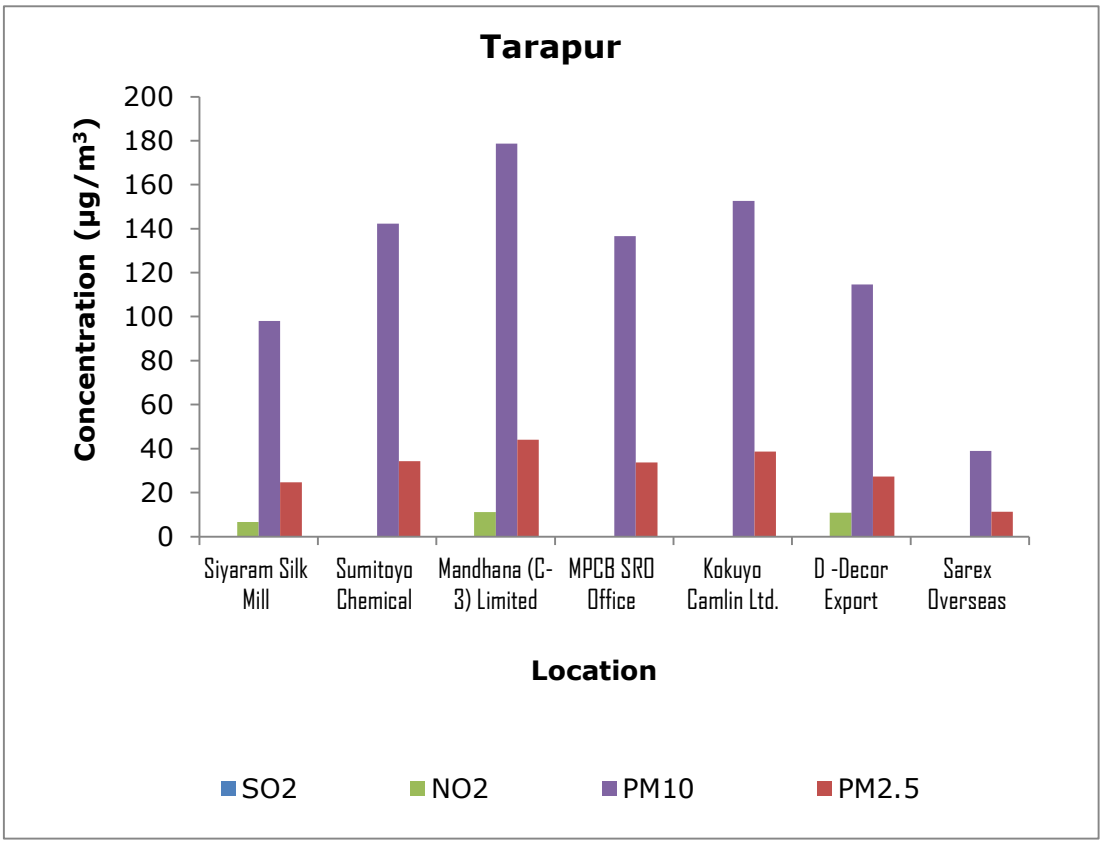
Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (18.02.2020)	Round-2 (20.02.2020)	Round-3 (22.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	10.8	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	163	94	87
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	38	20	24
Ozone (O_3)	µg/m^3	**100**	BDL	BDL	BDL
Lead (Pb)	µg/m^3	**1**	BDL	BDL	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	3.5
Ammonia (NH_3)	µg/m^3	**400**	26.3	BDL	BDL
Benzene (C_6H_6)	µg/m^3	**5**	BDL	8.34	1.6
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.473	BDL	1.8
Nickel (Ni)	ng/m^3	**20**	24	6.28	6.97

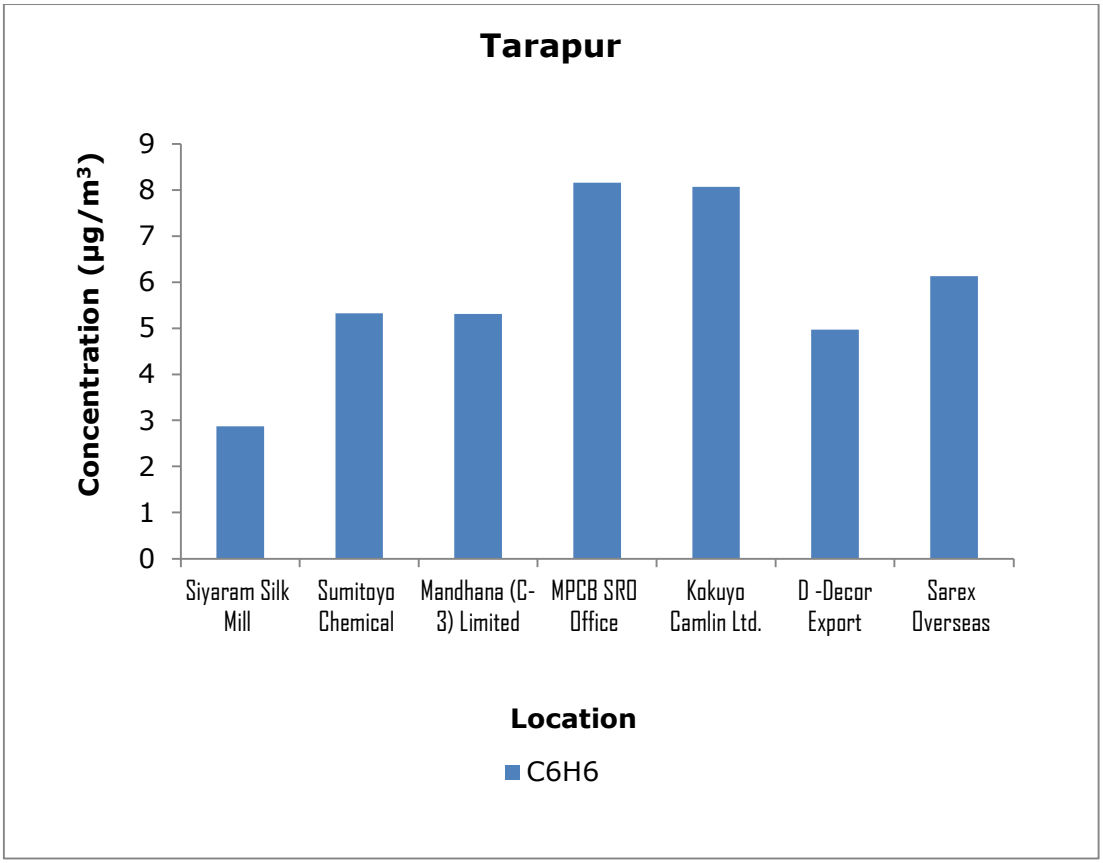
Location: Sarex Overseas

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (21.02.2020)	Round-2 (23.02.2020)	Round-3 (25.02.2020)
Sulphur Dioxide (SO_2)	µg/m^3	**80**	BDL	BDL	BDL
Nitrogen Dioxide (NO_2)	µg/m^3	**80**	BDL	BDL	BDL
Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	**100**	14	17	86
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	**60**	6	5	23
Ozone (O_3)	µg/m^3	**100**	22.4	23.8	19.6
Lead (Pb)	µg/m^3	**1**	BDL	0.024	BDL
Carbon Monoxide (CO)	mg/m^3	**4**	BDL	BDL	3.39

Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
			Round-1 (21.02.2020)	Round-2 (23.02.2020)	Round-3 (25.02.2020)
Ammonia (NH_3)	$\mu g/m^3$	**400**	BDL	BDL	BDL
Benzene (C_6H_6)	$\mu g/m^3$	**5**	12.3	1.57	4.52
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
Arsenic (As)	ng/m^3	**6**	0.507	BDL	0.654
Nickel (Ni)	ng/m^3	**20**	7.39	BDL	12.4

Graphs: Ambient Air Monitoring Results

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Concentration (µg/m³)
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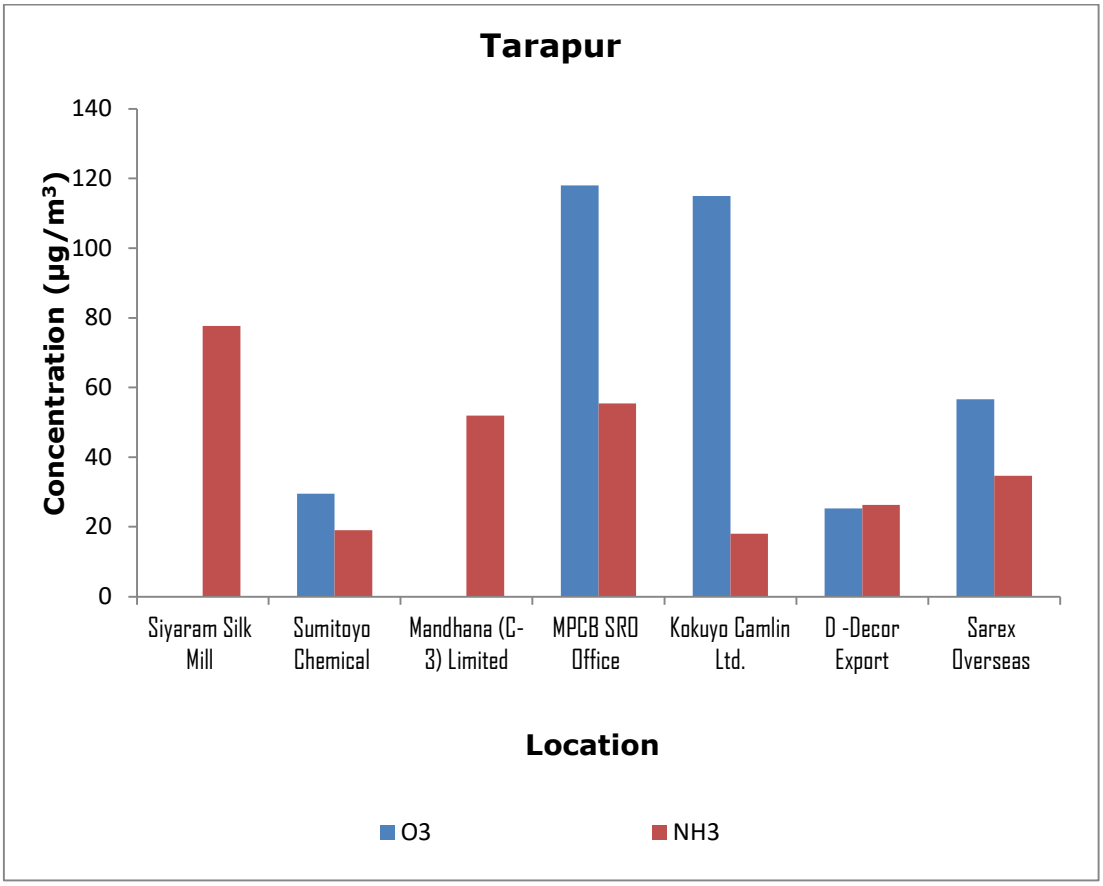
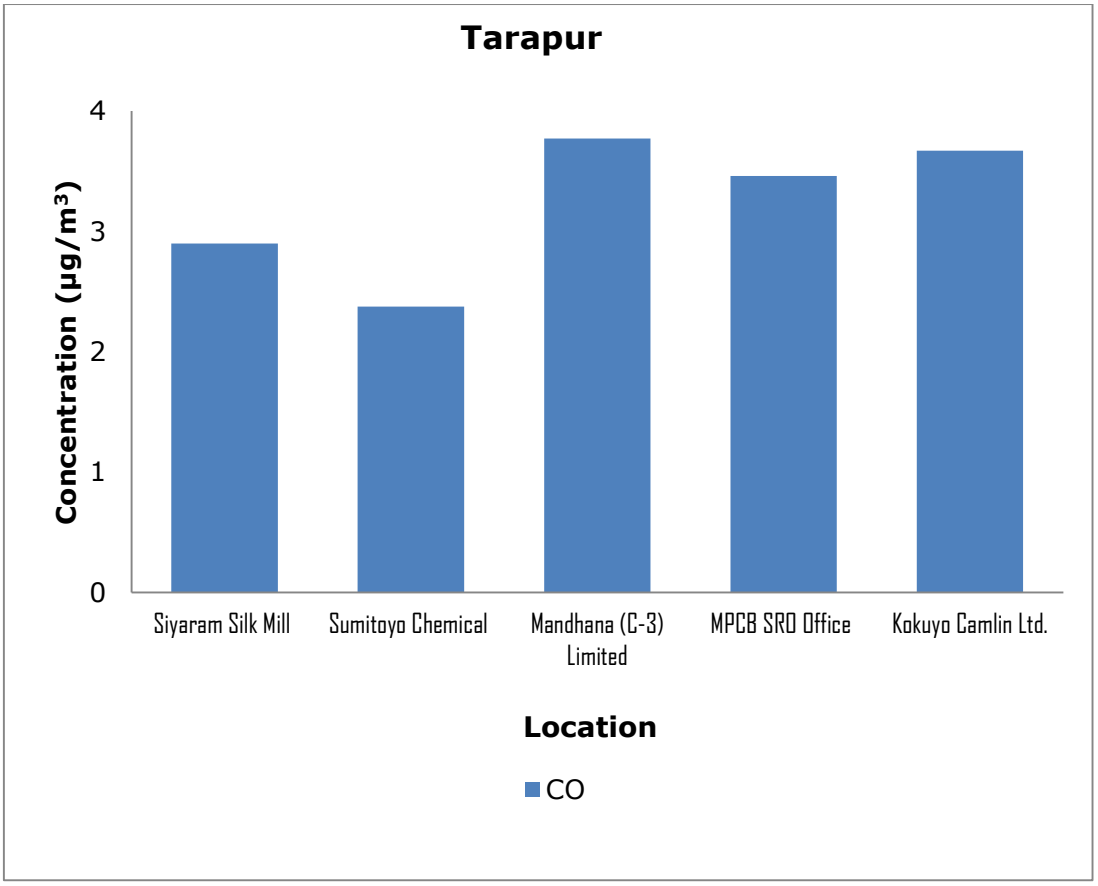
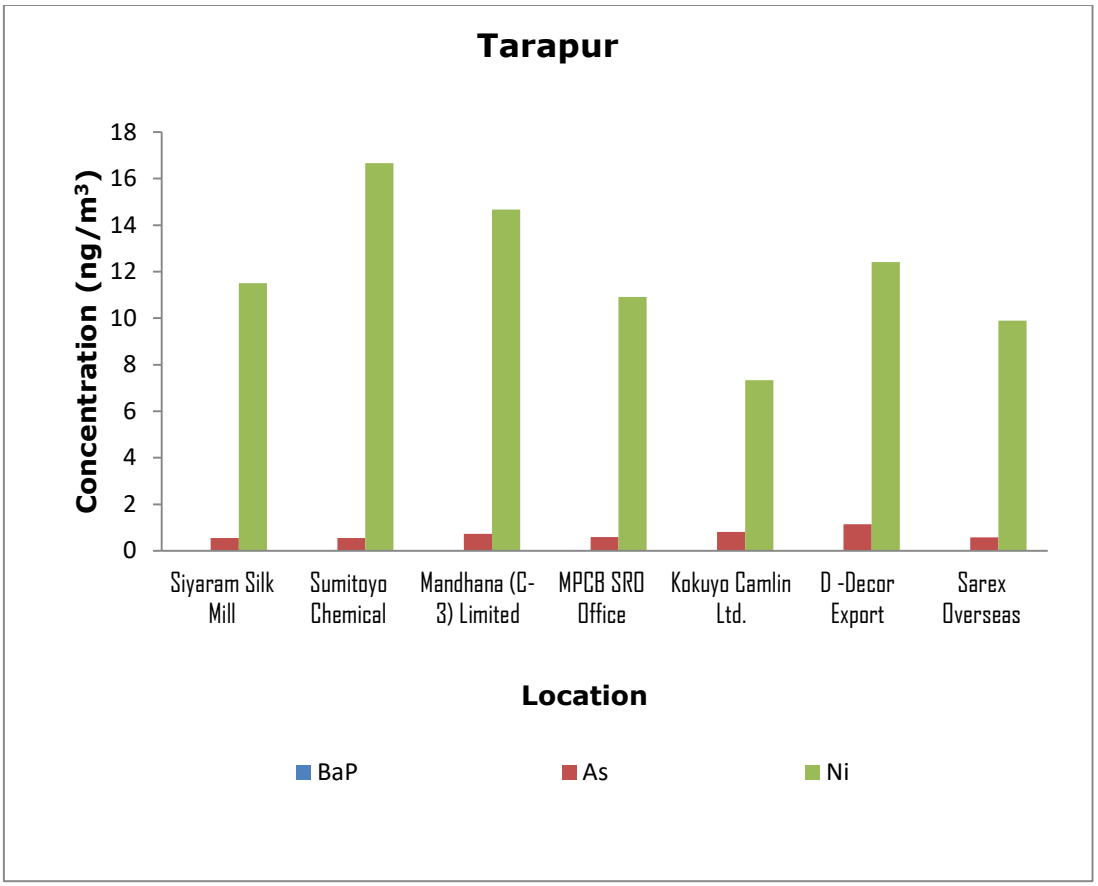
8
7
6
5
4
3
2
1
0
Siyaram Silk Mill
Sumitoyo Chemical
Mandhana (C-3) Limited
MPCB SRO Office
Kokuyo Camlin Ltd.
D -Decor Export
Sarex Overseas
Location
C6H6


Tarapur
Concentration (µg/m³)
140
120
100
80
60
40
20
0
Siyaram Silk Mill
Sumitoyo Chemical
Mandhana (C-3) Limited
MPCB SRO Office
Kokuyo Camlin Ltd.
D -Decor Export
Sarex Overseas
Location
O3
NH3


Tarapur
Concentration (µg/m³)
4
3
2
1
0
Siyaram Silk Mill
Sumitoyo Chemical
Mandhana (C-3) Limited
MPCB SRO Office
Kokuyo Camlin Ltd.
Location
CO


Tarapur
Concentration (ng/m³)
18
16
14
12
10
8
6
4
2
0
Siyaram Silk Mill
Sumitoyo Chemical
Mandhana (C-3) Limited
MPCB SRO Office
Kokuyo Camlin Ltd.
D -Decor Export
Sarex Overseas
Location
BaP
As
Ni

4.3 Surface Water Quality Analysis:

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 **(Annexure V)**.

Location: BPT Navapur out Fall

Parameters	**Unit**	**Std. Limit**	**Results**		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	12	75
Smell	-		Agreeable	Disagreeable	Disagreeable
pH	-	**5.5 -9.0**	7.32	6.41	7.19
Oil & Grease	mg/L	**10**	BDL	BDL	BDL
Suspended Solids	mg/L	**100**	18	188	180
Dissolved Oxygen (% Saturation)	%	**60-140**	91	70	58.6
Chemical Oxygen Demand	mg/L	**250**	10	710	70
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	**30**	3	220	25
Electrical Conductivity (at 25°C)	µmho/cm	**4000**	464	8750	16140
Nitrite Nitrogen (as NO_2)	mg/L	**5**	BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L	**10**	17.8	54.3	148
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	17.8	54.3	148
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	BDL	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Fluoride (as F)	mg/L	**2**	0.8	1.8	1.41
Sulphide (as S^{2-})	mg/L	**2**	BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	0.32	0.3	BDL
Sodium Absorption Ratio	-		0.88	16.1	27.2
Total Coliforms	MPN index/ 100 mL		23	1600	280
Faecal Coliforms	MPN index/ 100 mL		4.5	280	170
Total Phosphorous (as P)	mg/L		0.6	0.88	BDL
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	1.12	31.10	8.7
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	2.5	0.14
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	0.014	0.038	0.027
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Total Chromium (as Cr)	mg/L	**100**	0.022	0.087	0.027
Total Arsenic (as As)	mg/L	**100**	BDL	0.172	0.029
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	0.166	0.546	0.398
Iron (as Fe)	mg/L	**3**	1.99	1.76	0.542
Vanadium (as V)	mg/L	**0.2**	0.043	0.036	0.021
Selenium (as Se)	mg/L	**0.05**	0.017	0.07	0.039
Boron (as B)	mg/L		0.169	0.469	1.59
Total Nitrogen	mg/L		5.03	43	41.2
Bioassay Test on fish	% survival	**90% survival of fish after 96 hours in 100% effluent**	90	50	50

Location: Nallah Carrying Domestic Sewage at Saravali

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		80	1	1
Smell	-		Disagreeable	Agreeable	Agreeable
pH	-	**5.5 -9.0**	7.19	7.41	8.09

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Oil & Grease	mg/L	**10**	BDL	BDL	BDL
Suspended Solids	mg/L	**100**	110	8	28
Dissolved Oxygen (% Saturation)	%	**60-140**	36	80	85
Chemical Oxygen Demand	mg/L	**250**	64	BDL	21
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	**30**	18	BDL	6
Electrical Conductivity (at 25°C)	µmho/cm	**4000**	1497	7270	1231
Nitrite Nitrogen (as NO_2)	mg/L	**5**	BDL	0.02	BDL
Nitrate Nitrogen (as NO_3)	mg/L	**10**	25	9.7	9.66
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	25	9.72	9.66
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	BDL	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
Fluoride (as F)	mg/L	**2**	0.7	0.72	0.4
Sulphide (as S^{2-})	mg/L	**2**	BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	1.08	0.11	0.4
Sodium Absorption Ratio	-		2.1	38.5	3.89
Total Coliforms	MPN index/ 100 mL		9.2×10^3	350	240

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Faecal Coliforms	MPN index/ 100 mL		4.7×10^2	280	79
Total Phosphorous (as P)	mg/L		2.24	0.12	0.68
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	16.4	6.16	13
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	0.1	1.62
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	0.17	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	0.17
Nickel (as Ni)	mg/L	**200**	0.012	0.039	0.018
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	0.023	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	0.012	0.008	0.009
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	0.166	0.216	0.167

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Iron (as Fe)	mg/L	**3**	1.97	0.077	0.189
Vanadium (as V)	mg/L	**0.2**	0.043	0.014	BDL
Selenium (as Se)	mg/L	**0.05**	0.016	0.01	0.011
Boron (as B)	mg/L		0.169	0.573	0.116
Total Nitrogen	mg/L		21.9	8.29	15.1
Bioassay Test on fish	% survival	**90% survival of fish after 96 hours in 100% effluent**	40	60	80

Location: Nallah to Dandi

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Colour	Hazen		5	1	10
Smell	-		Agreeable	Agreeable	Disagreeable
pH	-	**5.5 -9.0**	7.6	7.43	7.42
Oil & Grease	mg/L	**10**	BDL	BDL	BDL
Suspended Solids	mg/L	**100**	36	43	89
Dissolved Oxygen (% Saturation)	%	**60-140**	30.3	60	70
Chemical Oxygen Demand	mg/L	**250**	50	12	104
Biochemical Oxygen Demand (3 days, 27^{o}C)	mg/L	**30**	14	6	40

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Electrical Conductivity (at 25°C)	µmho/cm	**4000**	1083	22000	640
Nitrite Nitrogen (as NO_2)	mg/L	**5**	BDL	0.07	BDL
Nitrate Nitrogen (as NO_3)	mg/L	**10**	22.6	31.4	8.7
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	22.6	31.5	8.7
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	BDL	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
Fluoride (as F)	mg/L	**2**	2.01	1.16	0.9
Sulphide (as S^{2-})	mg/L	**2**	BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	BDL	0.66	0.5
Sodium Absorption Ratio	-		2.53	14.9	1.84
Total Coliforms	MPN index/ 100 mL		9.2×10^3	23	5.4×10^3
Faecal Coliforms	MPN index/ 100 mL		1.7×10^3	13	1.7×10^3
Total Phosphorous (as P)	mg/L		BDL	0.7	0.72
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	10.5	9.3	20.6
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	0.12	2.5
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Surface Active Agents (as MBAS)	mg/L	200	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	BDL	BDL	0.016
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	0.013	0.031
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	0.046	0.045	0.116
Iron (as Fe)	mg/L	**3**	0.138	BDL	0.282
Vanadium (as V)	mg/L	**0.2**	0.029	BDL	0.035
Selenium (as Se)	mg/L	**0.05**	0.012	0.014	0.017
Boron (as B)	mg/L		0.146	2.41	0.186
Total Nitrogen	mg/L		15.4	16.2	22.5

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Bioassay Test on fish	% survival	90% survival of fish after 96 hours in 100% effluent	30	80	40

Location: Nallah Near of sump 2 Tarapur CETP

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Colour	Hazen		1	50	1
Smell	-		Agreeable	Disagreeable	Agreeable
pH	-	5.5 -9.0	7.22	7.23	7.21
Oil & Grease	mg/L	10	BDL	BDL	BDL
Suspended Solids	mg/L	100	12	98	186
Dissolved Oxygen (% Saturation)	%	60-140	80	46	20.4
Chemical Oxygen Demand	mg/L	250	BDL	450	460
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	30	BDL	113	122
Electrical Conductivity (at 25°C)	µmho/cm	4000	453	9050	5220
Nitrite Nitrogen (as NO_2)	mg/L	5	1.48	0.2	BDL
Nitrate Nitrogen (as NO_3)	mg/L	10	14.6	49	185
(NO_2 + NO_3)-Nitrogen	mg/L	15	16	49.2	185

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	BDL	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
Fluoride (as F)	mg/L	**2**	0.66	1.5	1.54
Sulphide (as S^{2-})	mg/L	**2**	BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	0.12	0.6	BDL
Sodium Absorption Ratio	-		0.44	45.3	20.2
Total Coliforms	MPN index/ 100 mL		33	1600	1600
Faecal Coliforms	MPN index/ 100 mL		7.8	220	47
Total Phosphorous (as P)	mg/L		0.28	0.8	BDL
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	2.35	22	BDL
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	0.12	9.63
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	0.23	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	0.116	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Nickel (as Ni)	mg/L	**200**	BDL	0.081	0.045
Copper (as Cu)	mg/L	**100**	BDL	0.038	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	0.159	0.062
Total Arsenic (as As)	mg/L	**100**	BDL	0.078	0.096
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	BDL	0.561	0.355
Iron (as Fe)	mg/L	**3**	BDL	1.3	0.629
Vanadium (as V)	mg/L	**0.2**	0.043	0.024	0.035
Selenium (as Se)	mg/L	**0.05**	BDL	0.073	0.043
Boron (as B)	mg/L		BDL	0.695	0.302
Total Nitrogen	mg/L		7.04	32.8	50.3
Bioassay Test on fish	% survival	**90% survival of fish after 96 hours in 100% effluent**	60	70	70

Location: Over Flow of Sump No-1

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		3	25	68
Smell	-		Disagreeable	Disagreeable	Disagreeable
pH	-	**5.5 -9.0**	6.81	7.18	7.62
Oil & Grease	mg/L	**10**	BDL	BDL	BDL
Suspended Solids	mg/L	**100**	98	190	220
Dissolved Oxygen (% Saturation)	%	**60-140**	60	50	40.1
Chemical Oxygen Demand	mg/L	**250**	10	170	76
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	**30**	3	50	27
Electrical Conductivity (at 25°C)	µmho/cm	**4000**	1160	4520	3180
Nitrite Nitrogen (as NO_2)	mg/L	**5**	BDL	0.11	BDL
Nitrate Nitrogen (as NO_3)	mg/L	**10**	59.4	24.4	34.8
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	59.4	24.5	34.8
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	BDL	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
Fluoride (as F)	mg/L	**2**	1.54	0.56	1.09
Sulphide (as S^{2-})	mg/L	**2**	BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	0.27	0.5	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Sodium Absorption Ratio	-		2.69	16.8	3.64
Total Coliforms	MPN index/ 100 mL		280	920	920
Faecal Coliforms	MPN index/ 100 mL		40	540	47
Total Phosphorous (as P)	mg/L		0.32	0.8	BDL
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	16.1	9.18	7.65
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	3.31	0.17	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	0.28	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	0.074	BDL	0.105
Nickel (as Ni)	mg/L	**200**	0.012	0.021	0.079
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium |(as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	0.026	0.049	0.175
Total Arsenic (as As)	mg/L	**100**	0.011	BDL	0.279
Lead (as Pb)	mg/L	**100**	0.041	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	0.136	0.653	1.05
Iron (as Fe)	mg/L	**3**	3.96	19.5	17.2
Vanadium (as V)	mg/L	**0.2**	0.027	0.018	0.041
Selenium (as Se)	mg/L	**0.05**	0.018	BDL	0.143
Boron (as B)	mg/L		0.191	1.07	0.794
Total Nitrogen	mg/L		29.2	14.6	10.6
Bioassay Test on fish	% survival	**90% survival of fish after 96 hours in 100% effluent**	70	60	70

Location: Open Drain Near Sump 3 Node

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Colour	Hazen		1	75	28
Smell	-		Agreeable	Disagreeable	Disagreeable
pH	-	**5.5 -9.0**	6.89	7.77	7.23
Oil & Grease	mg/L	**10**	BDL	BDL	BDL
Suspended Solids	mg/L	**100**	12	202	176
Dissolved Oxygen (% Saturation)	%	**60-140**	60.9	27	61.2

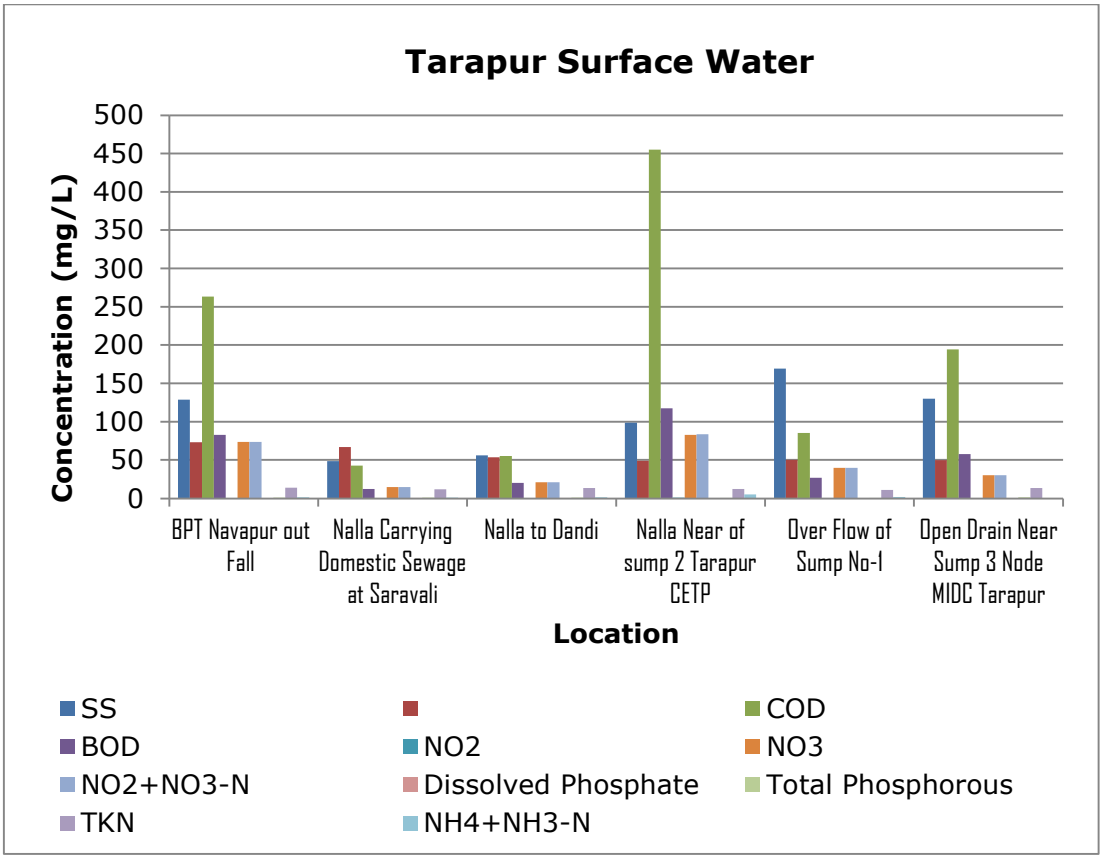
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Chemical Oxygen Demand	mg/L	**250**	6	520	57
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	**30**	2	150	21
Electrical Conductivity (at 25°C)	µmho/cm	**4000**	478	7370	5780
Nitrite Nitrogen (as NO_2)	mg/L	**5**	BDL	0.12	0.02
Nitrate Nitrogen (as NO_3)	mg/L	**10**	3.11	47.3	40
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	3.11	47.4	40
Free Ammonia (as NH_3-N)	mg/L	**5**	BDL	0.16	BDL
Total Residual Chlorine	mg/L	**1**	BDL	BDL	BDL
Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
Fluoride (as F)	mg/L	**2**	1.9	2.4	0.82
Sulphide (as S^{2-})	mg/L	**2**	0.025	BDL	BDL
Dissolved Phosphate (as P)	mg/L	**5**	BDL	BDL	0.2
Sodium Absorption Ratio	-		0.42	30.8	19.3
Total Coliforms	MPN index/ 100 mL		49	280	9.2×10^3
Faecal Coliforms	MPN index/ 100 mL		13	94	5.4×10^3
Total Phosphorous (as P)	mg/L		BDL	BDL	1.4
Total Kjeldahl Nitrogen (as N)	mg/L	**100**	4.03	3.92	32.4

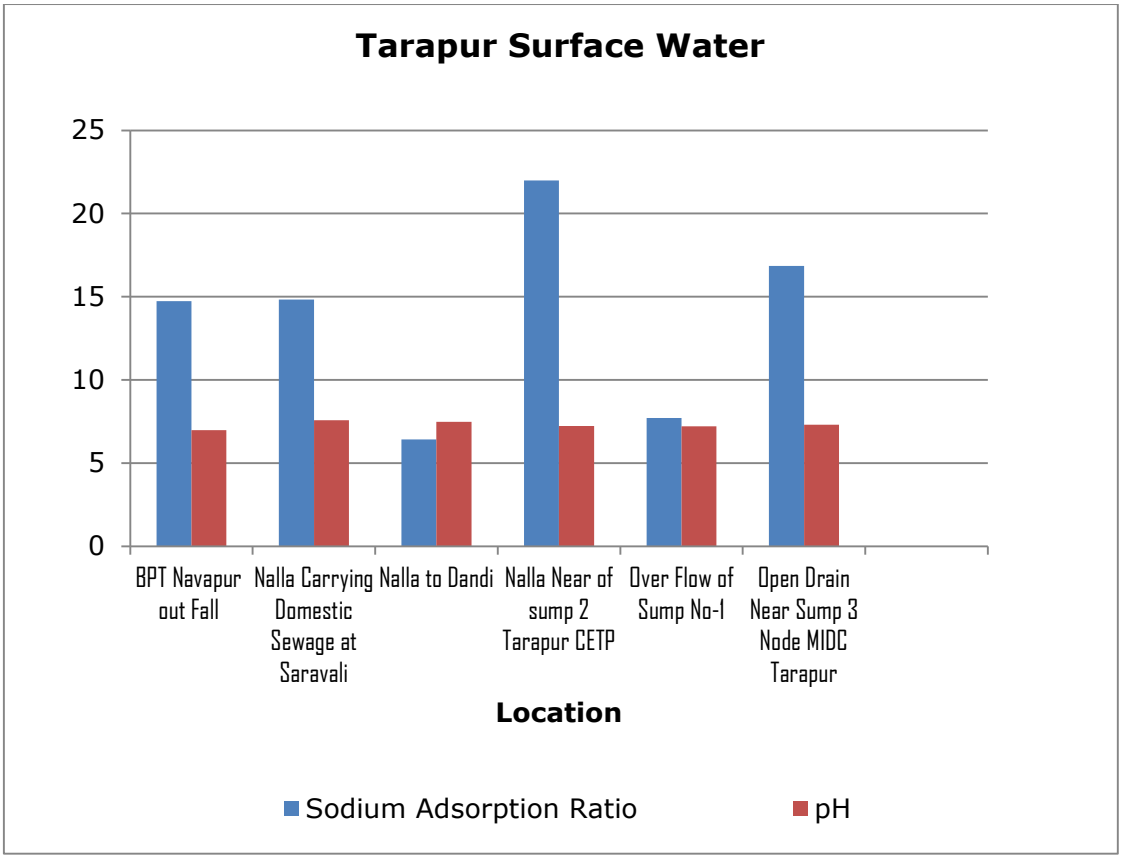
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL

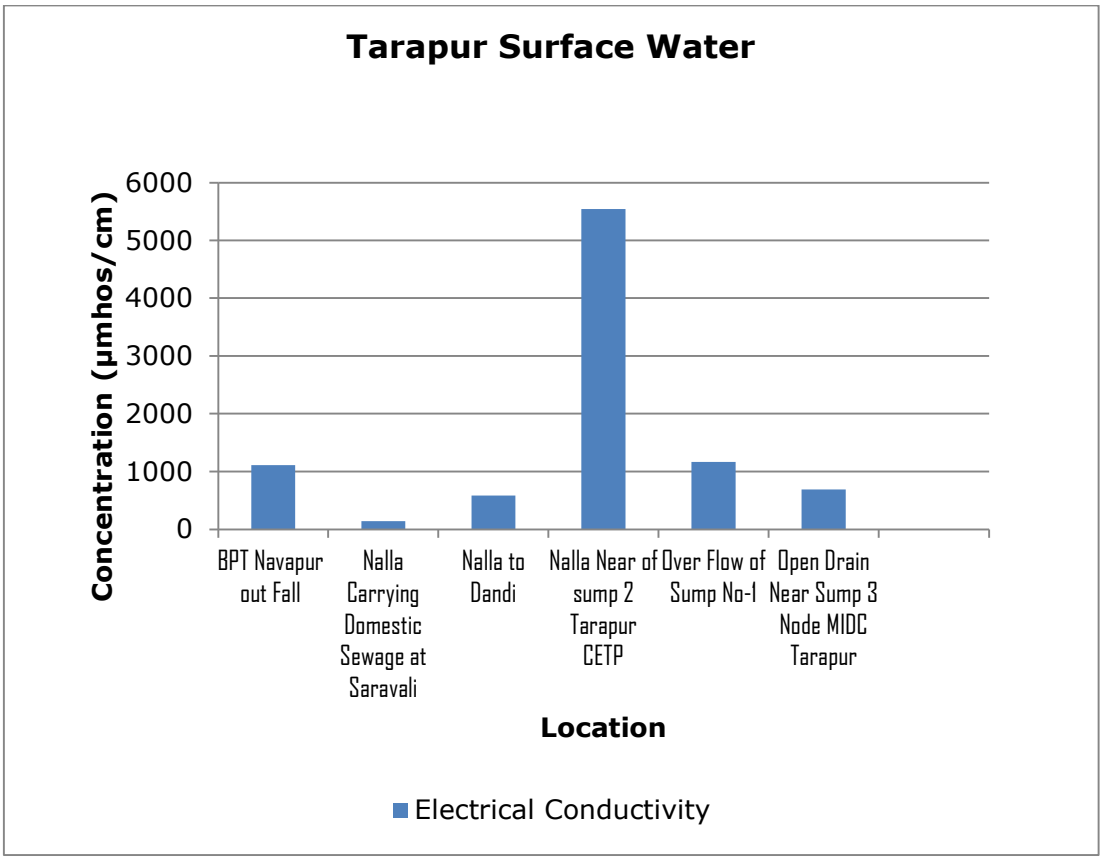
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	0.079	BDL
Nickel (as Ni)	mg/L	**200**	BDL	0.071	0.052
Copper (as Cu)	mg/L	**100**	BDL	0.108	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	0.422	0.105
Total Arsenic (as As)	mg/L	**100**	BDL	BDL	0.206
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L	**2**	BDL	0.388	0.703
Iron (as Fe)	mg/L	**3**	BDL	1.26	6.55
Vanadium (as V)	mg/L	**0.2**	0.07	0.377	0.041
Selenium (as Se)	mg/L	**0.05**	BDL	0.026	0.085
Boron (as B)	mg/L		BDL	1.15	0.599
Total Nitrogen	mg/L		4.71	14.3	41.2

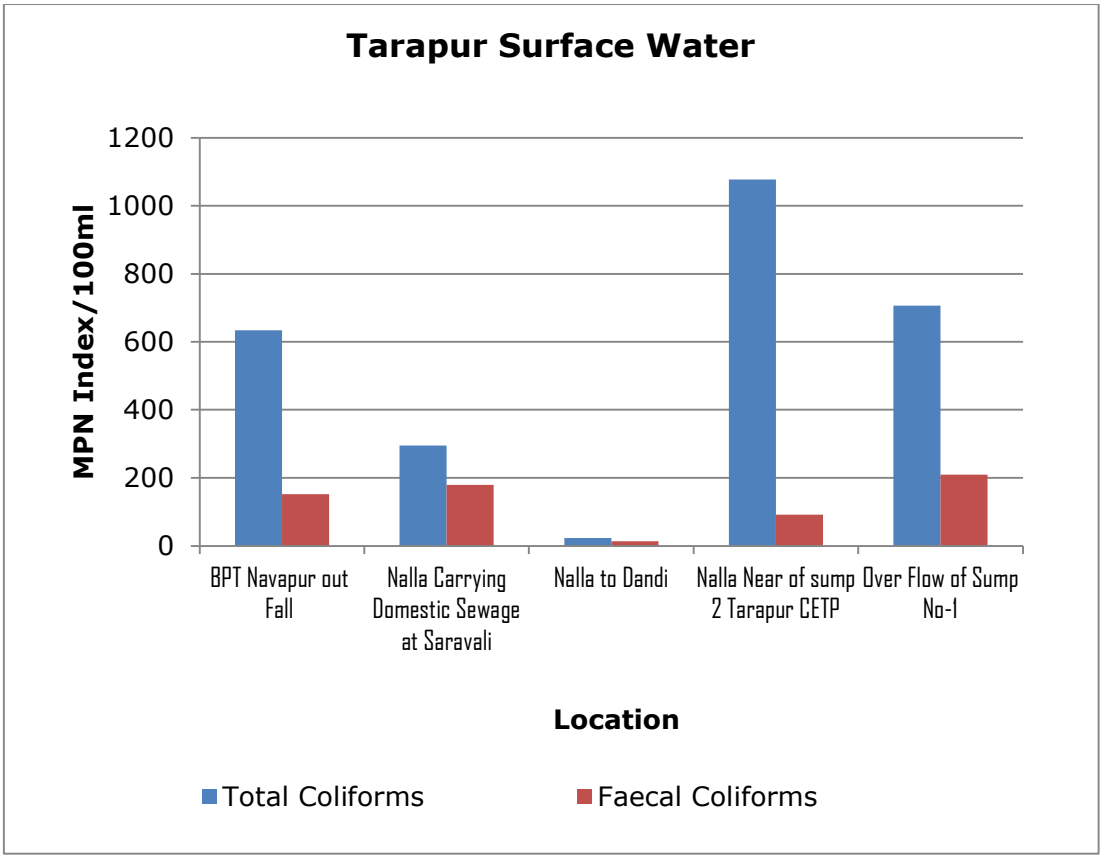
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Bioassay Test on fish	% survival	90% survival of fish after 96 hours in 100% effluent	70	60	50

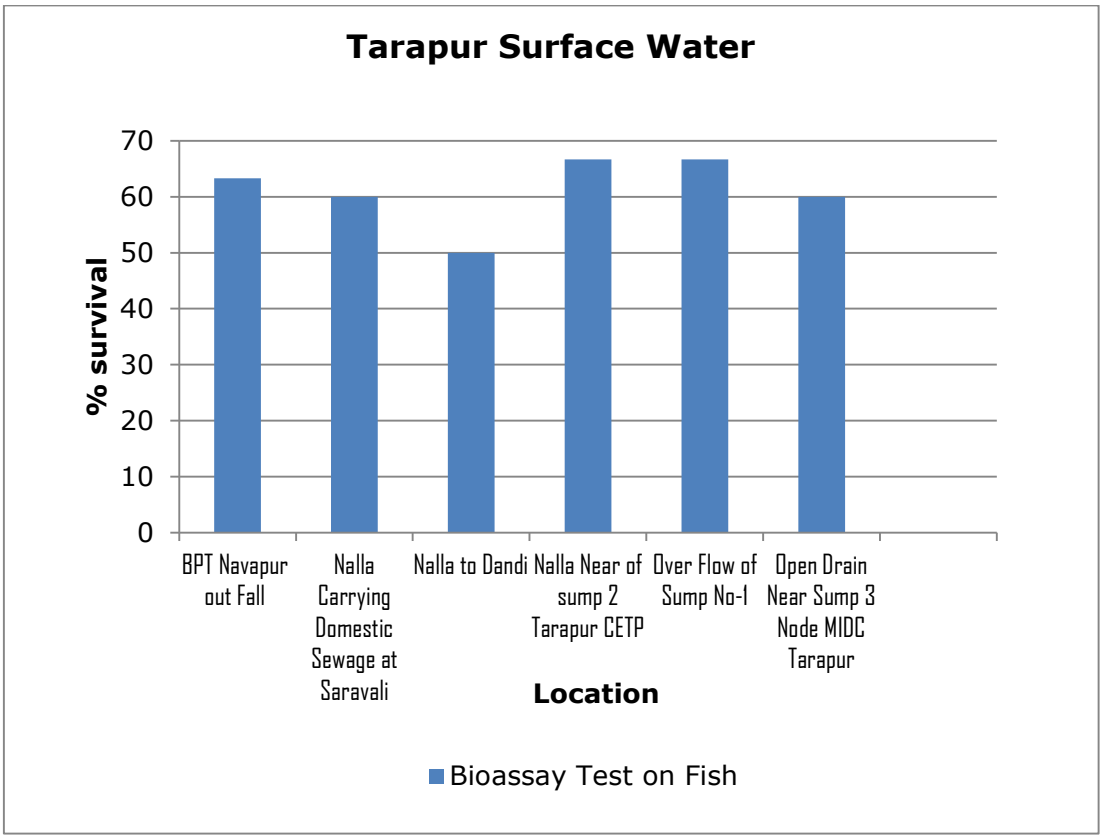
Graphs: Surface Water Monitoring




Tarapur Surface Water
25
20
15
10
5
0
BPT Navapur out Fall
Nalla Carrying Domestic Sewage at Saravali
Nalla to Dandi
Nalla Near of sump 2 Tarapur CETP
Over Flow of Sump No-1
Open Drain Near Sump 3 Node MIDC Tarapur
Location
Sodium Adsorption Ratio
pH


Tarapur Surface Water
Concentration (µmhos/cm)
6000
5000
4000
3000
2000
1000
0
BPT Navapur out Fall
Nalla Carrying Domestic Sewage at Saravali
Nalla to Dandi
Nalla Near of sump 2 Tarapur CETP
Over Flow of Sump No-1
Open Drain Near Sump 3 Node MIDC Tarapur
Location
Electrical Conductivity


Tarapur Surface Water
MPN Index/100ml
1200
1000
800
600
400
200
0
BPT Navapur out Fall
Nalla Carrying Domestic Sewage at Saravali
Nalla to Dandi
Nalla Near of sump 2 Tarapur CETP
Over Flow of Sump No-1
Location
Total Coliforms
Faecal Coliforms


Tarapur Surface Water
% survival
70
60
50
40
30
20
10
0
BPT Navapur out Fall
Nalla Carrying Domestic Sewage at Saravali
Nalla to Dandi
Nalla Near of sump 2 Tarapur CETP
Over Flow of Sump No-1
Open Drain Near Sump 3 Node MIDC Tarapur
Location
Bioassay Test on Fish

4.4 Ground Water Analysis Results:

Location: Open Well near Nalla Sump 1

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	6.81	8.03	8.26
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	BDL	18	8
Chemical Oxygen Demand	mg/L		BDL	BDL	24
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		BDL	BDL	8
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	618	833	3110
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		18.4	3.95	13.3
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	18.4	3.95	13.3
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		1.2	2.34	12.8
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	0.15	BDL
Sodium Absorption Ratio	-		0.32	8.07	6.19
Total Coliforms	MPN index/ 100 mL		BDL	BDL	13
Faecal Coliforms	MPN index/ 100 mL		BDL	BDL	7.8
Total Phosphorous (as P)	mg/L	**0.3**	BDL	0.26	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	0.9	2.01	6.83
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	BDL	BDL	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	0.007	BDL
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L		BDL	2.92	BDL
Iron (as Fe)	mg/L		BDL	BDL	BDL
Vanadium (as V)	mg/L		0.071	0.013	0.035
Selenium (as Se)	mg/L		0.005	0.009	0.006
Boron (as B)	mg/L		BDL	0.202	0.147
Total Nitrogen	mg/L		4.94	2.87	9.75
Bioassay Test on fish	% survival		60	90	70

Location: Hand Pump Water Besides Sai Complex

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	7.47	8.32	8.27
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	BDL	BDL	14
Chemical Oxygen Demand	mg/L		BDL	5	13
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		1	2	4
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	889	2930	3010
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		19.3	11.9	10.3
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	19.3	11.9	10.3
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		1.3	0.42	0.82
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
Sodium Absorption Ratio	-		0.84	3.77	5.58
Total Coliforms	MPN index/ 100 mL		7.8	BDL	27
Faecal Coliforms	MPN index/ 100 mL		7.8	BDL	9.3
Total Phosphorous (as P)	mg/L	**0.3**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	4.1	6.10	5.15
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	BDL	0.01	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	0.007	BDL	0.006
Lead (as Pb)	mg/L	**100**	BDL	0.009	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	0.003
Manganese (as Mn)	mg/L		BDL	BDL	BDL
Iron (as Fe)	mg/L		BDL	BDL	BDL
Vanadium (as V)	mg/L		0.071	0.032	0.035
Selenium (as Se)	mg/L		0.006	BDL	0.008
Boron (as B)	mg/L		BDL	0.167	0.149
Total Nitrogen	mg/L		20.2	6.52	7.41
Bioassay Test on fish	% survival		60	80	60

Location: Well Water Chikkuwadi in PID (Police Station)

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	7.28	7.19	7.93
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	BDL	38	6
Chemical Oxygen Demand	mg/L		BDL	BDL	19
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		BDL	BDL	8
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	598	3500	783
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		18.9	13.5	4.52
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	18.9	13.5	4.52
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		1.6	1.5	0.4
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
Sodium Absorption Ratio	-		0.34	11.3	1.53
Total Coliforms	MPN index/ 100 mL		23	BDL	BDL
Faecal Coliforms	MPN index/ 100 mL		13	BDL	BDL
Total Phosphorous (as P)	mg/L	**0.3**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	3.47	6.16	5.49
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	0.259
Nickel (as Ni)	mg/L	**200**	BDL	BDL	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	0.015	BDL
Lead (as Pb)	mg/L	**100**	BDL	BDL	0.009
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L		BDL	2.92	BDL
Iron (as Fe)	mg/L		BDL	BDL	0.276
Vanadium (as V)	mg/L		0.066	0.014	0.017
Selenium (as Se)	mg/L		0.009	BDL	BDL
Boron (as B)	mg/L		BDL	0.203	BDL
Total Nitrogen	mg/L		7.62	9.13	6.48
Bioassay Test on fish	% survival		80	70	70

Location: Borewell at Shivaji Nagar Boiser

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	7.76	8.3	8.35
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	8	12	BDL
Chemical Oxygen Demand	mg/L		BDL	BDL	6
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		BDL	BDL	2
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	1286	2950	800
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		18.9	12.3	13.2
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	18.9	12.3	13.2
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		0.68	1.5	0.3
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
Sodium Absorption Ratio	-		3.37	23.5	2.2
Total Coliforms	MPN index/ 100 mL		BDL	4.5	BDL
Faecal Coliforms	MPN index/ 100 mL		BDL	4.5	BDL
Total Phosphorous (as P)	mg/L	**0.3**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	4.03	6.04	7.61
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	BDL	BDL	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	BDL	BDL
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L		BDL	BDL	BDL
Iron (as Fe)	mg/L		BDL	BDL	0.073
Vanadium (as V)	mg/L		0.065	0.032	0.034
Selenium (as Se)	mg/L		0.007	BDL	0.007
Boron (as B)	mg/L		BDL	0.164	0.142
Total Nitrogen	mg/L		8.19	8.74	10.5
Bioassay Test on fish	% survival		60	70	70

Location: Salvad Village

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	7.99	7.84	7.94
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	BDL	14	12
Chemical Oxygen Demand	mg/L		7	BDL	7
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		2	BDL	3
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	2070	172	597
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		19.4	1.5	3.79
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	19.4	1.5	3.79
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		1	0.1	0.8
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
Sodium Absorption Ratio	-		1.77	0.5	1.12
Total Coliforms	MPN index/ 100 mL		4.5	BDL	BDL
Faecal Coliforms	MPN index/ 100 mL		BDL	BDL	BDL
Total Phosphorous (as P)	mg/L	**0.3**	BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	7.61	10.7	9.86
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	0.242
Nickel (as Ni)	mg/L	**200**	BDL	BDL	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	BDL	BDL
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L		BDL	BDL	BDL
Iron (as Fe)	mg/L		BDL	0.132	0.278
Vanadium (as V)	mg/L		0.065	BDL	0.014
Selenium (as Se)	mg/L		0.008	BDL	BDL
Boron (as B)	mg/L		BDL	BDL	BDL
Total Nitrogen	mg/L		14.9	10.2	6.32
Bioassay Test on fish	% survival		70	80	80

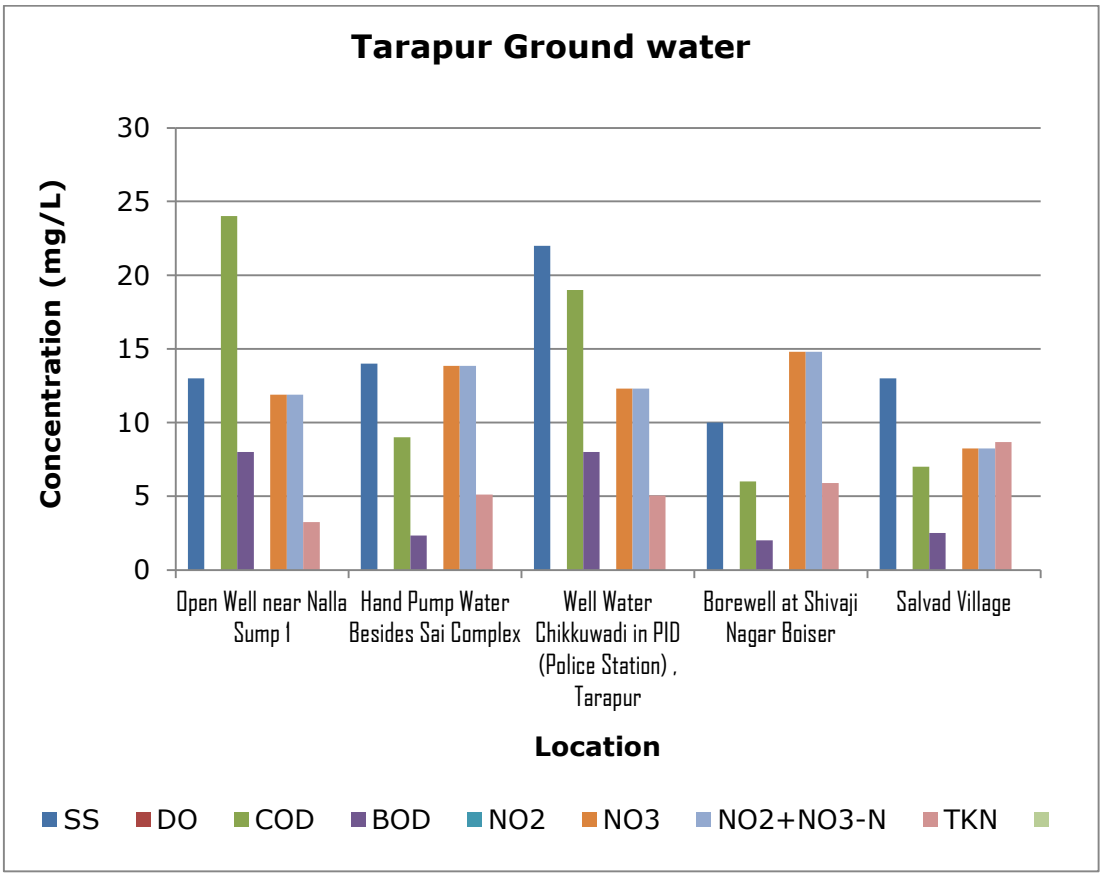
Location: Ankush Gharatwadi

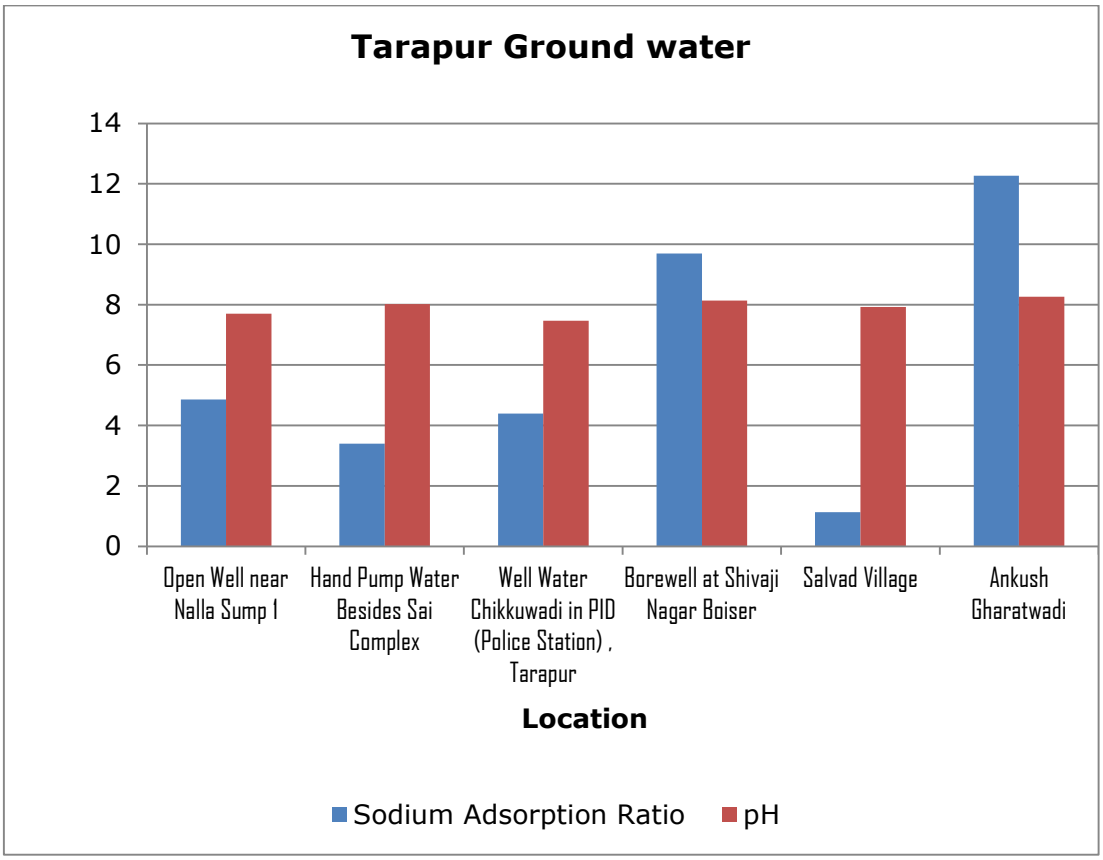
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Colour	Hazen		1	1	1
Smell	-		Agreeable	Agreeable	Agreeable
pH	-	**6.5-9.0**	8.22	8.27	8.3
Oil & Grease	mg/L		BDL	BDL	BDL
Suspended Solids	mg/L	**100**	BDL	8	6
Chemical Oxygen Demand	mg/L		5	5	6
Biochemical Oxygen Demand (3 days,27^{o}C)	mg/L		2	2	2
Electrical Conductivity (at 25^{o}C)	µmho/cm	**4000**	1620	3010	2980
Nitrite Nitrogen (as NO_2)	mg/L		BDL	BDL	BDL
Nitrate Nitrogen (as NO_3)	mg/L		13.2	12.2	13
(NO_2 + NO_3)-Nitrogen	mg/L	**15**	13.2	12.2	13
Free Ammonia (as NH_3-N)	mg/L		BDL	BDL	BDL
Total Residual Chlorine	mg/L		BDL	BDL	BDL
Cyanide (as CN)	mg/L		BDL	BDL	BDL
Fluoride (as F)	mg/L		0.68	1.4	0.54
Sulphide (as S^{2-})	mg/L		BDL	BDL	BDL
Dissolved Phosphate (as P)	mg/L		BDL	BDL	BDL
Sodium Absorption Ratio	-		2.58	27.5	6.72
Total Coliforms	MPN index/ 100 mL		23	23	BDL
Faecal Coliforms	MPN index/ 100 mL		13	7.8	BDL
Total Phosphorous (as P)	mg/L	**0.3**	BDL	BDL	BDL

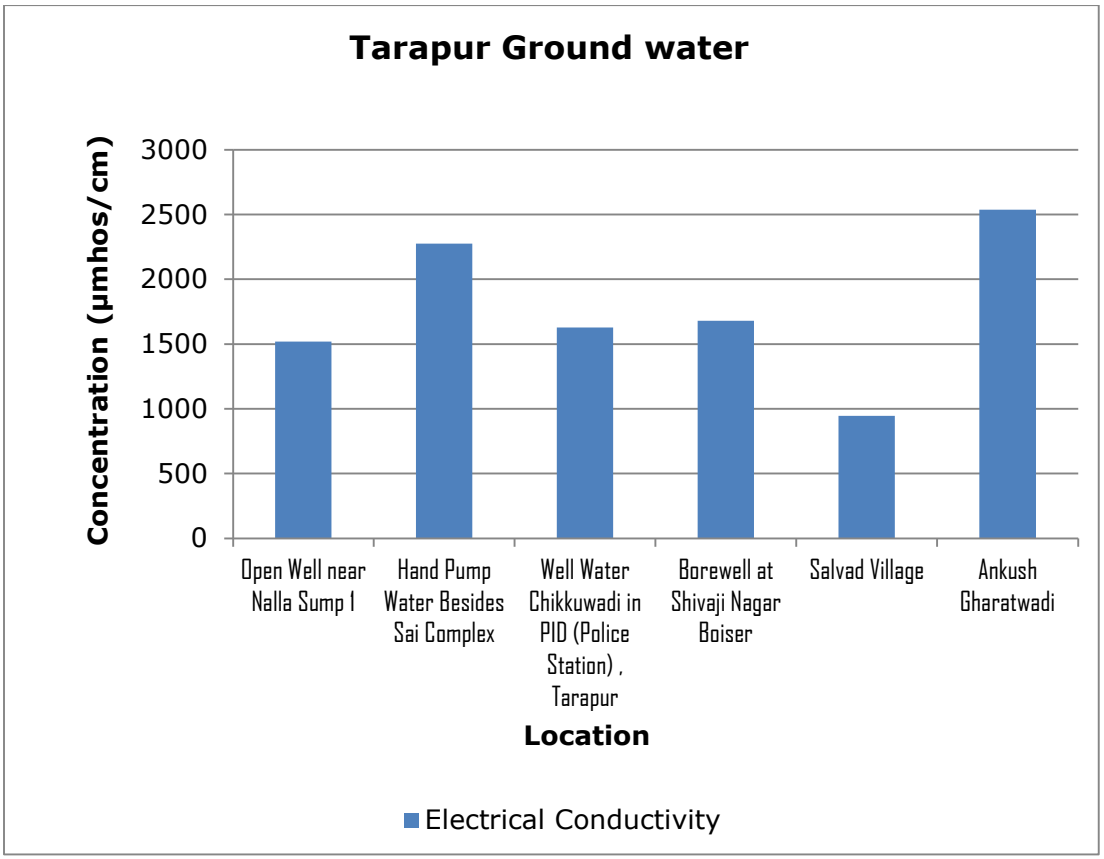
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	Round-2 (21.02.2020)	Round-3 (23.02.2020)
Total Kjeldahl Nitrogen (as N)	mg/L	**3**	4.82	2.01	8.18
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	**1.5**	BDL	BDL	BDL
Phenols (as C_6H_5OH)	mg/L	**10**	BDL	BDL	BDL
Surface Active Agents (as MBAS)	mg/L	**200**	BDL	BDL	BDL
Organo Chlorine Pesticides					
Alachlor	µg/L		BDL	BDL	BDL
Atrazine	µg/L		BDL	BDL	BDL
Aldrin	µg/L		BDL	BDL	BDL
Dieldrin	µg/L		BDL	BDL	BDL
Alpha HCH	µg/L		BDL	BDL	BDL
Beta HCH	µg/L		BDL	BDL	BDL
Delta HCH	µg/L		BDL	BDL	BDL
Butachlor	µg/L		BDL	BDL	BDL
Chlorpyriphos	µg/L		BDL	BDL	BDL
p,p DDT	µg/L		BDL	BDL	BDL
o,p DDT	µg/L		BDL	BDL	BDL
p,p DDE	µg/L		BDL	BDL	BDL
o,p DDE	µg/L		BDL	BDL	BDL
p,p DDD	µg/L		BDL	BDL	BDL
o,p DDD	µg/L		BDL	BDL	BDL
Alpha Endosulfan	µg/L		BDL	BDL	BDL
Beta Endosulfan	µg/L		BDL	BDL	BDL
Endosulfan Sulphate	µg/L		BDL	BDL	BDL
Y HCH (Lindane)	µg/L		BDL	BDL	BDL

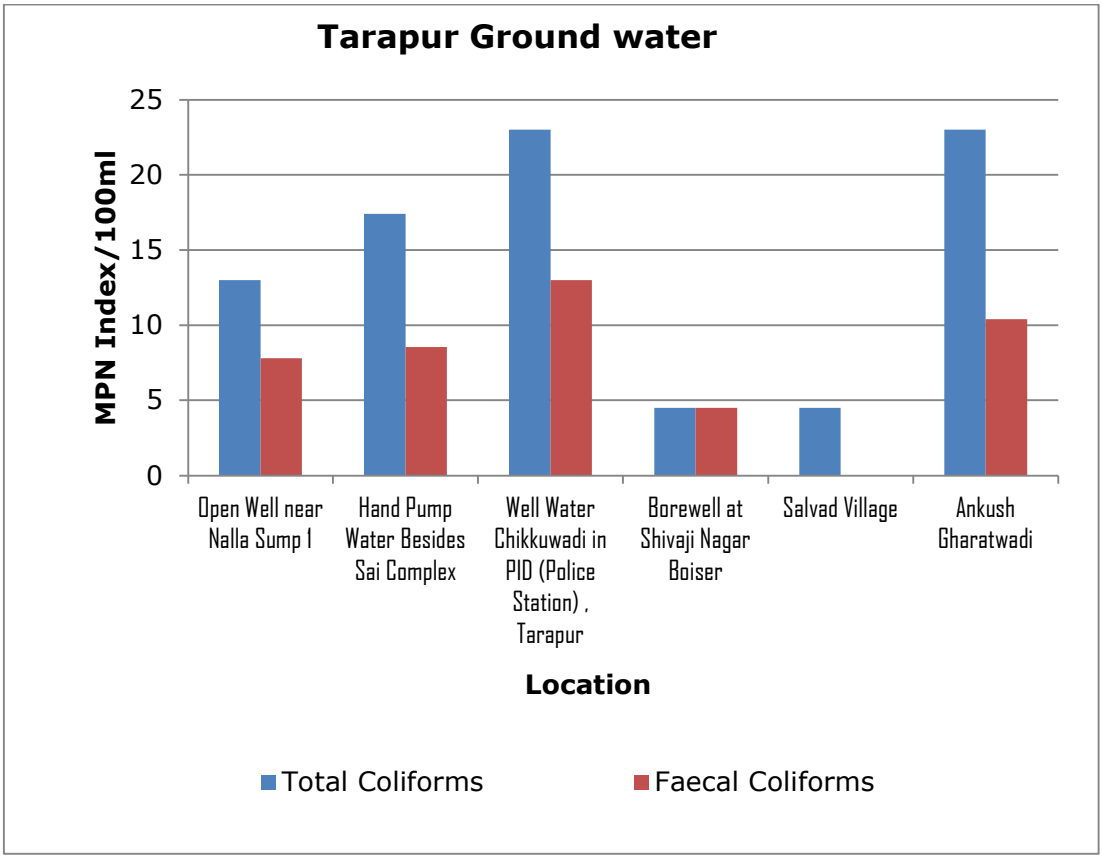
Parameters	Unit	Std. Limit	Results		
			Round-1 (19.02.2020)	**Round-2 (21.02.2020)**	**Round-3 (23.02.2020)**
Polynuclear aromatic hydrocarbons (PAH)	µg/L	**0.2**	BDL	BDL	BDL
Polychlorinated Biphenyls (PCB)	µg/L	**0.02**	BDL	BDL	BDL
Zinc (as Zn)	mg/L	**300**	BDL	BDL	BDL
Nickel (as Ni)	mg/L	**200**	BDL	BDL	BDL
Copper (as Cu)	mg/L	**100**	BDL	BDL	BDL
Hexavalent Chromium (as Cr^{6+})	mg/L		BDL	BDL	BDL
Total Chromium (as Cr)	mg/L	**100**	BDL	BDL	BDL
Total Arsenic (as As)	mg/L	**100**	BDL	BDL	BDL
Lead (as Pb)	mg/L	**100**	BDL	BDL	BDL
Cadmium (as Cd)	mg/L	**5**	BDL	BDL	BDL
Mercury (as Hg)	mg/L	**1**	BDL	BDL	BDL
Manganese (as Mn)	mg/L		BDL	BDL	BDL
Iron (as Fe)	mg/L		BDL	BDL	BDL
Vanadium (as V)	mg/L		0.032	0.032	0.034
Selenium (as Se)	mg/L		0.006	BDL	0.015
Boron (as B)	mg/L		0.149	0.162	0.146
Total Nitrogen	mg/L		7.72	4.69	11
Bioassay Test on fish	% survival		60	40	80

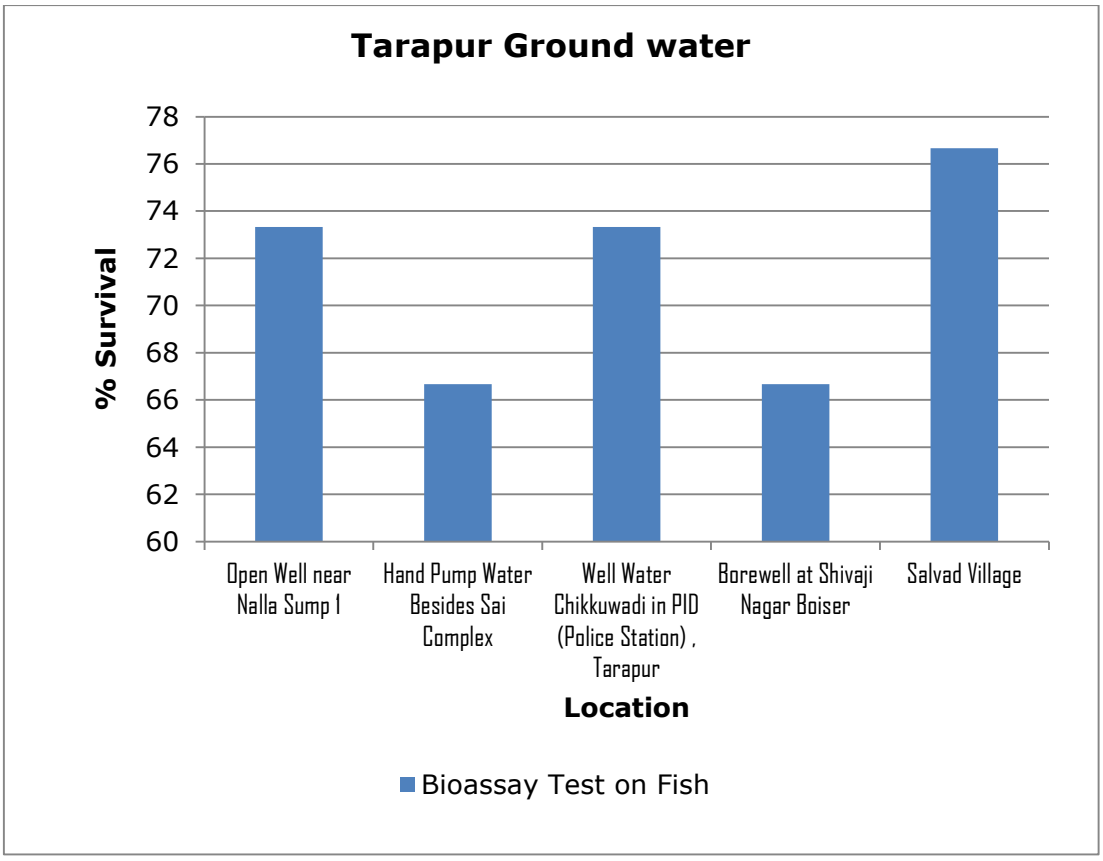
Graphs: Ground Water Monitoring Results






Tarapur Ground water
Concentration (µmhos/cm)
3000
2500
2000
1500
1000
500
0
Open Well near Nalla Sump I
Hand Pump Water Besides Sai Complex
Well Water Chikkuwadi in PID (Police Station) , Tarapur
Borewell at Shivaji Nagar Boiser
Salvad Village
Ankush Gharatwadi
Location
Electrical Conductivity


Tarapur Ground water
MPN Index/100ml
25
20
15
10
5
0
Open Well near Nalla Sump I
Hand Pump Water Besides Sai Complex
Well Water Chikkuwadi in PID (Police Station) , Tarapur
Borewell at Shivaji Nagar Boiser
Salvad Village
Ankush Gharatwadi
Location
Total Coliforms
Faecal Coliforms


Tarapur Ground water
78
76
74
72
70
68
66
64
62
60
% Survival
Open Well near Nalla Sump I
Hand Pump Water Besides Sai Complex
Well Water Chikkuwadi in PID (Police Station) , Tarapur
Borewell at Shivaji Nagar Boiser
Salvad Village
Location
Bioassay Test on Fish

5. Summary of the Results

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

5.1 Stack Emission Monitoring:

In Tarapur, six different stacks were monitored at Siyaram Silk, Mandhana Industries Ltd., Gini Silk Mills, UPL Ltd., Calyx Chemical Ltd. and Angadpal Industries. 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 17.67 to 28.33 mg/Nm^3 and sulphur dioxide in the range of 67.33 to 116.13 mg/Nm^3. However, the nitrogen dioxide is observed is observed with the range of 15.83 to 27.8 mg/Nm^3.

5.2 Ambient Air Monitoring:

At Tarapur, ambient air quality was monitored at seven locations namely: Siyaram Silk Mill, Sumitomo Chemicals, Mandhana Industries Ltd Plot no. C3, MPCB SRO Office, Kokuyo Camlin Ltd., D -Decor Export and Sarex Overseas. At all these places 12 parameters of ambient air quality standards were monitored.

1. **Suphur dioxide (SO_2):** All the results for SO_2 are observed lower than the standard limit of 80 µg/m^3. It is observed below detection limit.
2. **Nitrogen Dioxide (NO_x):** All the results for SO_2 are observed lower than the standard limit of 80 µg/m^3. It is observed in the range of 6.6 to 11.1 µg/m^3 in the sample of three industries. However, results of other three industries are observed below detection limit.
3. **Particulate Matter (PM_{10}):** It is the most critical parameter as its higher concentration in the air affects ecosystem health a lot. However, all the locations are observed with above the standard limit of 100 µg/m^3 of PM_{10}. Minimum of 39 µg/m^3 is observed at Sarex Overseas and maximum of 178.67 µg/m^3 at Mandhana Industries Ltd. plot no.C3.
4. **Particulate Matter ($PM_{2.5}$):** Concentration of $PM_{2.5}$ is observed in the range of 11.33 µg/m^3 to 44 µg/m^3.
5. **Ozone (O_3):** Values of O_3 recorded below the detection limit i.e.19.8 µg/m^3 at Siyaram Silk mill and Mandhana Industries Ltd plot no. C3. However, the remaining samples of 4 industries are recorded with minimum of 25.3 µg/m^3 and maximum of 118 µg/m^3.
6. **Lead (Pb):** Lead is categorised as known human carcinogen by CPCB. In our results, concentration of Lead is found below the detection limit i.e. below 0.02 µg/m^3.
7. **Carbon Monoxide (CO):** It is observed minimum of below detection limit at Siyaram Silk mill & Mandhana Industries Ltd plot no. C3 and maximum (3.77 mg/m^3) at Kokuyo Camlin Limited.
8. **Ammonia (NH_3):** Out of all values recorded, minimum is observed in the sample of Kokuyo Camlin Ltd. (18.03 µg/m^3) and maximum is observed at Siyaram Silk mill with 7.65 µg/m^3 of ammonia in its vicinity.
9. **Benzene:** Benzene falls under group C category, which includes known carcinogens. Out of all samples only one sample i.e. Siyaram Silks is recorded below the standard limit of 5 µg/m^3. However, all other samples are observed in the range of 2.87 to 8.16 µg/m^3 of benzene.
10. **Benzo (a) Pyrene (BaP):** All values recorded below the detection limit i.e. less than 0.2 ng/m^3.

11. **Arsenic:** Arsenic values are also observed in the range of 0.548 ng/m^3 to 1.13 ng/m^3.
12. **Nickel:** All the values are observed below the standard limit of 20 ng/m^3 i.e. in the range of 7.33 ng/m^3 to 16.67 ng/m^3.

5.3 Surface Water Quality:

Seven samples of ETP outlet 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 6.9 to 7.56.
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 in the range of 48.6 to 169.33 mg/L.
4. **Chemical Oxygen Demand:** Chemical Oxygen Demand is found above the standards of 250 mg/L in two water samples namely BPT Navapur out Fall (263.33 mg/L) and Nalla Near of sump 2 Tarapur CETP (455 mg/L). Remaining samples are found in the range of 42.5 to 194.33 mg/L.
5. **Biochemical Oxygen Demand:** Biochemical Oxygen demand also exhibits the same picture as COD. This is recorded highest (117.5 mg/L) at Navapur Discharge and minimum at TEPS Outlet (12 mg/L).
6. **Total Kjeldahl Nitrogen:** It is observed in the range of 10.97 to 13.6 mg/L.
7. **Total Ammonia:** Among all the samples, minimum is observed as below detection limit (BDL) and maximum is observed as 4.875 mg/L.
8. **Metals:** All metals like Arsenic, Nickel, Copper, Hexavalent Chromium (Cr^{6+}) are observed either below detection limit or below their standard limits.
9. **Fish Bioassay:** Fish bioassay exhibits 50-66.67% survival.
10. Parameters like Total Residual Chlorine, Cyanide, Fluoride, Sulphide, Dissolved Phosphate, Total Ammonical Nitrogen and Phenolic compounds, also meet the criteria as prescribed by CPCB.

5.4 Ground Water Quality:

Six Borewell samples were collected from different locations namely: (i) Open Well near Nalla Sump 1 (ii) Hand Pump Water Besides Sai Complex (iii) Well Water Chikkuwadi in PID (Police Station) (iv) Borewell at Shivaji Nagar Boiser (v) Salvad village (vi) Ankush Gharatwadi

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 7.46 to 8.26.
4. **Chemical Oxygen Demand:** Except Open Well near Nalla Sump 1 and Well Water Chikkuwadi in PID water sample, all other samples were detected below the standard limit of 10 mg/L set by WHO. It is ranged from 6 to 24 mg/L.
5. **Biological Oxygen Demand:** BOD also follows the same trend as followed by COD readings. Except Open Well near Nalla Sump 1 and Well Water of Chikkuwadi in PID water sample, all other samples were detected below the standard limit of 6 mg/L set by WHO. It is ranged from 2 to 8 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 8.23 mg/L and 14.8 mg/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**: observed within the acceptable range.
5. **Cyanide:** Concentration of cyanide in all the bore well water is very much below the standard.
6. **Fluoride:** It is observed in the range of 0.63 to 5.44 mg/L. Open Well near Nalla Sump 1 is observed with 5.44 mg/L, which is above the permissible limit.
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. **Metals:** Metals like Copper, Total Chromium, Lead, Arsenic, Cadmium and Mercury are well within the acceptable limits of drinking water standards.
10. **PAH & PCB** are also below the acceptable limits.
11. **Fish Bioassay:** Fish bioassay exhibits 60-76.67% survival

6. 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

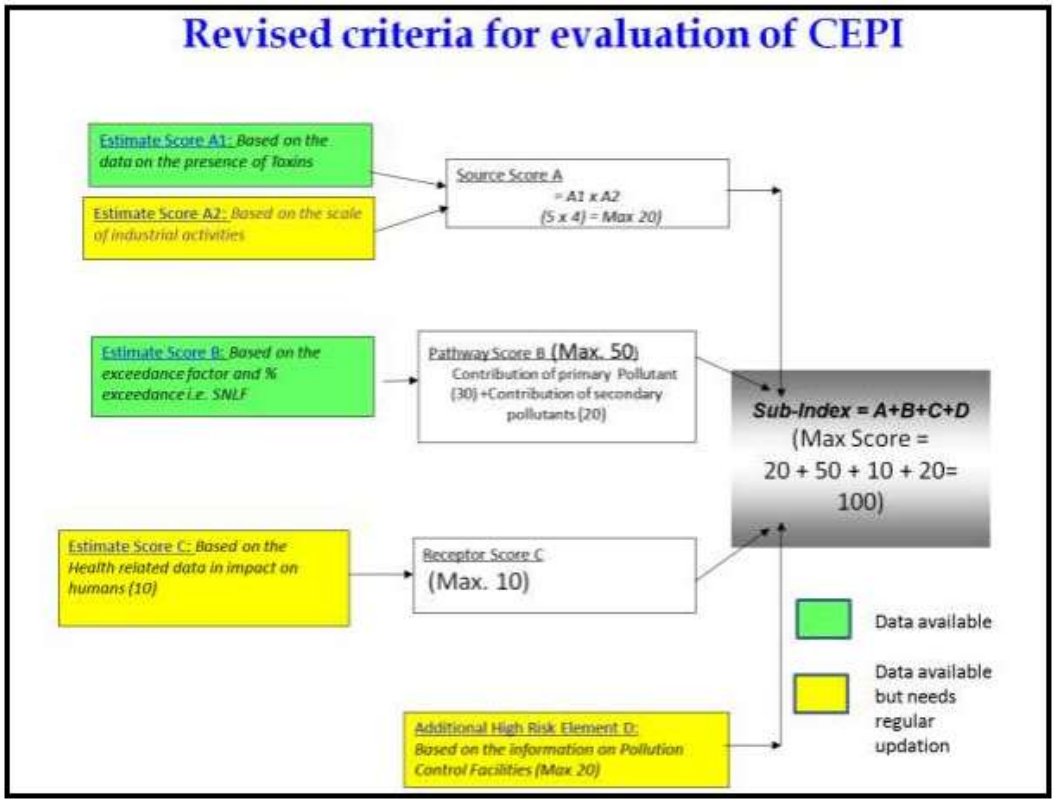
The outlines of the revised CEPI criteria are as follows:

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 and every year review was taken on the same.

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.

6.1 Comparison of CEPI scores:

The result shows that CEPI score of present report is 71.3. The present study is the compilation of post monsoon season, which also affects the score value. This time CEPI is observed lower than the CPCB CEPI score February 2018.

Aggregated CEPI

	Air Index	**Water Index**	**Land Index**	**CEPI**
CEPI score March 2020	47	65.3	36.5	**71.3**
CPCB CEPI score Feb 2018	72	89	59.25	**93.69**

7. 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 CEPI score of 71.3 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	3.25	4	13	24	0	10	47
Water Index	2.5	4	10	45.25	0	10	65.3
Land Index	2.75	4	11	15.5	0	10	36.5
						Aggregated CEPI	**71.3**

8. Photographs

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.

ANNEXURE B

INFORMATION ON HEALTH STATISTICS IN PIA

1. **Name of the Polluted Industrial Area (PIA):** Tarapur
2. **Name of the major health centre/ organization:** Thunga Hospital
3. **Name and designation of the contact person:**
4. **Address:** AM-32,Tarapur M.I.D.C., Boisar, Maharashtra 401506
5. **Year of Establishment:**

Sl No.	Diseases	No. of patients reported for the years				
		2018-2017	2017-2016	2016-2015	2015-2014	2014-2013
	Air Borne Diseases					
1.	**Asthma**	21	53			
2.	**Acute Respiratory Infection**	58	184			
3.	**Bronchitis**	26	43			
4.	**Cancer**	2	6			
	Water Borne Diseases					
5.	**Gastroenteritis**	50	101			
6.	**Diarrhea**	154	133			
7.	**Renal diseases**	0	0			
8.	**Cancer**	0	0			

Signature of the Hospital Head/ Superintend

ANNEXURE B

INFORMATION ON HEALTH STATISTICS IN PIA

6. **Name of the Polluted Industrial Area (PIA):**
7. **Name of the major health centre/ organization:** TAPS Hospital
8. **Name and designation of the contact person:**
9. **Address:** Tarapur Rd, Boisar, Maharashtra 401504
10. **Year of Establishment:**

Sl No.	Diseases	No. of patients reported for the years				
		2018-2017	2017-2016	2016-2015	2015-2014	2014-2013
	Air Borne Diseases					
1.	**Asthma**	27	59			
2.	**Acute Respiratory Infection**	95	75			
3.	**Bronchitis**	5				
4.	**Cancer**					
	Water Borne Diseases					
5.	**Gastroenteritis**	39	73			
6.	**Diarrhea**	41	37			
7.	**Renal diseases**					
8.	**Cancer**					

Signature of the Hospital Head/ Superintend

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
13.	Sulphur Dioxide	IS 11255 (Part 2): 1985, Reaffirmed 2003	Titrimetric IPA thorine Method	5.0 mg/Nm^3 0.02 kg/day
14.	BTX (Benzene, Toluene, Xylene)	NIOSH (NMAM) 1501	Adsorption and Desorption followed by GC-FID analysis	0.001 mg/Nm^3

Sr.	Parameters	Method References	Techniques	Detection Limit
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 (NDIR) 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	4.0 µg/m^3
9.	Benzene (C_6H_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	0.3 ng/m^3
12.	Nickel (Ni)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	3.0 ng/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, 22nd Ed., 2012, 1060 B, 1-39	-	-
2.	Sampling Procedure for Microbiological Parameters	APHA, 22nd Ed., 2012, 1060 B, 1-39, 9040, 9-17, and 9060B, 9-35	-	-
3.	Temperature	APHA, 22nd Ed., 2012, 2550-B, 2-69	By Thermometer	-
4.	Colour	APHA, 22nd 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, 22nd Ed., 2012, 4500-H^+- B, 4-92	By pH Meter	1
7.	Oil & Grease	APHA, 22nd 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, 22nd 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, 22nd Ed., 2012, 2510- B, 2-54	By Conductivity Meter	0.1 µmho/cm
13.	Nitrite-Nitrogen	APHA, 22nd 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, 22nd Ed., 2012, 4500-NO_3, B-4-122	UV Spectrophotometer Screening Method	0.2 mg/l
15.	(NO_2 + NO_3)-Nitrogen	APHA, 22nd Ed., 2012, 4500-NO_2-B, 4-120 APHA, 22nd Ed., 2012, 4500-NO_3, B-4-122	Colorimetric Method V Spectrophotometer Screening Method	0.2 mg/l
16.	Free Ammonia	APHA, 22nd 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, 22nd Ed., 2012,4500-CN, C & E, 4-41 & 4-43	Colorimetric Method	0.001 mg/l
19.	Fluoride (F)	APHA, 22nd Ed., 2012, 4500-F, D, 4-87	SPADNS Method	0.05 mg/l
20.	Sulphide (S^{2-})	APHA, 22nd Ed., 2012, 4500 –S^2, C-4-175, F-4-178	Iodometric Method	0.08 mg/l
21.	Dissolved Phosphate (P)	APHA, 22nd 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,22nd Ed., 2012, 4500 P,E, 4-155	Ascorbic Acid Method	0.03 mg/l
24.	Total Kjeldahl Nitrogen	APHA, 22nd 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, 22nd Ed., 2012, 4500 NH_3, F, 4 - 115	Colorimetric Method	0.001 mg/l
26.	Phenols (C_6H_5OH)	APHA, 22nd 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, 22nd Ed., 2012, 5540-B & C, 5-50	Methylene Blue Extraction Method	0.1 mg/l
28.	Organo Chlorine Pesticides	APHA, 22nd Ed., 2012, 6410B, 6-74	GC MS-MS Method	0.01 µg/L
29.	Polynuclear aromatic hydrocarbons (PAH)	APHA, 22nd Ed., 2012, 6410B, 6-74	GC MS-MS Method	0.01 µg/L
30.	Polychlorinated Biphenyls (PCB)	APHA, 22nd 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, 22nd 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

Sr.	Parameters	Methods References	Techniques	Detection Limit
43.	Selenium (Se)	IS 3025 (Part 2): 2004	ICP Method	0.005 mg/l
44.	Boron (B)	IS 3025 (Part 2): 2004	ICP Method	0.1 mg/l
45.	Total Coliforms	APHA, 22nd Ed., 2012, 9221-B, 9-66	Multiple tube fermentation technique (MPN/100ml)	1.1 MPN/100ml
46.	Faecal Coliforms	APHA, 22nd 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

The Gazette of India

EXTRAORDINARY PART III-Section 4 PUBLISHED BY AUTHORITY
NEW DELHI, WEDNESDAY, **NOBEMBER 18, 2009** No. B-29016/20/90/PCI-I

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 (Prevntion 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) µg/m³	Annual *	50	20	– Improved West and Gaeke – Ultraviolet fluorescence
		24 hours **	80	80	
2	Nitrogen Dioxide (NO_2) µg/m³	Annual *	40	30	– Modified Jacob & Hochheiser (Na-Arsenite) – Chemilminescence
		24 hours **	80	80	
3	Particulate Matter (size less than 10 µm) or PM_{10} µg/m³	Annual *	60	60	– Gravimetric – TOEM – Beta attenuation
		24 hours **	100	100	
4	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ µg/m³	Annual *	40	40	– Gravimetric – TOEM – Beta attenuation
		24 hours **	60	60	
5	Ozone (O_3) µg/m³	8 hours **	100	100	– UV photometric – Chemiluminescence – Chemical Method
		1 hour **	180	180	
6	Lead (Pb) µg/m³	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/m³	8 hours **	02	02	– Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour **	04	04	
8	Ammonia (NH_3) µg/m³	Annual *	100	100	– Chemiluminescence – Indophenol blue method
		24 hours **	400	400	
9	Benzene (C_6H_6) µg/m³	Annual *	05	05	– Gas Chromatography based continuous analyzer – Adsorption and Desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP) – particulate phase only, ng/m³	Annual *	01	01	– Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) ng/m³	Annual *	06	06	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper.
12	Nickel (Ni) ng/m³	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.

µg/m³: micro-gram/m³ i.e. 10^{-6}gm/m³ ng/m³ : nano-gram/m³ i.e. 10^{-9}gm/m³

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 mailer 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
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

Sr.	Parameter	Standards			
		Inland surface Water	**Public Sewers**	**Land for Irrigation**	**Marine Coastal Areas**
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
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/l, Max.	2.0	15	--	15
30.	Dissolved Phosphate (as P), mg/l, Max.	5.0	--	--	--

Sr.	Parameter	Standards			
		Inland surface Water	**Public Sewers**	**Land for Irrigation**	**Marine Coastal Areas**
31.	Sulphate (as SO_4), mg/l, Max.	1000	1000	1000	--
32.	Sulphide (as S), mg/l, Max.	2.0	--	--	5.0
33.	Pesticides	Absent	Absent	Absent	Absent
34.	Phenolic compounds (as C_6H_5OH), 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 $C1_2$)	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
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_6H_5OH)	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_2S)	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 (as Cd)	mg/l	Max 0.003	No relaxation

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
32.	Cyanide (as CN)	mg/l	Max 0.05	No relaxation
33.	Lead (as Pb)	mg/l	Max 0.01	No relaxation
34.	Mercury (as Hg)	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.	Polychlorinated biphenyls	mg/l	Max 0.0005	No relaxation
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)	Dibromochloro Methane	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
x)	DDT (o,p & p,p — Isomers of DDT, DDE and DDD)	µg/L	1	No relaxation
xi)	Endosulfan (α, β & sulphate)	µg/L	0.4	No relaxation
xii)	Ethion	µg/L	3	No relaxation
xiii)	Gamma - HCH (Lindane)	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

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
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	➢ 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	➢ 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	➢ 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	➢ 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	➢ 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	➢ 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 Indian 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, µmhos/cm	<1000	<2250	<4000
(v)	(NO_2+NO_3)-Nitrogen, mg/l	<5	<10	<15

Sr.	Parameters	Requirement for Waters of Class		
		A Excellent	B-Desirable	C-Acceptable
(vi)	Suspended solid, mg/l	<25	<50	<100
(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	<0.1 mg/l	<0.2 mg/l	<0.3 mg/l
(ii)	T.K.N	<1.0 mg/l	<2.0 mg/l	<3.0 mg/l
(iii)	Total Ammonia (NH4 + NH3)-Nitrogen	<0.5 mg/l	<1.0 mg/l	<1.5 mg/l
(iv)	Phenols	<2 µg/l	<5 µg/l	<10 µg/l
(v)	Surface Active Agents	<20 µg/l	<100 µg/l	<200 µg/l
(vi)	Organo Chlorine Pesticides	<0.05 µg/l	<0.1 µg/l	<0.2 µg/l
(vii)	PAH	<0.05 µg/l	<0.1 µg/l	<0.2 µg/l
(viii)	PCB and PCT	<0.01 µg/l	<0.01 µg/l	<0.02 µg/l
(ix)	Zinc	<100 µg/l	<200 µg/l	<300 µg/l
(x)	Nickel	<50 µg/l	<100 µg/l	<200 µg/l
(xi)	Copper	<20 µg/l	<50 µg/l	<100 µg/l
(xii)	Chromium (Total)	<20 µg/l	<50 µg/l	<100 µg/l
(xiii)	Arsenic (Total)	<20 µg/l	<50 µg/l	<100 µg/l

Sr.	Parameters	Requirement for Waters of Class		
		A- Excellent	**B-Desirable**	**C-Acceptable**
(xiv)	Lead	<20 µg/l	<50 µg/l	<100 µg/l
(xv)	Cadmium	<1.0 µg/l	<2.5 µg/l	<5.0 µg/l
(xvi)	Mercury	<0.2 µg/l	<0.5 µg/l	<1.0 µg/l